

REPRODUCTION IN ORGANISMS

“A man has always to be busy with his thoughts if anything is to be accomplished.”

“ANTONIE VAN LEEUWENHOEK (1632-1723)”

INTRODUCTION

As we all know that a vast number of plant as well as animal species have existed on the earth for several thousand of years. So to maintain this continuity living organism possess a process known as Reproduction. Reproduction is one of the most characteristic feature of living organisms. Reproduction is defined as a biological process in which an organism gives rise to young ones similar to itself. Thus there is cycle of birth , growth and death. Life will not exist if plants or animals will not reproduce. In this way an organism gurantees his survival. There is a large diversity among biological world and each organism in this world has evolves its own mechanism to multiply and produce offsprings. The organism’s habitat, its internal physiology and several other factors are collectively responsible for how it reproduces.

It is clear from above discussion that for a species of plant or animals to continue living on this earth, it must reproduce itself. This chapter deals with the life span of organism, basic feature of reproduction and types of reproduction.

Reproduction in Organism

Reproduction in Organisms

Reproduction is the process of producing offspring similar to itself. It is a characteristic of living organisms. The offspring grow, mature and in turn produce **new offspring**. Thus, there is a cycle of birth, growth and death. Reproduction enables the continuity of the species, generation after generation.

There is large diversity in the biological world and each organism has evolved its own mechanism to multiply and produce offspring. Based on whether there is participation of one organism or two in the process of reproduction, it is of two types. When offspring is produced by a single parent with or without the involvement of gamete formation, the reproduction is **Asexual**. When two parents (opposite sex) participate in the reproductive process and also involve fusion of male and female gametes, it is called **Sexual reproduction**. The organism's habitat, its internal physiology and several other factors are collectively responsible for how it reproduces.

Asexual Reproduction :- In this method, a single individual (parent) is capable of producing offspring. As a result, the offspring that are produced are not only identical to one another but are also exact copies of their parent.

Now the question arises that are these offspring produced are likely to be genetically identical or different? Therefore the term **clone** is used to describe such morphologically and genetically similar individuals. Let us see how widespread asexual reproduction is, among different groups of organisms. Asexual reproduction occurs in both single celled and multicelled individuals. The parent individual splits, buds or fragments to form identical daughter cells or individuals, e.g. *Amoeba*, *Paramecium*, *Euglena*, *Sycon*, *Hydra*, *Tubularia*, *Planaria*, *Ascidia*. In yeast, the division is unequal and small buds are produced that remain attached initially to the parent cell which eventually gets separated and mature into new yeast organisms (cells). Asexual reproduction is also called **agamogenesis or agamogeny**. While in animals and other simple organisms the term **asexual** is used unambiguously, in plants, the term **vegetative** reproduction is frequently used. In plants, the units of vegetative propagation such as *runner*, *rhizome*, *sucker*, *tuber*, *offset*, *bulb* are all capable of giving rise to new offspring. These structures are called vegetative propagules. Obviously, since the formation of these structures does not involve two parents, the process involved is asexual. The fleshy buds which produce new plants in bryophytes is called **Turion**.

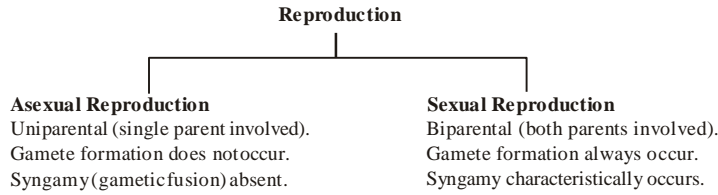
Members of the kingdom Fungi and simple plants such as algae reproduce through special asexual reproductive structures. The most common of these structures are **zoospores** that usually are microscopic motile structures. Other common asexual reproductive structures are **conidia** (*Penicillium*), **buds** (*Hydra*) and **gemmules** (sponge). In mode of reproduction, somatic cells undergo mitosis during the formation of new individuals. Therefore it is also called **Somatogenic reproduction**. **Water hyacinth** (Terror of Bengal) which is one of the most invasive weeds found growing wherever there is standing water. It drains oxygen from the water, which leads to death of fishes.

Asexual reproduction occurs by fission, budding and fragmentation.

Types:

1. **Fission** : It is a mode of asexual reproduction in which the body of a mature individual divides in two or more similar and equal sized daughter individuals. Fission can be binary fission or multiple fission.
 - a. **Binary fission**: It is the division of the body or an individual into two equal halves, each of which functions as an independent daughter individual. Depending on the plane of division the binary fission is of following types:
 - i. Simple Binary Fission: E.g. *Amoeba*
 - ii. Longitudinal Binary Fission: E.g. *Euglena*, *Vorticella*.
 - iii. Oblique Binary fission: E.g. *Ceratium*, *Gonyaulax*
 - iv. Transverse Binary Fission: E.g. *Paramecium*
 - b. **Multiple fission**: The nucleus divides several times by amitosis to produce many nuclei, without involving any cytokinesis. Later, each nucleus gathers a small amount of cytoplasm around it and the mother individual splits into many tiny daughter cells. E.g. *Plasmodium*, *Monocystis*.

- Reproduction is the process of producing offspring similar to itself. It is a characteristic of living organisms. Biologically it means the **multiplication and perpetuation of the species**.
- According to the conditions available in environment, organisms have adapted the processes of reproduction. Generally, two types of reproduction mechanisms are present in organisms.

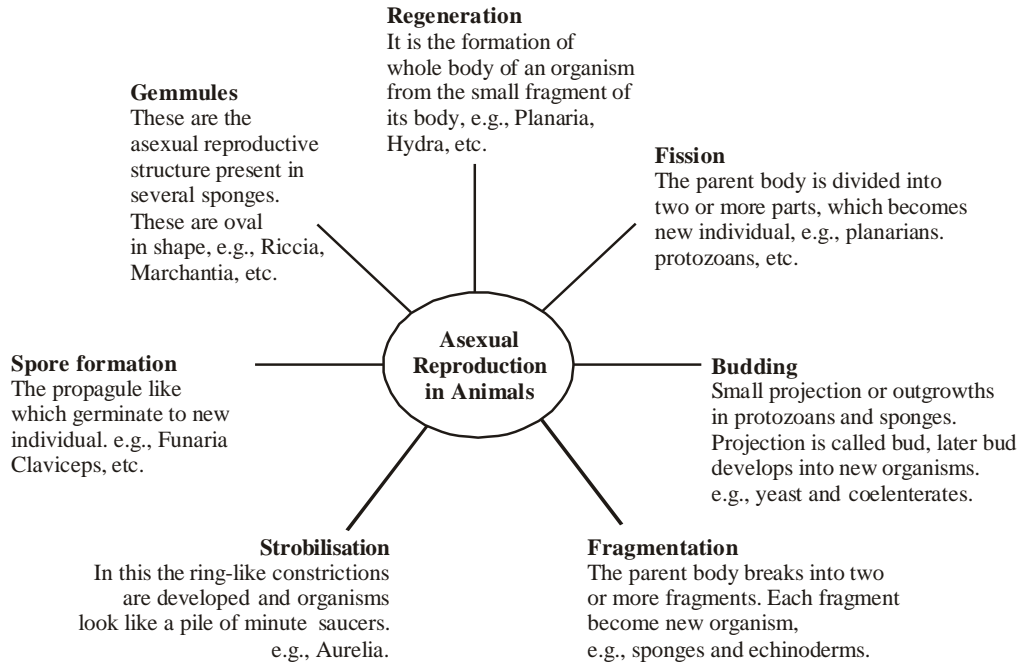


1. Reproduction in Animals

→ Animal reproduce by both asexual and sexual methods.

2. Asexual Reproduction

→ It is the primary means of reproduction among the protists, cnidarians and tunicates. The process of asexual reproduction can be occur though following mehtods.



3. Sexual Reproduction

- In animals the sexual reproduction occurs by the fertilisation of **haploid sperm** and **haploid egg**, generating a diploid offspring. In most individuals (i.e., **dioecious**), the female produce eggs, (i.e, large non-motile cells contain food reserve) and the male produce **sperms** (i.e., small, motile cell and have almost no food reserve).
- In other individual, (i.e., **monoecious**) such as **earthworm** and many **snails**, single individual produce both sperm and egg occurs in variety of ways, depending on the mobility and the breeding environment of individual.
- Sexual reproduction is two types

SOLVED EXAMPLE

- Ex.1** In Vorticella, the total number of micronuclei formed at the end of pre-zygotic nuclear division in female gamont is
(A) 4 (B) 6
(C) 8 (D) 5
- Sol. (A)**
- Ex.2** Which one of the following glands is absent in reproductive system of rabbit.
(A) Cowper's gland (B) Collateral gland
(C) Perineal gland (D) Prostate gland
- Sol. (B)**
- Ex.3** Drones in a colony of honey bees originate by
(A) Thelytoky
(B) Arrhenotoky
(C) Cyclic parthenogenesis
(D) Diploid parthenogenesis
- Sol. (B)** : Arrhenotoky is a type of parthenogenesis, in which the unfertilized eggs develop into males with haploid cells.
- Ex.4** Arrhenotoky is related to
(A) Parthenogenesis (B) Wax formation
(C) Both (A) and (B) (D) None of these
- Sol. (A)** : Parthenogenesis can be classified into arrhenotoky and thelytoky.
- Ex.5** Natural parthenogenesis occurs in
(A) Frog to form female
(B) Honeybee to produce drones
(C) Cockroach
(D) Vegetarian eggs
- Sol. (B)** : Parthenogenesis is the development of an individual from an unfertilized egg. In honey bees drones develop parthenogenetically.
- Ex.6** Which one of the following plants does not help in vegetative propagation by leaves
(A) Begonia (B) Kalanchoe
(C) Bryophyllum (D) Oxalis
- Sol. (C)**
- Ex.7** Development of embryo from the cells of the nucellus is called
(A) Parthenocarpy (B) Apocarpy
(C) Adventive embryony (D) Apospory
- Sol. (C)** : In adventive embryony embryo arises from diploid sporophytic cells such as nucellus or integuments (other egg) e.g., citrus.
- Ex.8** Grafting of tissue or organ between individuals different species is called
(A) Autograft (B) Isograft
(C) Xenograft (D) Allograft
(E) Intergraft
- Sol. (C)**
- Ex.9** Carrot is micropropagated through
(A) Embryo (B) Embryoids
(C) Shoot culture (D) Callus
- Sol. (D)**
- Ex.10** What Apomixis is common between vegetative reproduction and Apomixis
(A) Both occur round the year
(B) Both produces progeny identical to the parent
(C) Both are applicable to only dicot plants
(D) Both bypass the flowering phase
- Sol. (B)**
- Ex.11** Why is reproduction essential for organisms?
- Sol.** Reproduction is a fundamental feature of all living organisms. It is a biological process through which living organisms produce offspring's similar to them. Reproduction ensures the continuance of various species on the Earth. In the absence of reproduction, the species will not be able to exist for along time and may soon get extinct
- Ex.12** Why is the offspring formed by asexual reproduction referred to as clone?
- Sol.** A clone is a group of morphologically and genetically identical individuals. In the process of asexual reproduction, only one parent is involved and there is no fusion of the male and the female gamete. As a result, the offsprings so produced are morphologically and genetically similar to their parents and are thus, called clones.

Exercise # 1

SINGLE OBJECTIVE

NEET LEVEL

1. Which are exclusively viviparous
(A) Bony fishes
(B) Cartilaginous fishes
(C) Sharks
(D) Whales
2. The asexual process replaced by the sexual method is known as
(A) Semigamy (B) Amphimixis
(C) Apospory (D) Apomixis
3. In all the methods of asexual reproduction
(A) Offsprings produced are genetically identical to the parents
(B) Offsprings produced are genetically different from the parents
(C) Offsprings produced may or may not be identical to the parents
(D) None of the above
4. A person which shows the secondary sexual characters of both male and female is called
(A) Intersex (B) Hermaphrodite
(C) Bisexual (D) Gynandromorph
5. In sexual reproduction, offsprings resemble the parents
(A) Structurally but not functionally
(B) Functionally but not structurally
(C) Both structurally and functionally
(D) Neither structurally nor functionally
6. The polyestrous mammal is
(A) Man (B) Rabbit
(C) Cat (D) Horse
7. Viviparity is found in
(A) Frog (B) Lizard
(C) Snake (D) Rabbit
8. Common method of asexual reproduction is by
(A) Regeneration (B) Budding
(C) Archeocytes (D) Gemmulation
9. Asexual reproduction takes place in
(A) Higher animals (B) Lower animals
(C) Plants (D) All the above
10. As a result of binary fission number of individuals produced by one fission is
(A) Two (B) Three
(C) Four (D) Five
11. An alternation of asexual and sexual generations where both the generations are diploid and the haploid stage is represented only by the gametes is called
(A) Alternation of generation
(B) Metagenesis
(C) Paedogenesis
(D) Parthenogenesis
12. Differentiation in morphology of the two sexes of the same species is called
(A) Hermaphrodite (B) Heteromorphosis
(C) Sexual dimorphism (D) Unisexual
13. Fertilization is internal in
(A) Toads (B) Frogs
(C) Dog fish (D) Cat fish
14. Haploid parthenogenesis among insects is shown by order
(A) Hymenoptera (B) Homoptera
(C) Coleoptera (D) All the above
15. A person which shows the secondary sexual characters of both male and female is called
(A) Intersex (B) Hermaphrodite
(C) Bisexual (D) Gynandromorph
16. In some species parthenogenesis may alternate with sexual reproduction this process is called
(A) Complete parthenogenesis
(B) Incomplete or cyclic parthenogenesis
(C) Both the above
(D) None of the above
17. Product of sexual reproduction generally generates
(A) Large biomass
(B) Longer viability of seeds
(C) Prolonged dormancy
(D) New genetic combination leading to variation
18. Which is mode of reproduction in Amoeba
(A) Binary fission only
(B) Binary fission and multiple fission
(C) Binary fission and conjugation
(D) Multiple fission only
19. In Earthworms, self fertilization does not occur due to
(A) Hypogyny (B) Protogyny
(C) Protandry (D) Epigyny

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. The croaking sounds made by frogs is
 - (A) Hunger call
 - (B) Just a musical note
 - (C) Signaling call of danger
 - (D) Sex call for female partner
2. Which type of reproduction is found in Hydra
 - (A) Polyembryony
 - (B) Sexual and asexual
 - (C) Parthenogenesis
 - (D) Encystment
3. Gemmule formation in sponges is helpful in
 - (A) Parthenogenesis
 - (B) Sexual reproduction
 - (C) Only dissemination
 - (D) Asexual reproduction
4. Which is mode of reproduction in Amoeba
 - (A) Binary fission only
 - (B) Binary fission and multiple fission
 - (C) Binary fission and conjugation
 - (D) Multiple fission only
5. Which of the following shows the sexual dimorphism
 - (A) *Hydra* and *Ascaris*
 - (B) *Hydra* and *Oryctolagus*
 - (C) *Ascaris* and *Pheretima*
 - (D) *Ascaris* and *Oryctolagus*
6. Drones in a colony of honey bees originate by
 - (A) Thelytoky
 - (B) Arrhenotoky
 - (C) Cyclic parthenogenesis
 - (D) Diploid parthenogenesis
7. Arrhenotoky is related to
 - (A) Parthenogenesis
 - (B) Wax formation
 - (C) Both (A) and (B)
 - (D) None of these
8. Binary fission is found in
 - (A) *Amoeba*
 - (B) *Paramecium*
 - (C) *Planaria*
 - (D) All of these
9. Eutherian mammals are
 - (A) Oviparous
 - (B) Viviparous
 - (C) Ovoviviparous
 - (D) Both (A) and (C)
10. In Earthworms, self fertilization does not occur due to
 - (A) Hypogyny
 - (B) Protogyny
 - (C) Protandry
 - (D) Epigyny
11. In some species parthenogenesis may alternate with sexual reproduction this process is called
 - (A) Complete parthenogenesis
 - (B) Incomplete or cyclic parthenogenesis
 - (C) Both the above
 - (D) None of the above
12. Haploid parthenogenesis among insects is shown by order
 - (A) Hymenoptera
 - (B) Homoptera
 - (C) Coleoptera
 - (D) All the above
13. Natural parthenogenesis occurs in
 - (A) Frog to form female
 - (B) Honeybee to produce drones
 - (C) Cockroach
 - (D) Vegetarian eggs
14. Drones in a colony of honey bees originate by
 - (A) Thelytoky
 - (B) Arrhenotoky
 - (C) Cyclic parthenogenesis
 - (D) Diploid parthenogenesis
15. Which of the following shows the sexual dimorphism
 - (A) *Hydra* and *Ascaris*
 - (B) *Hydra* and *Oryctolagus*
 - (C) *Ascaris* and *Pheretima*
 - (D) *Ascaris* and *Oryctolagus*
16. Arrhenotoky is related to
 - (A) Parthenogenesis
 - (B) Wax formation
 - (C) Both (A) and (B)
 - (D) None of these

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

i. Match the following with correct combination

Column - I

- A. Hyaluronidase
- B. Corpus luteum
- C. Gastrulation
- D. Capacitation
- E. Colostrum

Codes :

- (A) A-v, B-ii, C-iv, D-i, E-iii
- (C) A-i, B-ii, C-iii, D-iv, E-v

Column - II

- i. Acrosomal reaction
- ii . Morphogenetic movements
- iii. Progesterone
- iv. Mammary gland
- v. Sperm activation

- (B) A-i, B-iii, C-ii, D-v, E-iv
- (D) A-iv, B-ii, C-v, D-iii, E-i

ii. Match the items ABCD of table 'A' with that of items in table 'B' then the correct pairing sequence of ABCD will be

Column - I

- A. Cleavage
- B. Gastrulation
- C. Neurulation
- D. Organogenesis

- (A) iv, i, ii, iii
- (C) iv, ii, iii, i

Column - II

- i. Formation of iii germ layers
- ii. Formation of embryo spinal cord
- iii. Results in formation of skeleton and muscles from mesoderm
- iv. Pattern depends on the amount and distribution of yolk

- (B) ii, iii, i, iv
- (D) iii, i, ii, iv

iii. Match the following and choose the correct combination from the options given

Column - I

(Organism)

- A. Butterfly
- B. Crow
- C. Parrot
- D. Crocodile

- (A) A - i; B - ii; C - iii; D - iv
- (C) A - ii; B - iii; C - iv; D - i
- (E) A - iv; B - iii; C - ii; D - i

Column - II

(Approximately lifespan)

- i. 60 years
- ii. iv0 year
- iii. iv years
- iv. i - ii weeks

- (B) A - iv; B - iii; C - i; D - ii
- (D) A - iii; B - ii; C - i; D - iv

iv. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Sponge
- B. Yeast
- C. Potato
- D. Water hyacinth

- (A) A - iv; B - i; C - ii; D - iii
- (C) A - iii; B - iv; C - i; D - ii

Column - II

- i. Tuber
- ii. Offset
- iii. Gemmules
- iv. Budding

- (B) A - iii; B - i; C - iv; D - ii
- (D) A - iv; B - ii; C - i; D - iii

v. Match the organisms given in Column - I with their mode of reproduction in column -II and select the correct answer from the codes given below :

Column - I

- A.. Potato
- B. Spirogyra
- C. Rose
- D. Penicillium

- (A) A - i; B - iii; C - ii; D - iv
- (C) A - iv; B - i; C - iii; D - ii

Column - II

- i. Conjugation
- ii. Stem cutting
- iii. Conidiospores
- iv. Stem tubers

- (B) A - iv; B - i; C - ii; D - iii
- (D) A - ii; B - i; C - iv; D - iii

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. During regeneration modification of an organ to another organ is known as [CBSE AIPMT 2001]
 - (A) Morphogenesis
 - (B) Epimorphosis
 - (C) morphallaxis
 - (D) accretionary growth

2. In oogamy, fertilisation involves [CBSE AIPMT 2004]
 - (A) A small non-motile female gamete and a large motile male gamete
 - (B) A large non-motile female gamete and a small motile male gamete
 - (C) A large non-motile female gamete and a small non-motile male gamete
 - (D) A large motile female gamete and a small non-motile gamete

3. Why is vivipary an undesirable character for annual crop plants ? [CBSE AIPMT 2005]
 - (A) It reduces the vigour of the plant
 - (B) It adversely affects the fertility of the plant
 - (C) The seeds exhibit long dormancy
 - (D) The seeds cannot be stored under normal conditions for the next season

4. In which one pair both the plants can be vegetatively propagated by leaf pieces ? [CBSE AIPMT 2004]
 - (A) Agava and Kalanchoe
 - (B) Bryophyllum and Kalanchoe
 - (C) Asparagus and Bryophyllum
 - (D) Chrysanthemum and Agave

5. Vegetative propagation in mini occurs by [CBSE AIPMT 2009]

(A) Offset	(B) Rhizome
(C) Sucker	(D) Runner

6. Vegetative propagation in Pistia occurs by [CBSE AIPMT 2010]

(A) Stolon	(B) Offset
(C) Runner	(D) Sucker

7. The 'Eyes' of the potato tuber are [CBSE AIPMT 2011]

(A) Flower buds	(B) Shoot buds
(C) Axillary buds	(D) Root buds

8. Which one of the following is correctly matched ? [CBSE AIPMT 2012]

(A) Onion	– Bulb
(B) Ginger	– Sucker
(C) Chlamydomonas	– Conidia
(D) Yeast	– Zoospores

9. Product of sexual reproduction generally generates [NEET 2013]
 - (A) Longer viability of seeds
 - (B) Prolonged dormancy
 - (C) New genetic combination leading to variation
 - (D) Large biomass

10. Select the wrong statement. [NEET 2013]
 - (A) Isogametes are similar in structure, function and behaviour
 - (B) Anisogametes differ either in structure, function and behaviour
 - (C) In oomycetes female gamete is smaller and motile, while male gamete is large and non-motile
 - (D) Chlamydomonas exhibits both isogamy and anisogamy and Fucus shows oogamy

11. Which of the following pairs is not correctly match ? [CBSE AIPMT 2015]

Mode of reproduction	Example
(A) Offset	Water hyacinth
(B) Rhizome	Banana
(C) Binary fission	Sargassum
(D) Conidia	Penicillium

MOCK TEST

1. Which one of the following statements is not correct?
 - (A) Offspring produced by the asexual reproduction are called clone.
 - (B) Microscopic, motile, asexual reproductive structures are called zoospores.
 - (C) In potato, banana and ginger, the plantlets arise from, the internodes present in the modified stem.
 - (D) Water hyacinth, growing in the standing water, drains oxygen from water that leads to the death of fishes.

2. Select the incorrect match out of the following.

(A) Offset	–	Potato
(B) Runner	–	Grass
(C) Stolon	–	Jasmine
(D) Sucker	–	<i>Chrysanthemum</i>

3. Stock and scion are used in

(A) cutting	(B) grafting	(C) layering	(D) micropropagation
-------------	--------------	--------------	----------------------

4. Vegetative propagation in water hyacinth takes place by

(A) rhizome	(B) bulbil	(C) leaf bud	(D) offset
-------------	------------	--------------	------------

5. Which one of the following is correctly matched?

(A) Onion	–	Bulb
(B) Ginger	–	Sucker
(C) <i>Chlamydomonas</i>	–	Conidia
(D) Yeast	–	Zoospores

6. Vegetative reproduction, in which new plants develop in the notches along the tip of intact leaves is seen in

(A) <i>Asparagus</i>	(B) <i>Agave</i>	(C) <i>Chrysanthemum</i>	(D) <i>Bryophyllum</i>
----------------------	------------------	--------------------------	------------------------

7. Banana is vegetatively propagated by

(A) tubers	(B) rhizomes	(C) bulbs	(D) suckers
------------	--------------	-----------	-------------

8. Find out order of vegetative propagules of plants like potato, ginger, *Agave*, *Bryophyllum* and water hyacinth.

(A) Offset, bulbil, leaf bud, rhizome and eyes	(B) Leaf bud, bulbil, offset, rhizome and eyes
(C) Eyes, rhizome, bulbil, leaf bud and offset	(D) Rhizome, bulbil, leaf bud, eyes and offset
(E) Offset, bulbil, leaf bud, rhizome and eyes	

9. Which one of the following pairs is wrongly matched while the remaining three are correct?

(A) <i>Penicillium</i>	–	conidia
(B) Water hyacinth	–	runner
(C) <i>Bryophyllum</i>	–	leaf buds
(D) <i>Agave</i>	–	bulbils

www.blog.neetnearme.com

PLANT GROWTH AND DEVELOPMENT

“The true laboratory is the mind, where behind illusions we uncover the laws of truth..”

“J.C. BOSE (1858-1937)”

INTRODUCTION

Growth is a characteristic feature of all living organisms. It is also a vital process, which brings about permanent and irreversible change in any plants or its part. Development is the sum of two processes: growth and differentiation. To begin with, it is essential and sufficient to know that a mature plant develops from a single-celled zygote which divides and differentiates to form various types of cell.

The structures like flowers, leaves or fruits show limited growth and dimensions due to which these appear and fall periodically whereas other structures like roots and stem remain intact and show unlimited growth. This chapter will let you know about the various factors involved in govern and control of development processes.

PLANT GROWTH & DEVELOPMENT**INTRODUCTION:**

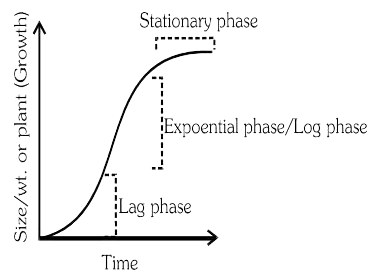
- Growth is a characteristic feature of all living organisms.
- Growth is a vital process, which brings about **permanent and irreversible change** in any plant or its part.
- Growth in plants means increase in shape, size, weight and volume of a plant or plant part.
- Growth leads to increase in fresh weight, dry weight, length, area, volume and cell number. All these are controlled externally (by environmental factors) and internally (by Genetics).
- Growth is **diffused in animals**, but in **plants growth is localised & irregular** (nail in plant stem, occupies same height till several years of growth).
- Seed germination is the first step of plant growth. Almost all the plants face a period of suspended growth.
- If the suspension of growth is due to **exogenously controlled factors** (environmental factors) then it is called **quiescence**. Development is a part of growth.
- When the suspension of growth is due to the **endogenously controlled factors** (hormonal, genetic) then it is termed as **dormancy**.
- Weight increased during growth but exceptions are **potato & seed germination**, where weight decrease.

PHASES OF GROWTH

- (1) **Phase of cell division or cell formation** :- Number of cells increases by cell division.
- (2) **Phase of cell enlargement or cell elongation** :- Size of cells increases due to **vacuolization & TP** (turgor pressure).
- (3) **Cell maturation or differentiation phase** :- (Also called as **morphogenetic, organogenic phase**) Development or qualitative change is important feature of this phase.

Pattern or course of plant growth : (growth curve)

- The pioneering work on growth was done by **Von Sachs**.
 - He plotted a growth curve between time & growth, which is known as **sigmoid curve** or **S-curve** or **GP** (Grand period)-curve.
 - Growth pattern of cell, organisms is uniform under favourable conditions. Thus following phases of growth are recognized.
- (1) **Lag phase** :- In lag period the growth is slow.



- (2) **Log phase** :- Also called as exponential phase. During this phase growth is maximum & most rapid.
- (3) **Steady or stationary phase** :-
Time taken in growth phases (mainly log phase) is called as "**grand period of growth**".

+ve ex : Stem

(a) **Phototropism** {

-ve ex : Root

Definite direction in relation to light

+ve Ex : Root

(b) **Geotropism** {

(Root cap percept stimulus)

-ve Ex : Stem & Mangrove plant roots.

Definite direction in relation to gravity, (root cap percept stimulus).

(c) **Chemotropism** :- Ex. Pollen tubes & fungal hyphae

Definite direction in relation to chemicals.

(d) **Thigmotropism (haptotropism)** :- Ex : Tendrils, haustoria of *Cuscuta*.

Definite direction in response to contact or support.

(e) **Hydrotropism** :- Ex : Roots of seedlings

(ii) **Nastic movement (External stimulus but diffused type or nondirectional)** :-

(a) **Nyctinasty** :- Ex : Flowers, leaves, stomata, daily movement (Sleep movements)

Due to rhythmicity of day and night.

(b) **Thigmonasty or haptanasty** :- Tentacles of insectivorous plants

(c) **Chemonasty** :- Ex : Tentacles of insectivorous plants

(d) **Seismonasty** :- Ex : *Mimosa* (touch me not plant) turgor change in pulvinus leaf base

K^+ ion also involved in this movement.



ED OS KEY POINTS

Many plant parts specially leaves exhibits nastic movement and involves differential growth, this type of movement is known as movement of growth. This movement, is caused due to unequal growth in plant organs.

Ex : Epinasty, hyponasty, Nutation.

Epinasty & hyponasty :- Ex : Leaves, flower (petal) opening & closing respectively.

Epinasty - More growth on upper surface of plant parts.

Hyponasty - More growth on lower surface of plant parts.

Both epinasty & hyponasty are example of autonomic growth movements.

Nutation :- Zig zag growth of plant organ mainly shoot, is called as nutation

Circumnutation :- Spiral growth of plants in tendrils

Portulaca is known as **compas plant**.

Rhizomes diageotropic (90° to gravitation force)

Clinostat :- used for nullifying geotropism

Xerochasy :- Due to loss of water

Hygroscopic movement {

Ex :- Dehiscence of legume fruits

- Development is the sum of two processes -Growth and differentiation
- Growth is irreversible permanent increase in size of an organ or its parts or even of an individual cell.
- Growth is accompanied by metabolic processes-both catabolic and anabolic, that occur at the expense of energy. → Plants show open form of growth -new cells are always being added to the plant body
- Apical meristem -contribute primary growths
- Lateral meristem (vascular cambium and cork cambium) contribute lateral growth and causes increase in girth.
- Growth at cellular level is principally a consequence of increase in the amount of protoplasm.
- Growth is measured by a variety of parameters like -increase in fresh weight, dry weight, lengths, areas, volume and cell number
- Period of growth is generally divided into three phases -“Meristematic“Elongation“Maturation“Cells in meristematic phase are rich in protoplasm, possess large conspicuous nuclei.“Their cell walls are primary“Phase of elongation characterised by increased vacuolation, cell enlargement and new cell wall deposition
- Cell of maturation phase attain their maximal size in terms of wall thickening & protoplasmic modification.
- The increased growth per unit time is termed as growth rate.
- The growth rate shows an increase that may be arithmetic or geometrical.
- In Arithmetic growth only one daughter cell continues to divide while other differentiate and matures. Root elongation at constant rate is the expression of arithmetic growth
- It proved linear growth and can be expressed as $L_t = L_0 + rt$
- In Geometrical growth -both daughter cells continuously divide. It attains sigmoid curve if space and food is limited. trees with seasonal activities show sigmoid curve.
- Exponential growth (log phase of sigmoid curve) can be expressed as -
- Here r is referred as efficiency index
- Quantitative comparisons between the growth of living system can also be made in two ways -
 - (1) Absolute growth rate → measurement and comparison of total growth per unit time
 - (2) Relative growth rate → per unit initial parameter. increase/initial parameter $\times 100$
- Water, oxygen and nutrients are essential for growth
- Plant growth and further development is intimately linked to the water status of plant
- Water helps in -Turgidity, enzyme activation
- Oxygen → helps in releasing metabolic energy
- Nutrients → helps in synthesis of protoplasm and act as source of energy.
- Optimum temperature range and environmental signals such as light and gravity also affect growth.
- Plant growth is open - can be determinate (Plant organs) or Indeterminate (Shoot & root apices).
- Plant differentiation is also open - Same meristem have different structures at maturity
- Final structure at maturity of cell/tissue is also determined by location of cell within.
- Development includes all changes from seed germination to senescence.
- Plant follow different pathway in response to environment or phases of life to form different kinds of structure, this ability called Plasticity
- Heterophylly in Butter cup, cotton, coriander and larkspur is an examples of plasticity
- Development in plants is under control of extrinsic (light, Temperature, water, oxygen & nutrition) and Intrinsic (Intracellular - genetic/intercellular - PGR) factors
- Plant growth regulators are small, simple molecules of diverse chemical composition

SOLVED EXAMPLE

Ex.1 Maximum growth in roots occurs

- (A) At apex (B) In presence of light
(C) Behind the apex (D) In presence of soil

Sol. (C) : Apex portion of root is made up of protective tissue 'root cap' and region of cell division is situated below the root cap.

Ex.2 The rate of growth of any organism follows

Or

Typical growth curves in plants is

- (A) Hyperbola curve (B) J-shaped curve
(C) Sigmoid curve (D) Parabola curve

Sol. (C) : The growth of an organism/organ passes through different phases. If the growth rate of a plant part is plotted against time on a graph paper, a sigmoid/S-shaped growth curve is obtained.

Ex.3 Exponential growth occurs in

- (A) Yeast
(B) Asexual reproduction
(C) Bacterial
(D) All of these

Sol. (B)

Ex.4 Given below is a graph drawn on the parameters of growth versus time A, B, C respectively represent

- (A) Exponential phase, log phase and steady state phase
(B) Steady state phase, log phase and lag phase
(C) Slow growing phase, lag phase and Steady state phase
(D) Lag phase, steady state phase and logarithmic phase
(E) Lag phase, steady state phase and logarithmic phase

Sol. (B)

Ex.5 The instrument by which the rate of growth of stem is accurately measured is

- (A) Hydrometer (B) Auxanometer
(C) Osmometer (D) Potometer

Sol. (B) : Auxanometer can register total, rate of growth at specific time and overall pattern of growth. In arc auxanometer actual growth in length of a plant is measured as Actual growth =

$$\frac{\text{distance travelled by pointer} \times \text{radius of pulley}}{\text{Length of pointer from centre of pulley}}$$

Ex.6 To induce formation of organs in a callus it is necessary to provide

- (A) Growth hormones (B) Water
(C) Soil (D) Antibiotics

Sol. (A)

Ex.7 Dr. F. Went noted that if coleoptile tips were removed and placed on agar for one hour, the agar would produce a bending when placed on one side of freshly cut coleoptile stumps. Of what significant is this experiment

- (A) It supports the hypothesis that IAA is auxin
(B) It demonstrate polar movement of auxins
(C) It made possible the isolation and exact identification of auxin
(D) It is the basis for quantitative determination of small amounts of growth-promoting substances

Sol. (C) : F.W. went isolated auxin from Avena coleoptile tip.

Ex.8 Which one of the following plants function is not generally governed or controlled by auxin

- (A) Apical dominance (B) Phototropism
(C) Photosynthesis (D) Growth

Sol. (C) : Because photosynthesis is enzymatic reaction and it is anabolic process

Ex.9 One of the synthetic auxin is

Or

Flowering in pineapple is promoted by

- (A) NAA (B) IAA
(C) GA (D) IBA

Sol. (A)

Ex.10 Both is callus and suspension cultures commonly used auxin is

- (A) NAA
(B) IBA
(C) 2, 4-D
(D) 2, 4, 5-Trichlorophenoxy acetic acid
(E) Abscisic acid

Sol. (C)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Fruit drop is caused by -
(A) Less auxin in fruit than in stem
(B) More auxin in fruit than in stem
(C) Equal distribution of auxin in stem and fruit
(D) Absence of auxin in stem and fruit
2. In plants growth is -
(A) Restricted to certain regions or structure
(B) Irreversible
(C) Change in size
(D) All the above
3. Growth is primarily affected by two climatic factors which are ?
(A) Light and temperature
(B) Temperature and relative humidity
(C) Light and wind
(D) Rainfall and temperature
4. Which of the following instrument can be used to record plant growth by seconds ?
(A) Arc auxanometer (B) Arc indicator
(C) Space marker disc (D) Crescograph
5. In a growing plant, the first phase during the process of growth is -
(A) Cell division (B) Cell enlargement
(C) Cell differentiation (D) Cell maturation
6. The natural plant hormones were first isolated from
(A) Cotton fruits, spinach leaves and rice plant
(B) Avena coleoptiles, spinach leaves and fungus Gibberella
(C) Human urine and corn germ oil
(D) Human urine and rice plant
7. Which one of the following nutrients is concerned with the growth of the plants in view of their role in synthesis of auxin -
(A) S (B) Mn
(C) Zn (D) K
8. Plants bend toward the light because -
(A) They need light for photosynthesis
(B) They need light for respiration
(C) Light attracts them
(D) Cells on the shaded side elongate more
9. Clinostat is used in study for -
(A) Photosynthesis (B) Respiration
(C) Geotropism (D) Osmosis
10. Which of the following exerts profound effect on the reproductive growth of a flowering plant ?
(A) Quality of light
(B) Quantity of light
(C) Direction of light
(D) Duration of light cycles
11. Which one of the following hormone is concerned chiefly with root initiation?
(A) IBA (B) GA₃
(C) ABA (D) Kinetin
12. If the tip of a seedling is cut off growth as well as bending ceases because it hampers
(A) Respiration
(B) Photosynthesis
(C) Perception of light stimulus
(D) Transpiration
13. An apparatus used to demonstrate phototropism is :-
(A) Luxmeter (B) Solarometer
(C) Clinostate (D) Heliotropic chamber
14. Phytohormone term was coined by -
(A) Gregory and Purvis (B) F.W. Went
(C) Thieman (D) L.J. Audus
15. The growth regulator that retards ageing of plant organ is -
(A) Auxin (B) Gibberellin
(C) Cytokinin (D) Abscisic acid
16. Which of the following breaks the dormancy of seeds ?
(A) IAA (B) GA₃
(C) Ethylene (D) All the above
17. First natural cytokinin was discovered by :-
(A) Miller (B) Letham
(C) Calvin (D) Govindii

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

- Avena coleoptile test to find out the quantity of growth promoting hormones was discovered by
(A) F.W. Went (B) L.J. Oudus
(C) K.V. Thimann (D) F. Skoog
- Primary precursor of I.A.A is :-
(A) Phenyl alanine (B) Tyrosine
(C) Tryptophan (D) Leucin
- Indole, 3 acetic acid, called as auxin was first isolated from :-
(A) Human urine (B) Corn germ oil
(C) Fusarium (D) Rhizopus
- Which of the following effects of auxins is of wide application ?
(A) Induction of fruit development
(B) Induction of root initiation
(C) Prevention of abscission
(D) All of the above
- Apical dominance means :-
(A) Suppression of growth of apical bud by axillary buds
(B) Suppression of growth of axillary buds by the presence of apical bud.
(C) Stimulation of growth of axillary buds by removal of apical bud
(D) Inhibition of growth of axillary buds by removal of apical bud.
- Auxin inhibits the growth of -
(A) Apical bud
(B) Lateral axillary buds
(C) Roots on stem cutting
(D) Parthenocarpic development of fruits
- Which of the following is not natural occurring plant hormone ?
(A) 2, 4 - D (B) GA₂
(C) Gibberellin (D) I.A.A
- Leaf fall occurs when the content of :-
(A) Auxin increases
(B) Auxin decreases
(C) Abscisic acid decreases
(D) Gibberellic acid decreases
- Substance which originate at the tip of stem to control growth :-
(A) Vitamins (B) Enzymes
(C) Food materials (D) Auxins
- Which of the growth substance acts as a stimulant during nodule formation in leguminous plant
(A) Ethylene (B) ABA
(C) IAA (D) Morphactin
- Auxanometer is meant for measuring -
(A) Respiratory activity
(B) Photosynthetic activity
(C) Growth activity
(D) Osmotic pressure
- Apical dominance in higher plants is due to -
(A) Phyto hormones (B) Enzymes
(C) Carbohydrates (D) Photoperiodism
- Auxin is mainly produced by -
(A) Apical root meristem
(B) Root cambium
(C) Apical shoot meristem
(D) Phloem in shoot tip
- Indole acetic acid generally inhibits the growth of
(A) Roots (B) Leaves
(C) Shoots (D) Plants in general
- Native auxin (Endogenous) is transported in the plant
(A) From the shoot tip in the downward direction
(B) From the root tip in the upward direction
(C) Through vascular systems in plants
(D) By a special transport system in the root
- The formula of Auxin-A is -
(A) C₁₈ H₃₀ O₇ (B) C₁₈ H₃₂ O₅
(C) C₁₂ H₃₀ O₆ (D) C₂₀ H₃₀ N₅
- Which growth hormone is responsible for apical dominance ?
(A) Auxin (B) Cytokinin
(C) Gibberellin (D) Ethylene
- 2, 4 - D is a synthetic -
(A) Auxin (B) Gibberellin
(C) Cytokinin (D) Florigen

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. C. Darwin and F. Darwin
- B. Miller and Skoog
- C. Letham
- D. Kurosawa

Column - II

- i. Cytokinin
- ii. ABA
- iii. Zeatin
- iv. Auxin
- v. GA

- (A) A-(iv), B-(i), C-(iii), D-(v)
- (C) A-(iii), B-(i), C-(ii), D-(iv)

- (B) A-(iv), B-(i), C-(ii), D-(iii)
- (D) A-(v), B-(iv), C-(ii), D-(i)

2. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Natural auxin
- B. Synthetic auxin
- C. Bakane disease of rice
- D. Natural cytokinin

Column - II

- i. NAA
- ii. Zeatin
- iii. IAA
- iv. GA
- v. Kinetin

- (A) A-(iii), B-(i), C-(iv), D-(ii)
- (C) A-(iii), B-(i), C-(iv), D-(v)

- (B) A-(i), B-(iii), C-(iv), D-(v)
- (D) A-(iv), B-(i), C-(v), D-(ii)

3. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Auxins
- B. Gibberellins
- C. Cytokinins
- D. Ethylene

Column - II

- i. Breaking seed dormancy
- ii. Inducing fruit ripening
- iii. Formation of abscission layer
- iv. Root initiation
- v. Chloroplast development in leaves

- (A) A-(iv), B-(i), C-(v), D-(ii)
- (C) A-(i), B-(iii), C-(ii), D-(iv)

- (B) A-(iv), B-(v), C-(iii), D-(ii)
- (D) A-(iii), B-(iv), C-(i), D-(v)

4. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. IAA
- B. Cytokinins
- C. Ethylene

Column - II

- i. Tissues undergoing senescence
- ii. Shoot apices
- iii. Root apices

- (A) A-(ii), B-(iii), C-(i)
- (C) A-(i), B-(ii), C-(iii)

- (B) A-(iii), B-(ii), C-(i)
- (D) A-(ii), B-(i), C-(iii)

5. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Auxin
- B. Cytokinins
- C. Abscisic acid
- D. Ethylene

Column - II

- i. Fruit ripening
- ii. Phototropism
- iii. Antagonist to GAs
- iv. Growth of lateral buds

- (A) A-(iv), B-(ii), C-(iii), D-(i)
- (C) A-(ii), B-(iii), C-(iv), D-(i)

- (B) A-(ii), B-(iv), C-(iii), D-(i)
- (D) A-(iii), B-(iv), C-(ii), D-(i)

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. Geocarpic fruits are produced by :
[CBSE AIPMT 2000,02]
(A) Onion (B) Watermelon
(C) Ground nut (D) Carrot
2. What reason will you assign for coconut milk used in tissue culture [CBSE AIPMT 2000, 03]
(A) Gibberellin (B) Cytokinin
(C) Auxin (D) Ethylene
3. The method that renders the seed coat permeable to water so that embryo expansion is not physi- cally retarded, is [CBSE AIPMT 2000]
(A) vernalisation (B) stratification
(C) denudation (D) scarification
4. Proteinaceous pigment which control the activities concerned with light: - [CBSE AIPMT 2001]
(A) Phytochrome (B) Chlorophyll
(C) Anthocyanin (D) Carotenoids
5. Which plant is a long-day plant : - [CBSE AIPMT 2001]
(A) Tobacco (B) Glycine max
(C) Mirabilis jalapa (D) Spinach
6. Which breaks dormancy of potato tuber : - [CBSE AIPMT 2001]
(A) Gibberellin (B) IAA
(C) ABA (D) Zeatin
7. Which of the following prevents the fall of fruits : - [CBSE AIPMT 2001]
(A) GA₃ (B) NAA
(C) Ethylene (D) Zeatin
8. Hormone responsible for senescence : - [CBSE AIPMT 2001]
(A) ABA (B) Auxin
(C) GA (D) Cytokinin
9. Plants deficient of element zinc, show its effect on the biosynthesis of plant growth hormone - [CBSE AIPMT 2003]
(A) Abscissic acid (B) Auxin
(C) Cytokinin (D) Ethylene
10. Differentiation of shoot is controlled by : - [CBSE AIPMT 2003]
(A) High gibberellin : cytokinin ratio
(B) High auxin : cytokinin ratio
(C) High cytokinin : auxin ratio
(D) High gibberellin : auxin ratio
11. One set of a plant was grown at 12 hours day and 12 hours night period cycles and it flowered while in the other set night phase was interrupted by flash of light and it did not produce flower. Under which one of the following categories will you place this plant ? [CBSE AIPMT 2004]
(A) Long day (B) Darkness neutral
(C) Day neutral (D) Short day
12. Anthesis is a phenomenon which refers to - [CBSE AIPMT 2004]
(A) Reception of pollen by stigma
(B) Formation of pollen
(C) Development of anther
(D) Opening of flower bud
13. Cell elongation in internodal regions of the green plants takes place due to :- [CBSE AIPMT 2004]
(A) Indole acetic acid (B) Cytokinins
(C) Gibberellins (D) Ethylene
14. Treatment of seed at low temperature under moist conditions to break its dormancy is called - [CBSE AIPMT 2006]
(A) Vernalisation (B) Chelation
(C) Stratification (D) Scarification
15. An enzyme that can stimulate germination of barley seeds is - [CBSE AIPMT 2006]
(A) Lipase (B) Protease
(C) Invertase (D) α -amylase
16. How does pruning help in making the hedge dense ? [CBSE AIPMT 2006]
(A) It frees axillary buds from apical dominance
(B) The apical shoot grows faster after pruning
(C) It releases wound hormones
(D) It induces the differentiation of new shoots from the rootstock
17. Which one of the following pairs, is not correctly matched? [CBSE AIPMT 2007]
(A) Abscissic Acid – Stomatal closure
(B) Gibberellic Acid – Leaf fall
(C) Cytokinin – Cell division
(D) IAA – Cell wall elongation
18. ‘Foolish Seedling’ disease of rice led to the discovery of : [CBSE AIPMT 2007]
(A) GA (B) ABA
(C) 2, 4 D (D) IAA

MOCK TEST

1. The cell derived from meristems differentiate and regain the capacity to divide by a phenomenon called
 (A) differentiation (B) dedifferentiation (C) redifferentiation (D) totipotency
 (E) regeneration
2. A few normal seedlings of tomato were kept in a dark room. After a few days they were found to have become white-coloured like albinos. Which of the following terms will you use to describe them?
 (A) Mutated (B) Embolised (C) Etiolated (D) Defoliated
3. Auxanometer is used to measure
 (A) the growth in length of a plant organ (B) the growth in breadth of a plant organ
 (C) population of the pests attacking a plant (D) both (A) and (B).
4. The *Avena* curvature is used for bioassay of
 (A) IAA (B) ethylene (C) ABA (D) GA₃
5. Auxin can be bioassayed by
 (A) potometer (B) lettuce hypocotyl elongation
 (C) *Avena* coleoptile curvature (D) hydroponics
6. **Assertion :** Plant growth regulators (PGRs) are very important for plant growth and development.
Reason : Auxins do not induce flowering in gymnosperms.
 (A) If both assertion and reason are true and reason is the correct explanation of assertion.
 (B) If both assertion and reason are true but reason is not the correct explanation of assertion.
 (C) If assertion is true but reason is false.
 (D) If both assertion and reason are false.
7. Dr. F. Went noted that if coleoptile tips were removed and placed on agar for one hour, the agar would produce a bending when placed on one side of freshly-cut coleoptile stumps. Of what significance is this experiment?
 (A) It made possible the isolation and exact identification of auxin.
 (B) It is the basis for quantitative determination of small amount of growth-promoting substances.
 (C) It supports the hypothesis that IAA is auxin.
 (D) It demonstrated polar movement of auxins.
8. The pineapple which under natural condition is difficult to blossom has been made to produce fruits throughout the year by application of
 (A) NAA, 2, 4-D (B) phenyl acetic acid (C) cytokinin (D) IAA, IBA
9. One of the commonly used plant growth hormone in tea plantation is
 (A) ethylene (B) abscisic acid (C) zeatin (D) indole - 3-acetic acid
10. Compare the statements A and B
Statement A : Auxins promote apical dominance by suppressing the activity of lateral buds.
Statement B : In moriculture, periodic pruning of shoot tips is done to make mulberry plants bushy.
 Select the correct description
 (A) statement A is wrong and B is correct
 (B) both the statements A and B are correct and A is not the reason for B
 (C) both the statements A and B are correct and A is the reason for B.
 (D) statement A is correct and B is wrong.

www.blog.neetnarme.com

BIOMOLECULES

“Scientific research is one of the most exciting and rewarding of occupations.”

“**FREDERICK SANGER (1919-2013)**”

INTRODUCTION

There is a wide range of variety in living organisms in our biosphere. All living organisms are made up of the same chemicals, i.e. elements and compounds. If we analyse animals or plant tissue or a microbial waste, we will obtain elements like carbon, oxygen, hydrogen, etc. If the same analysis is performed on a piece of earth's crust as an example of non-living matter. All elements present in a sample of earth's crust are also present in a sample of living tissue. But when examined closely it is observed that in living organisms the relative abundance of carbon and hydrogen with respect to other elements is higher than in earth's crust.

BIOMOLECULES

All the carbon compound that Present in living tissue.

But exceptionally lipid is micromolecule but present in acid insoluble fraction.

1. CARBOHYDRATE

→ Although polysaccharide is non reducing but in a polysaccharide chain one end is reducing and another end is non reducing.

→ Starch form helical structure so starch can hold I_2 molecules in the helical portion so starch- I_2 is blue in colour.

While cellulose have linear structure so it cannot hold I_2 and don't give Iodine test.

→ Paper made from plant pulp is cellulose.

→ Difference between gums and fevicol → Gums are natural mucopolysaccharide while fevicol is synthetic rubber based adhesive.

2. LIPID

→ Fatty acids are of two types →

(i) Saturated → eg palmitic acid (16 carbon compound), stearic acid

(ii) unsaturated → eg oleic acid, Linoleic acid, Linolenic acid, Arachidonic acid (20 carbon compound) Glycerole is trihydroxy propane. "Lipids are called fats and oils on the basis of melting point. Oils have lower melting point and fats have higher melting point.

→ Some lipids also have phosphorus like lecithin.

3. Protein

→ Proteins are heteropolymer of amino acids.

→ Amino acids contain an amino group and carboxylic group on the same carbon i.e. the α -carbon so they are called α -amino acid.

→ Amino acid are substituted methane.

→ Amino acids are of two types:-

(i) Essential amino acid

(ii) Non essential amino acid

→ Protein show mainly four type of configuration :-

(A) Primary configuration (B) Secondary configuration

(C) Tertiary configuration (D) Quaternary configuration

→ Tertiary structure is absolutely necessary for the many biological activities of protein.

4. DNA

→ In a DNA molecule one purine always pairs with a pyrimidine. This generates approximately uniform distance between the two strands of DNA.

→ In DNA plane of one base pair stacks over the other in double helix. This, in addition to H-bonds, confers stability of the helical structure of DNA.

→ Difference between DNAs and DNase is that DNAs means many DNA and DNase means DNA digestive enzymes.

→ Oswald Avery, Colin Macleod and Maclyn Mccarty firstly proved the genetic material is DNA.

→ Alfred Hershey and Martha Chase Firstly proved that in bacteriophage DNA is also genetic material.

→ A molecule that can act as a genetic material must fulfil the following criteria

(i) It should be able to generate it's replica (replication)

(ii) It should chemically and structurally be stable

(iii) It should has property of mutation.

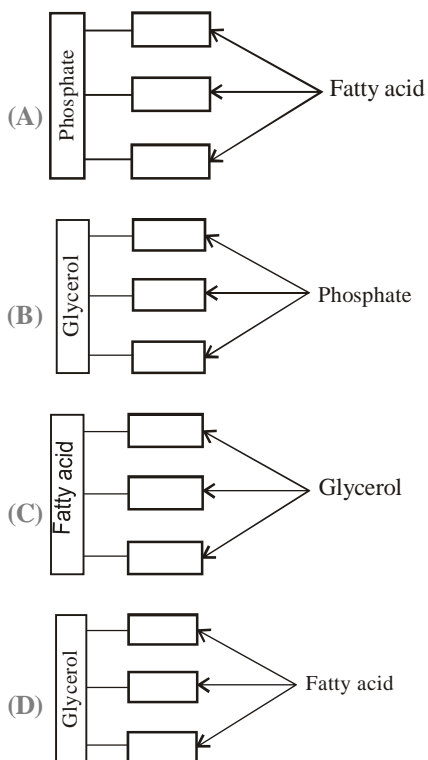
(iv) It should be able to express itself in the form of "Mendelian Characters".

→ The presence of thymine at the place of uracil also provide additional stability to DNA.

→ Both DNA and RNA are able to mutate. In fact, RNA being less stable, mutate at faster rate so virus having RNA

SOLVED EXAMPLE

Ex.1 Which one of the following diagrams shows a molecule of simple lipid



Sol. (D)

Ex.2 Which is non-reducing sugar

- (A) Glucose (B) Galactose
(C) Mannose (D) Sucrose

Sol. (D) : The carbohydrates or sugar where free aldehyde or ketonic group is absent (utilized in glycosidic bond formation) can not reduce the above reagents are called non-reducing sugar i.e., Sucrose, glycogen, Starch.

Ex.3 Which one of the following biomolecules is correctly characterised

- (A) Lecithin - a phosphorylated glyceride found in cell membrane
(B) Palmitic acid - an unsaturated fatty acid with 18 carbon atoms
(C) Adenylic acid - adenosine with a glucose phosphate molecule
(D) Alanine amino acid - Contains an amino group and an acidic group anywhere in the molecule

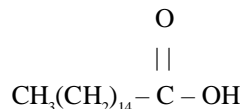
Sol. (A)

Ex.4 Which of the following is a homopolysaccharide is

- (A) Heparin (B) Inulin
(C) Pectin (D) Hyaluronic acid

Sol. (B)

Ex.5 Given below is the chemical formula of



- (A) Palmitic acid (B) Stearic acid
(C) Glycerol (D) Galactose

Sol. (A)

Ex.6 Select the wrong statement

- (A) The building blocks of lipids are amino acids
(B) Majority of enzymes contain a non-protein part called the prosthetic group
(C) The thylakoids are arranged one above the other like a stack of coins forming a granum
(D) Crossing-over occurs at pachytene stage of meiosis I
(E) Steroids are complex compounds commonly found in cell membranes and animal hormones

Sol. (A)

Ex.7 Chitin is a

- (A) Polysaccharide
(B) Nitrogenous polysaccharide
(C) Lipoprotein
(D) Protein

Sol. (B) : Polymer of N-acetylglucosamine ($\text{C}_8\text{H}_{13}\text{O}_5\text{N}$)_n that forms exoskeleton of arthropods and cell wall of fungi.

Ex.8 Which one of the following pairs is not correctly matched

- (A) Recombinant DNA - DNA formed by the joining of segments of DNA from different sources
(B) Purine - Nitrogenous bases Cytosine, thymine and uracil
(C) ATP - The principal energy carrying compound in the cell
(D) r-RNA - RNA molecules found in ribosomes

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Which of the following biomolecule is insoluble in water :
(A) α -Keratin (B) Haemoglobin
(C) Ribonuclease (D) Adenine
2. Which one of the following statement is true for protein synthesis (translation) :
(A) Amino acids are directly recognized by m-RNA
(B) The third base of the codon is less specific
(C) Only one codon codes for an amino acid
(D) Every t-RNA molecule has more than one amino acid attachment site
3. Amino acid sequence, in protein synthesis is decided by the sequence of
(A) tRNA (B) mRNA
(C) cDNA (D) rRNA
4. One turn of the helix in a B-form DNA is approximately
(A) 20 nm (B) 0.34 nm
(C) 3.4 nm (D) 2 nm
5. Antiparallel strands of a DNA molecule means that
(A) one strand turns anti-clockwise
(B) the phosphate groups of two DNA strands, at their ends, share the same position
(C) the phosphate groups at the start of two DNA strands are in opposite position (pole)
(D) one strand turns clockwise
6. The causative agent of mad-cow disease is
(A) Bacterium (B) Prion
(C) Worm (D) Virus
7. Thymine is –
(A) 5-Methyl uracil (B) 4-Methyl uracil
(C) 3-Methyl uracil (D) 1-Methyl uracil
8. Molecular basis of organ differentiation depends on the modulation in transcription by :
(A) RNA polymerase (B) Ribosome
(C) Transcription factor (D) Anticodon
9. The two polynucleotide chains in DNA are :
(A) Parallel (B) Discontinuous
(C) Antiparallel (D) Semiconservative
10. Which monosaccharide does not show optical isomerism :
(A) Dihydroxy acetone (B) Glyceraldehyde
(C) Erythrose (D) Ribose
11. Polysome is formed by :-
(A) A ribosome with several subunits
(B) Ribosomes attached to each other in a linear arrangement
(C) Several ribosomes attached to a single mRNA
(D) Many ribosomes attached to a strand of endoplasmic reticulum
12. In the DNA molecule:-
(A) the proportion of Adenine in relation to thymine varies with the organism
(B) there are two strands which run antiparallel one in 5' \rightarrow 3' direction and other in 3' \rightarrow 5'
(C) the total amount of purine nucleotides and pyrimidine nucleotides is not always equal
(D) there are two strands which run parallel in the 5' \rightarrow 3' direction
13. Which of the following bond is not related to nucleic acid :
(A) H-bond (B) Ester bond
(C) Glycosidic bond (D) Peptide bond
14. Removal of introns and joining the exons in a defined order in a transcription unit is called :-
(A) Capping (B) Splicing
(C) Tailing (D) Transformation
15. Whose experiments cracked the DNA and discovered unequivocally that a genetic code is a "triplet" :-
(A) Beadle and tatum
(B) Nirenberg and Mathaei
(C) Hershey and Chase
(D) Morgan and Sturtevant
16. A higher nucleotide is a nucleotide having
(A) higher molecular weight
(B) More than one phosphate residue
(C) More than one nitrogen base
(D) More than one sugar residue
17. Which is odd -
(A) Chitin Carbohydrates (B) Pectin - Protein
(C) Steroid - Lipid (D) Wax - Lipid
18. Cholesterol is synthesized in -
(A) pancreas (B) Brunners gland
(C) Spleen (D) Liver

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. Which is a disaccharide-
(A) Galactose (B) Fructose
(C) Maltose (D) Dextrin
2. To get quick energy one should use -
(A) Carbohydrate (B) Fats
(C) Vitamins (D) Proteins
3. Which is not polysaccharide -
(A) Sucrose (B) starch
(C) Glycogen (D) cellulose
4. Characteristic feature of haemoglobin-
(A) Reversible union with oxygen
(B) Red Colour
(C) Presence of Cu
(D) Presence of Globulin protein
5. External Coat composed of cellulose like material occurs in-
(A) Hemichordata (B) Urochordata
(C) Cephalochordata (D) Cyclostomata
6. Common in feather and Silk is-
(A) Carbohydrate (B) Fats
(C) Protein (D) Nucleic acid
7. Monosaccharide is -
(A) Pentose Sugar (B) Hexose Sugar
(C) Only Glucose (D) all the above
8. Which substance is most abundant in cell-
(A) Carbohydrates (B) Protein
(C) Water (D) Fats
9. Dipeptide is-
(A) Structure of two peptide bonds
(B) Two amino acids linked by one peptide bond
(C) bond between one amino acid and one peptide
(D) None
10. Nails, horns and hoofs contain -
(A) Chitin (B) Keratin
(C) Both (D) None
11. In which form the extra Sugars stored in the body -
(A) Glucose monosaccharide
(B) Sucrose Disaccharide
(C) Glycogen polysaccharide
(D) Fatty acid and glycerol
12. Products of proteins catabolism
(A) NH_3 , CO_2 and Urea
(B) Urea, CO_2 and NH_3
(C) Urea, NH_3 and uric acid
(D) Urea, NH_3 , alanine and creatine
13. Glycogen is -
(A) Polymer of amino acids
(B) Polymer of fatty acids
(C) Unsaturated fats
(D) Polymer of glucose
14. Carbohydrate is -
(A) Polymers of fatty acid
(B) Polymer of amino acids
(C) Poly hydroxy aldehyde or ketone
(D) None
15. Which compound produces more than twice the amount of energy as compared to carbohydrates
(A) Protein (B) Fats
(C) Vitamins (D) Glucose
16. What is the normal ratio of sugar in human blood.
(A) .01 % (B) 0.1%
(C) 1 % (D) 0.18%
17. Carbohydrate metabolism is controlled by :
(A) Parathormone (B) Insulin
(C) Glucose (D) Vitamin B_{12}
18. Fattiness is due to the excess of :-
(A) Connective tissue (B) Blood
(C) Muscular tissue (D) Adipose tissue
19. Starving person will first use :-
(A) Fats (B) Glycogen
(C) Blood protein (D) Muscle protein

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

- Match Column-I with Column-II and select the correct option from the codes given below.

<p>Column - I</p> <p>A. Galactose</p> <p>B. Anticoagulant</p> <p>C. Fructose</p> <p>D. Lecithin</p> <p>E. Insulin</p>	<p>Column - II</p> <p>i. Protein</p> <p>ii. Phospholipid</p> <p>iii. Brain sugar</p> <p>iv. Heparin</p> <p>v. Fruit sugar</p>
--	--

(A) A-v, B-iii, C-ii, D-i, E-iv (B) A-v, B-iii, C-i, D-iv, E-ii (C) A-i, B-ii, C-iii, D-v, E-iv (D) A-iii, B-iv, C-v, D-ii, E-i
- Match Column - I with Column - II and select the correct option from the codes given below.

<p>Column - I</p> <p>A. Cotton fibre</p> <p>B. Exoskeleton of cockroach</p> <p>C. Liver</p> <p>D. Peeled potato</p> <p>E. Roots of <i>Dahlia</i></p>	<p>Column - II</p> <p>i. Starch</p> <p>ii. Glycogen</p> <p>iii. Chitin</p> <p>iv. Inulin</p> <p>v. Cellulose</p>
---	---

(A) A- v, B-iii, C-ii, D-i, E-iv (B) A-v, B-iii, C-i, D-iv, E-ii (C) A-i, B-ii, C-iii, D-v, E-iv (D) A-iii, B-ii, C-v, D-iv, E-i
- Match Column-I with Column-II and select the correct option from the codes given below.

<p>Column - I</p> <p>A. Tetrose sugar</p> <p>B. Pentose sugar</p> <p>C. Hexose sugar</p> <p>D. Disaccharide</p>	<p>Column - II</p> <p>i. Galactose</p> <p>ii. Maltose</p> <p>iii. Erythrose</p> <p>iv. Ribose</p> <p>v. Sedoheptulose</p>
--	--

(A) A-v; B-iv; C-iii; D-i, ii (B) A-iii; B-iv; C-v; D-ii (C) A-iii; B-iv; C-i; D-ii (D) A-i; B-iv; C-iii; D-v
- Match Column - I with Column - II and select the correct option from the codes given below.

<p>Column - I</p> <p>(Category)</p> <p>A. Pigments</p> <p>B. Terpenoids</p> <p>C. Alkaloids</p> <p>D. Lectins</p>	<p>Column - II</p> <p>(Secondary metabolites)</p> <p>i. Concanacalin A</p> <p>ii. Monoterpenes, diterpenes</p> <p>iii. Morphine, codeine</p> <p>iv Carotenoids, anthocyanins</p>
--	---

(A) A-iv, B-ii, C-iii, D-i (B) A-iv, B-iii, C-ii, D-i (C) A-i, B-iv, C-iii, D-ii (D) A-i, B-iii, C-ii, D-iv
- Match the following and choose the correct combination from the options given

<p>Column - I</p> <p>(Organic Compound)</p> <p>A. Fatty acid</p> <p>B. Phospholipid</p> <p>C. Aromatic amino acid</p> <p>D. Acidic amino acid</p>	<p>Column - II</p> <p>(Example)</p> <p>i. Glutamic acid</p> <p>ii. Tryptophan</p> <p>iii. Lecithin</p> <p>iv. Palmitic acid</p>
--	--

(A) A-i, B-ii, C-iii, D-iv
 (C) A-ii, B-iii, C-iv, D-i
 (E) A-iv, B-iii, C-i, D-ii

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. Which is an essential amino acid ?
[CBSE AIPMT-2000]
(A) Serine (B) Aspartic acid
(C) Glycine (D) Phenylalanina
2. ATP is a [CBSE AIPMT-2000]
(A) nucleotide (B) nucleosome
(C) nucleosie (D) purine
3. One of the similarities between DNA and RNA is that both [CBSE AIPMT-2000]
(A) are polymers of nucleotides
(B) are capable of replicating
(C) have similar sugars
(D) have similar pyrimidine bases
4. Feedback inhibition of an enzymatic reaction is caused by [CBSE AIPMT-2000]
(A) are polymers of nucleotids
(B) are capable of replicating
(C) have similar sugars
(D) have similar pyrimidine bases
5. Enzymes enhance the rate of reaction [CBSE AIPMT-2000]
(A) forming a reactant - product complex
(B) changing the equilibrium point of the reaction
(C) combining with the product as soon as it is formed
(D) lowering the activation energy of the reaction
6. The transfer RNA molecule in 3D appears [CBSE AIPMT-2000]
(A) L-shaped (B) E-shaped (C) Lipoproteins
(D) S-shaped
7. Conjugated proteins containing carbohydrates as prosthetic group are known as [CBSE AIPMT-2000]
(A) chromoproteins (B) glycoproteins
(C) lipoproteins (D) nucleoproteins
8. In plants, inulin and pectin are [CBSE AIPMT-2000]
(A) reserve materials
(B) wastes
(C) excretory material
(D) insect-attracting material
9. Element necessary for the middle lamella [CBSE AIPMT-2001]
(A) Ca (B) Zn
(C) K (D) Cu
10. Cytochrome is [CBSE AIPMT-2001]
(A) metallo flavoprotein
(B) Fe containing porphyrin pigment
(C) glycoprotein
(D) lipid
11. Spoilage of oil can be detected by which on earth is [CBSE AIPMT-2000]
(A) protein (B) cellulose
(C) lipids (D) steroids
12. Most abundant organic compound on earth is [CBSE AIPMT-2001, 04]
(A) protein (B) cellulose
(C) lipids (D) steroids
13. Hydrolytic enzymes which act at low pH [CBSE AIPMT-2002]
(A) proteases (B) α -amylases
(C) hydrolases (D) peroxidases
14. Which steroid is used for transformation? [CBSE AIPMT-2002]
(A) Cortisol (B) Cholesterol
(C) Testosterone (D) Progesterone
15. Which of the following is a reducing sugar? [CBSE AIPMT-2002]
(A) Galactose (B) Gluconic acid
(C) β -methyl galactoside (D) Sucrose
16. Lipids are insoluble in water because lipid molecules are [CBSE AIPMT-2002]
(A) hydrophilic (B) hydrophobic
(C) neutral (D) Zwitter ions
17. Collagen is [CBSE AIPMT-2002]
(A) fibrous protein (B) globular protein
(C) lipid (D) carbohydrate
18. The major portion of the dry weight of plants comprises of [CBSE AIPMT-2003]
(A) carbon, nitrogen and hydrogen
(B) carbon, hydrogen and oxygen
(C) nitrogen, phosphorus and potassium
(D) calcium, magnesium and sulphur

1. In a polysaccharide, number of monosaccharides are linked by
(A) glycosidic bond (B) peptide bond (C) hydrogen bond (D) phosphoester bond
2. Which of the following is/are cellulosic?
(i) Paper (ii) Cotton fibre (iii) Chitin (iv) Glycogen
(A) (i) and (ii) only (B) (i) and (iii) only (C) (i), (iii) and (iv) only (D) (iii) and (iv) only
(E) (iii) only
3. The chitinous exoskeleton of arthropods is formed by the polymerisation of
(A) N - acetyl glucosamine (B) lipoglycans
(C) deratin sulphate and chondroitin sulphate (D) D - glucosamine
4. Macromolecule chitin is
(A) sulphur containing polysaccharide (B) simple polysaccharide
(C) nitrogen containing polysaccharide (D) phosphorous containing polysaccharide
5. Which of the following statements is not correct?
(A) Starch is a polymer of α -glucose.
(B) Starch is made up of amylose and amylopectin.
(C) Amylose is linear structure consisting of several glucose residues joined by 1,4-glycosidic linkages.
(D) Amylopectin is a straight chain with several glucose residues joined only by 1,4-glycosidic linkages.
6. Carbohydrates are commonly found as starch in plants storage organs. Which of the following five properties of starch (1-5) make it useful as a storage material?
(1) Easily translocated (2) Chemically non-reactive
(3) Easily digested by animals (4) Osmotically inactive
(5) Synthesised during photosynthesis
The useful properties are
(A) (1), (3) and (5) (B) (1) and (5) (C) (2) and (3) (D) (2) and (4)
7. Which of the following is the least likely to be involved in stabilising the three-dimensional folding of most proteins?
(A) Hydrogen bonds (B) Electrostatic interaction
(C) Hydrophobic interaction (D) Ester bonds
8. Which one of the following statements is wrong?
(A) Uracil is a pyrimidine (B) Glycine is a sulphur containing amino acid
(C) Sucrose is a disaccharide (D) Cellulose is a polysaccharide
9. Which of the following statements about amino acids is false?
(A) Based on the nature of the carboxyl group there are many amino acids.
(B) Amino acids are substituted methanes.
(C) Amino acids have an amino group and acidic group as substituents on the α -carbon.
(D) There are four substituent groups occupying the four valency positions.
(E) Tryptophan is an aromatic amino acid.

www.blog.neetnearme.com

www.blog.neetnearme.com

EXCRETORY PRODUCTS AND THEIR ELIMINATION

“Owing to the difficulty of dealing with substances of high molecular weight we are still a long way from having determined the chemical characteristics and the constitution of proteins, which are regarded as the principal constituents of living organisms.”

“WALTER BRADFORD CANNON(1871-1945)”

INTRODUCTION

Ammonia, urea, uric acid, carbon dioxide, water and ions like Na^+ , K^+ , Cl^- , Phosphate, sulphate, etc., either by metabolic activities or by other means like excess ingestion all gets accumulated in animals. These substances need to be removed partially or totally. Ammonia, Urea and Uric acid are the major forms of nitrogenous wastes excreted by the animals.

Ammonia being most toxic form requires large amount of water for its elimination, whereas uric acid, being the least toxic, can be removed with a minimum loss of water. The process of removal of metabolic wastes from the body is called **Excretion**. The process of excreting ammonia is called **Ammonotelism**. Many aquatic insects or aquatic animals are ammonotelic in nature. Ammonia is readily soluble and is generally excreted by diffusion across body surfaces or through gill surfaces as ammonium ions. Mammals, many terrestrial amphibians and marine fishes mainly excrete urea and are called **Ureotelic**. Reptiles, birds, land snails and insects excrete nitrogenous wastes as uric acid in the form of pellet or paste with a minimum loss of water and are called **ureotelic** animals.

EXCRETORY PRODUCTS & THEIR ELIMINATION

DEFINITION

- (i) Elimination of metabolic waste from body is called **excretion**.
- (ii) Due to metabolic activity in the body numerous waste substances are produced. The process which is concerned with removal of nitrogenous waste materials (e.g., urea, uric acid, CO_2 , Ammonia, salts, excess water etc.) is termed excretion.
Carbohydrate metabolism, produces CO_2 and H_2O . Protein metabolism produces nitrogenous wastes—**ammonia, urea and uric acid**.

HOMEOSTASIS

Maintenance of steady state (**Walter Cannon**).

Homeostatic mechanism are important for normal life as they maintain condition within a range in which the animals metabolic processes can occur.

Osmoregulation:

Osmoregulation : The regulation of solute movement and hence water movement (which follows solutes by osmosis) is called **osmoregulation**.

On the basis of osmoregulation, animals are either osmoconformer or osmoregulators.

- a. **Osmoconformers** : These animals can not actively control the osmotic condition of their body fluids. Instead of this, they change or adapt the osmolarity of body fluids according to the osmolarity of the surrounding medium.

Example :

- All marine invertebrates and some fresh water invertebrates.
- Hagfish (myxine) which is marine cyclostome fish, is the only vertebrate osmoconformer.
Osmoconformers show an excellent ability to tolerate a wide range of cellular osmotic environments.

b. Osmoregulators :

Osmoregulators are those who animals maintain an osmolarity internally different from the surrounding medium in which they inhabit. Osmoregulator animals must either eliminate excess water if they are in hypotonic medium or they should continuously take in water to compensate for water loss if they are in hypertonic medium. Due to this the osmoregulator animals have to spend energy

Strict osmoregulators : Are animals which maintain the composition of body fluids within a narrow osmotic range.

Eg. most vertebrates (except Hag fish and elasmobranch like shark & rays fish)

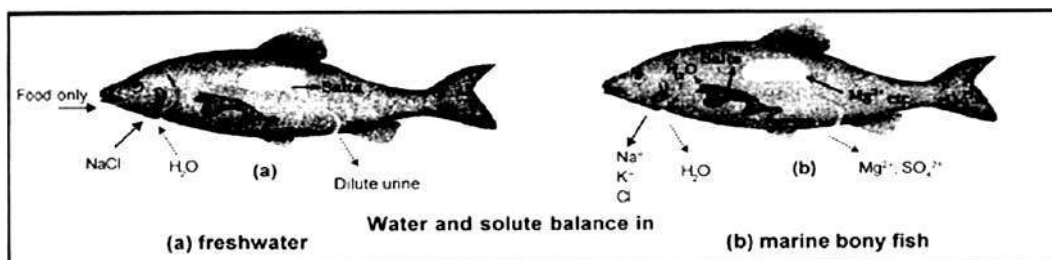
Water and solute regulation in freshwater environment :

Body fluids of fresh water animals (osmolarity 200-300 m osm L^{-1}) are hypertonic to surrounding medium (osmolarity 50 m osm L^{-1}). Due to this, the freshwater animals constantly face two problems :

- (i) They gain water passively due to osmotic gradient
- (ii) Continuous loss of body salts to surrounding low salt containing medium occurs.

To encounter these problems the fresh water fishes perform following acts :

- They do not drink water
- Specialised cells called ionocytes or chloride cells are present in the gill membrane of fresh water fish. These cells can actively import Na^+ & Cl^- from surrounding water (containing less than 1mM NaCl against concentration gradient).



EXCRETORY PRODUCTS & THEIR ELIMINATIONS

- Ammonia, Urea and Uric acid are the major forms of nitrogenous wastes excreted by the animals.
- Toxicity sequence = Ammonia > Urea > Uric acid.
- Ammonotelic animals = Many bony fishes, aquatic amphibians, aquatic insects.
- Ureotelic animals = Mammals, Marine fishes, terrestrial amphibians.
- Uricotelic animals = Reptiles, birds, insects, land snails.
- A survey of animal kingdom presents a variety of excretory structures.

S.No.	Excretory structures	Examples
1.	Protonephridia (Flame cells)	Platyhelminthes, Rotiferes, Some-annelids and Cephalochordate (Amphioxus).
2.	Nephridia	Earthworms and other annelids
3.	Malpighian tubules	Most insects
4.	Antennal/Green glands	Crustaceans (Prawn)
5.	Vertebrates	Kidney

- In humans, the excretory system consists of a pair of kidneys, one pair of ureters, a urinary bladder and a urethra.
- The outer layer of kidney is a tough capsule. Inside the kidney, there are two zones, an outer cortex and an inner medulla.
- The medulla is divided into a few conical masses (medullary pyramids) projecting into the calyces.
- The cortex extends in between the medullary pyramids as renal columns called "Columns of Bertini".
- Each kidney has nearly one million complex tubular structures called nephrons which are the functional units .
- Glomerulus + Bowman's capsule = Malpighian body or Renal corpuscle.
- The malpighian corpuscle, PCT and DCT of the nephron are situated in the cortical region of the kidney whereas the loop of Henle dip into the medulla.
- Glomerular filtration takes place in Bowman's capsule and glomerular filtrate is formed which is protein less plasma.
- On an average 1100-1200 ml of blood is filtered by the kidney per minute.
- Glomerular filtration rate (GFR) in a healthy individual is 125 ml/minute or 180 litres per day.
- Nearly 99 percent of the filtrate has to be reabsorbed by the renal tubules. This process is called reabsorption.
- Substances like glucose, amino acids, Na^+ etc. in the filtrate are reabsorbed actively whereas the nitrogenous wastes and water are absorbed by passive transport.
- During urine formation, the tubular cells secrete substances like H^+ , K^+ and ammonia into the filtrate. This tubular secretion is an active process.

Functions of the tubules:

1. PCT:

Maximum reabsorption occur

All the essential nutrients, 70-80% of electrolytes and water, HCO_3^- are reabsorbed.

Selective secretion of hydrogen ions, ammonia and potassium ions.

2. Henle's loop:

Descending limb reabsorb water passively and ascending limb reabsorbed electrolytes actively or passively.

EXCRETORY PRODUCTS & THEIR ELIMINATIONS

SOLVED EXAMPLE

Ex.1 Which one of the following blood vessels in mammals would normally carry the largest amount of urea.

- (A) Hepatic portal vein
- (B) Hepatic vein
- (C) Renal artery
- (D) Hepatic artery

Sol. (B) : Since urea formation takes place in liver.

Ex.2 The body cells in cockroach discharge their nitrogenous waste in the haemolymph mainly in the form of

- (A) Potassium urate
- (B) Urea
- (C) Calcium carbonate
- (D) Ammonia

Sol. (A)

Ex.3 Which one of the following characteristics is common both in humans and adult frogs

- (A) Four-chambered heart
- (B) Internal fertilisation
- (C) Nucleated RBCs
- (D) Ureotelic mode of excretion

Sol. (D) : Adult frog and human exhibit ureotelism because their excretory waste product is urea.

Ex.4 Almost all the aquatic animals excrete ammonia as the nitrogenous waste product. Which of the following statements is not in agreement with this situation.

- (A) Ammonia is easily soluble in water
- (B) Ammonia is released from the body in a gaseous state
- (C) Ammonia is highly toxic and needs to be eliminated as and when formed
- (D) Ammonia gets converted into a less toxic form called urea

Sol. (B)

Ex.5 Choose the wrong statement

- (A) In ureotelic organisms, ammonia is not a product of metabolism
- (B) In mammals some amount of urea may be retained in the kidney matrix of ureotelics to maintain osmolarity
- (C) In fishes, kidneys do not play any significant role in the removal of ammonium ions
- (D) Urea and uric acid are less toxic than ammonia
- (E) Ammonia is readily soluble and can diffuse easily

Sol. (A)

Ex.6 Man is

- (A) Ureotelic
- (B) Uricotelic
- (C) Ammonotelic
- (D) Both (B) and (C)

Sol. (A)

Ex.7 Which of the following does not have an excretory system

- (A) Myxine
- (B) Carcharodon
- (C) Balanoglossus
- (D) Asterias

Sol. (D)

Ex.8 Proboscis gland in Balanoglossus is associated with

- (A) Digestion
- (B) Respiration
- (C) Circulation
- (D) Excretion

Sol. (D)

Ex.9 The region of the nephron found in the renal medulla is

- (A) Malpighian corpuscle
- (B) Proximal convoluted tubule
- (C) Distal convoluted tubule
- (D) Henle's loop
- (E) Glomerulus

Sol. (D)

Ex.10 Urinary bladder is absent in

- (A) Lizards
- (B) Snakes
- (C) Crocodiles
- (D) All the above

Sol. (B)

Ex.11 Which one is the excretory organ in the following

- (A) Archaeocyte
- (B) Choanocyte
- (C) Pinacocyte
- (D) Solenocyte

Sol. (D) : Solenocytes (flame cells) help in excretion in flatworms (platyhelminthes)

Ex.12 Loop of Henle is concerned with

- (A) Excretory system
- (B) Reproductive system
- (C) Nervous system
- (D) Muscular system

Sol. (A)

Ex.13 Which is common to kidney and skeleton in mammals

- (A) Cortex
- (B) Medulla
- (C) Pelvis
- (D) Radius

Sol. (C)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Which one of the following substance is completely reabsorbed from the filtrate in the renal tubule under normal condition –
(A) Urea (B) Uric acid
(C) Salt and water (D) Glucose
2. The afferent and efferent vessels are –
(A) Arterial in nature
(B) Venous in nature
(C) One is arterial and the other is venous
(D) None of the above
3. Blood vessel leading to glomerulus is called
(A) Afferent arteriole (B) Renal artery
(C) efferent arteriole (D) Renal vein
4. Ultrafiltration occurs in a glomerulus when-
(A) Osmotic pressure exceeds hydrostatic pressure
(B) Hydrostatic pressure exceeds osmotic pressure
(C) Colloidal osmotic pressure plus capsular pressure remain less than glomerular hydrostatic pressure
(D) Capsular hydrostatic pressure exceeds glomerular hydrostatic pressure
5. Workers in deep mines usually suffer from dehydration because –
(A) Water is lost due to defecation
(B) Water is lost due to evaporation
(C) Water is lost along with salts in the form of sweat
(D) Water is lost in the form of urine
6. The yellow colour of urine is due to –
(A) Urea (B) Melanin
(C) Uric acid (D) Urochrome
7. Excretion is a continuous process but urine is not passed out continuously because of –
(A) Ureter (B) Rectum
(C) Urinary bladder (D) Cloaca
8. ADH will be released from the posterior pituitary when there is a decrease in –
(A) Plasma potassium concentration
(B) Plasma pH
(C) Plasma sodium concentration
(D) Plasma volume
9. Mammalian kidney serve to excrete –
(A) Excess salts, urea and excess water
(B) Excess water, urea and amino acids
(C) Excess salts, urea and glucose
(D) Excess salts, excess water and excess amino acids
10. Aquatic animals are mostly ammonotelic because –
(A) Excretion of ammonia requires large amount of water which is available to these animals
(B) Ammonia helps in checking inflow of water into body
(C) These get less light
(D) Water contains less nitrogen
11. Aldosterone stimulates the reabsorption of–
(A) Keto acids (B) Glucose
(C) K^+ ions (D) Na^+ ions
12. Which blood vessel carries least percentage of urea –
(A) Renal artery (B) Pulmonary vein
(C) Hepatic portal vein (D) Renal vein
13. One of the following substance is not found in mammalian urine –
(A) Ammonium salt (B) Sucrose
(C) Sodium chloride (D) Water
14. In which part of excretory system of mammals can you first use the term 'urine' for contained fluid –
(A) Urinary bladder (B) Collecting tubule
(C) Bowman's capsule (D) Loop of Henle
15. A person who is starving, that is not having food, water and beverages will have –
(A) Less urea in his urine
(B) Less fats in his urine
(C) More glucose in his blood
(D) More urea in his urine
16. When certain marine organisms are placed in distilled water, they ultimately die. Which could be the most likely explanation –
(A) Excess of water in the tissues
(B) Loss of water from the tissue
(C) Loss of permeability of some membranes
(D) Loss of salts

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Excretion involves process in which –
(A) Harmful substance are stored in cells before being eliminated
(B)) Expulsion of urine from the urinary bladder and sweat from the skin
(C) Harmful substance in the body are chemically changed
(D) Substance of no further use or those present in excessive quantities are thrown out of the body
2. In aquatic organisms the waste end product of nitrogen metabolism is –
(A) Urea (B) Ammonia
(C) Nitrogen (D) Allantois
3. Which of the following is likely to accumulate in dangerous proportion in the blood of a person whose kidney is not working properly–
(A) Urea (B) Sodium chloride
(C) Ammonia (D) Lysine
4. Which of the following sets of animals are uricotelic –
(A) Fish, frog, lizard and fowl
(B) Fish, snake, fowl and man
(C) Camel, dog, monkey and man
(D) Crow, snake, cockroach and lizard
5. Major nitrogenous waste product in ureotelic animals like rabbit and other mammals is –
(A) Ammonia (B) Amino acids
(C) Urea (D) Uric acid
6. Which of the following sets of animals produce the same substance as their chief excretory product –
(A) Camel, housefly and snake
(B) Fish, pigeon and frog
(C) Amoeba, ant and antelope
(D) Frog, monkey and dog
7. Urea is a nitrogenous waste. Which of the following substance contribute to the nitrogen–
(A) Mineral salts (B) Amino acids
(C) Vitamins (D) Lipids
8. Most insects are –
(A) Uricotelic (B) Ammonotelic
(C) Aminotelic (D) Ureotelic
9. Uric acid is chief excretory product in –
(A) Insects (B) Earthworms
(C) Amphibians (D) Mammals
10. The least toxic nitrogenous waste is –
(A) Ammonia + urea (B) Ammonia
(C) Uric acid (D) Urea
11. If benzoic acid is present in the food of mammals, it is excreted out in the form of–
(A) Hippuric acid (B) Ornithinic acid
(C) Uric acid (D) Aspartic acid
12. Column of Bertini is found in –
(A) Liver (B) Kidney
(C) Ovaries (D) Testes
13. Man is –
(A) Ammonotelic (B) Ureotelic
(C) Uricotelic (D) None of these
14. The retroperitoneal kidney is –
(A) Kidney covered by peritoneum on ventral side
(B) Kidney of fish
(C) Kidney uncovered by peritoneum on dorsal side
(D) Kidney covered by peritoneum on dorsal side
15. The kidneys not only remove the waste products from the blood but also play a very important role in maintaining –
(A)) Constant composition of the blood irrespective of the nature of the food or fluid intake
(B) Blood pressure constant
(C) Temperature of the body
(D) Equilibrium of the body
16. The functional part of the kidney of adult reptiles, birds and mammals is –
(A) Holonephros (B) Pronephros
(C) Mesonephros (D) Metanephros

Exercise # 3**PART - 1****MATRIX MATCH COLUMN**

1. Match Column-I with Column - II and select the correct option from the codes given below.
- | Column - I | Column - II |
|-----------------------|------------------------------|
| A. Nephridia | i. Crustaceans |
| B. Malpighian tubules | ii. Annelids |
| C. Antennal gland | iii. Insects or Green glands |
- (A) A-i, B-ii, C-iii
(B) A-iii, B-ii, C-i
(C) A-ii, B-iii, C-i
(D) A-ii, B-i, C-iii
2. Match Column - I with Column - II and select the correct option from the codes given below.
- | Column - I | Column - II |
|----------------------------|--|
| A. Delivers blood | i. Ascending glomerulus descending limbs |
| B. Carries urine to pelvis | ii. Renal artery |
| C. Collects filtrate from | iii. Collecting duct Bowman's capsule |
| D. Loop of Henle | iv. PCT |
- (A) A-ii, B-iii, C-iv, D-i
(B) A-i, B-iii, C-ii, D-iv
(C) A-ii, B-iv, C-i, D-iii
(D) A-iv, B-iii, C-ii, D-i
3. Match Column-I with Column-II and select the correct option from the codes given below.
- | Column - I | Column - II |
|--------------------|---|
| A. PCT | i. Concentrated urine formation |
| B. DCT | ii. Filtration of blood |
| C. Loop of Henle | iii. Reabsorption of 70-80% electrolytes |
| D. Counter-current | iv. Ionic balance mechanism |
| E. Renal corpuscle | v. Maintenance of concentration gradient in medulla |
- (A) A-iii, B-iv, C-i, D-v, E-ii
(B) A-iii, B-v, C-iv, D-ii, E-i
(C) A-i, B-iii, C-ii, D-v, E-iv
(D) A-iii, B-i, C-iv, D-v, E-ii
4. Match Column - I with Column - II and select the correct option from the codes given below.
- | Column - I | Column - II |
|-------------------------|-----------------------------|
| A. Lungs | i. Lactic acid |
| B. Liver | ii. Hypertonic urine |
| C. Micturition | iii. Counter-current system |
| D. Sweat | iv. CO ₂ |
| E. Vasa recta | v. Urinary bladder |
| F. Sebum | vi. Glucose |
| G. ADH | vii. Bilirubin |
| H. Tubular reabsorption | viii. Sterols |
- (A) A-iv, B-vii, C-v, D-i, E-iii, F-viii, G-ii, H-vi
(B) A-iii, B-i, C-iv, D-viii, E-ii, F-v, G-vii, H-vi
(C) A-iv, B-viii, C-i, D-vi, E-v, F-iii, G-ii, H-vii
(D) A-vii, B-i, C-iv, D-iii, E-viii, F-vi, G-v, H-ii

EXCRETORY PRODUCTS & THEIR ELIMINATIONS

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

- The ability of the vertebrates to produce concentrated (hyperosmotic) urine usually depends upon the [CBSE AIPMT 2000]
(A) Area of Bowman's capsule epithelium
(B) Length of Henle's loop
(C) Length of proximal convoluted tubule
(D) Capillary network forming glomerulus
- The enteronephric nephridia of earthworms are mainly concerned with [CBSE AIPMT 2000]
(A) digestion
(B) respiration
(C) osmoregulation
(D) Excretion of nitrogenous wastes
- In living beings, ammonia is converted into urea through [CBSE AIPMT 2000]
(A) Ornithine cycle (B) Citrulline cycle
(C) Fumarine cycle (D) Arginine cycle
- Which one of the following is correctly matched pair of the given secretion and its primary role in human physiology ? [CBSE AIPMT 2000]
(A) Sebum – Sexual attraction
(B) Sweat – Thermoregulation
(C) Saliva – Tasting food
(D) Tears – Excretion of salts
- In Hydra, waste material of food digestion and nitrogenous waste material removed from : - [CBSE AIPMT 2001]
(A) Mouth and mouth
(B) Body wall and body wall
(C) Mouth and body wall
(D) Mouth and tentacles
- In protozoa like Amoeba and Paramecium, an organ is found for osmoregulation which is : - [CBSE AIPMT 2002]
(A) Contractile vacuole (2) Mitochondria
(C) Nucleus (D) Food vacuole
- If Henle's loop were absent from mammalian nephron, which of the following is to be expected : - [CBSE AIPMT 2003]
(A) The urine will be more concentrated
(B) The urine will be more dilute
(C) There will be no urine formation
(D) There will be hardly any change in the quality and quantity of urine formed
- When a fresh water protozoan possessing a contractile vacuole, is placed in a glass containing marine water, the vacuole will - [CBSE AIPMT 2004]
(A) Increase in number (B) Disappear
(C) Increase in size (D) Decrease in size
- Uricotelism is found in - [CBSE AIPMT 2004]
(A) Mammals and birds
(C) Fishes and Fresh water protozoans
(D) Birds, reptiles and insects
(D) Frogs and toads
- In ornithine cycle which of the following wastes are removed from the blood - [CBSE AIPMT 2005]
(A) CO₂ and urea (B) Urea and urine
(C) CO₂ and ammonia (D) Ammonia and urea
- A person is undergoing prolonged fasting. His urine will be found to contain abnormal quantities of - [CBSE AIPMT 2005]
(A) Fats (B) Ketones
(C) Amino acids (D) Glucose
- The net pressure gradient that causes the fluid to filter out of the glomeruli into the capsule is - [CBSE AIPMT 2005]
(A) 20 mm Hg (B) 75 mm Hg
(C) 30 mm Hg (D) 50 mm Hg
- Angiotensinogen is a protein produced and secreted by - [CBSE AIPMT 2006]
(A) Macula densa cells
(B) Endothelial cells (cells lining the blood vessels)
(C) Liver cells
(D) Juxtaglomerular (JG) cells
- Bowman's glands are found in - [CBSE AIPMT 2006]
(A) Olfactory epithelium
(B) External auditory canal
(C) Cortical nephrons only
(D) Juxtamedullary nephrons
- A person who is on a long hunger strike and is surviving only on water, will have: [CBSE AIPMT 2007]
(A) more sodium in his urine
(B) less amino acids in his urine
(C) more glucose in his blood.
(D) less urea in his urine

- In mammals, ammonia produced by metabolism is converted into urea in the
(A) Kidney (B) Liver (C) Spleen (D) Blood
(E) Lymph.
- Excretory structures in Rotifers are
(A) green glands (B) malpighian tubules (C) flame cells (D) gills
(E) kidneys.
- Uricotelism is found in
(A) mammals and birds (B) birds, reptiles and insects
(C) fishes and freshwater protozoans (D) frogs and toads
- Which one of the following options gives the correct categorisation of six animals according to the type of nitrogenous waste they give out?

	Ammonotelic	Ureotelic	Uricotelic
(A)	Pigeon, humans	Aquatic amphibia, lizards	Cockroach, frog
(B)	Frog, lizards	Aquatic, amphibia, humans	Cockroach, pigeon
(C)	Aquatic amphibia	Frog, humans	Pigeon, lizards, cockroach
(D)	Aquatic amphibia	Cockroach, humans	Frog, pigeon, lizards
- Fresh water bony fishes maintain water balance by
(A) excreting a hypotonic urine
(B) drinking small amount of water
(C) excreting salt across their gills
(D) excreting wastes in form of uric acid
- In which one of the following organisms its excretory organs are correctly stated?

(A) Humans	–	kidneys, sebaceous glands and tear glands
(B) Earthworm	–	pharyngeal, integumentary and septal nephridia
(C) Cockroach	–	Malpighian tubules and enteric caeca
(D) Frog	–	kidneys, skin and buccal epithelium
- The nitrogenous excretory products are formed from the catabolism of amino acids by
(A) Calvin cycle (B) nitrogen cycle (C) ornithine cycle (D) Krebs' cycle

www.blog.neetnearme.com

ELECTROMAGNETIC WAVES

I happen to have discovered a direct relation between magnetism and light, also electricity and light, and the field it opens is so large and I think rich.

"MICHAEL FARADAY"

INTRODUCTION

We have seen that in certain situations light may be described as a wave. The wave equation for light propagating in x-direction in vacuum may be written as

$$E = E_0 \sin \omega(t - x/c)$$

where E is the sinusoidally varying electric field at the position x at time t. The constant c is the speed of light in vacuum. The electric field E is in the Y-Z plane, that is perpendicular to the direction of propagation.

There is also a sinusoidally varying magnetic field associated with the electric field when light propagates. This magnetic is perpendicular to the direction of propagation as well as to the electric field E. It is given by

$$B = B_0 \sin \omega(t - x/c)$$

Such a combination of mutually perpendicular electric and magnetic fields is referred to as an electromagnetic wave in vacuum. The theory of electromagnetic wave was mainly developed by Maxwell around 1864.

PHYSICS FOR NEET & AIIMS

Now if the charge Q on the capacitor plates changes with time, there is a current $i = (dQ / dt)$, so that using Eq. (3), we have

$$\frac{d\Phi_E}{dt} = \frac{d}{dt} \left(\frac{Q}{\epsilon_0} \right) = \frac{1}{\epsilon_0} \frac{dQ}{dt}$$

This implies that for consistency,

$$\epsilon_0 \left(\frac{d\Phi_E}{dt} \right) = i \dots \dots \dots (4)$$

This is the missing term in Ampere's circuital law. If we generalise this law by adding to the total current carried by conductors through the surface, another term which is ϵ_0 times the rate of change of electric flux through the same surface, the total has the same value of current i for all surfaces. If this is done, there is no contradiction in the value of B obtained anywhere using the generalized Ampere's law. B at the point P is non-zero no matter which surface is used for calculating it. B at a point P outside the plates [Fig. 1 (a)] is the same as at a point M just inside, as it should be. The current carried by conductors due to flow of charges is called conduction current. The current, given by Eq. (4), is a new term, and is due to changing electric field (or electric displacement). It is therefore called displacement current or Maxwell's displacement current. Figure 2 shows the electric and magnetic fields inside the parallel plates capacitor discussed above. The generalisation made by Maxwell then is the following. The source of a magnetic field is not just the conduction electric current due to flowing charges, but also the time rate of change of electric field. More precisely, the total current i is the sum of the conduction current denoted by i_c , and the displacement current denoted by $i_d (= \epsilon_0 (d\Phi_E) / dt)$. So we have

$$i = i_c + i_d = i_c + \epsilon_0 \frac{d\Phi_E}{dt} \dots \dots \dots (5)$$

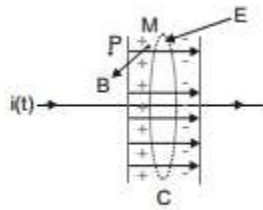


Figure 2 (a)

In explicit terms, this means that outside the capacitor plates, we have only conduction current $i_c = i$, and no displacement current, i.e., $i_d = 0$. On the other hand, inside the capacitor, there is no conduction current, i.e., $i_c = 0$, and there is only displacement current, so that $i_d = i$.

The generalised (and correct) Ampere's circuital law has the same form as Eq. (1), with one difference: " the total current passing through any surface of which the closed loop is the perimeter" is the sum of the conduction current and the displacement current The generalised law is

$$\oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 i_c + \mu_0 \epsilon_0 \frac{d\Phi_E}{dt} \dots \dots \dots (6)$$

and is known as Ampere-Maxwell law.

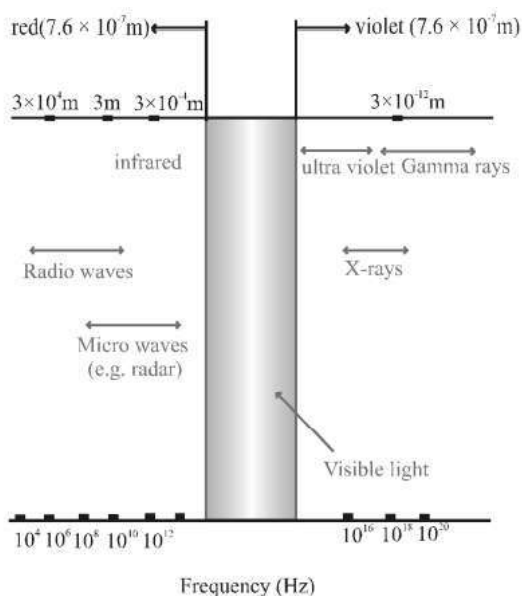
1. Cathode Rays :

- (a) Generated in a discharge tube in which a high vacuum is maintained.
- (b) They are electrons accelerated by high potential difference (10 to 15 kV)
- (c) K.E. of C.R. particle accelerated by a p.d V is $eV = \frac{1}{2}mv^2 = \frac{p^2}{2m}$
- (d) Can be deflected by Electric & magnetic fields.

2. Electromagnetic Spectrum

Ordered arrangement of the big family of electro magneti waves (EMW) either in ascending order of frequencies or decending order of wave lengths.

Speed of E.M.W. in vaccum : $c = 3 \times 10^8 \text{ m/s} = v\lambda$



3. Plancks Quantam Theory

A beam of EMW is a stream of discrete packets of energy called photons; each photon having a frequency ν and energy = $E = h\nu$

where h = planck's constant = 6.63×10^{-34} J-s.

- (a) According to Planck the energy of a photon is directly proportional to the frequency of the radiation.

$$E = \frac{hc}{\lambda} = \frac{12400}{\lambda} \text{ eV} = \frac{hc}{\lambda} \quad \left[\begin{array}{l} hc = 12400 \text{ (A} \cdot \text{eV)} \\ \lambda \text{ in } \text{\AA} \end{array} \right]$$

- (b) Effective mass of photon $m = \frac{E}{c^2} = \frac{hc}{c^2\lambda} = \frac{h}{c\lambda}$ i.e. $m \propto \frac{1}{\lambda}$

SOLVED EXAMPLE

Ex.1 A parallel-plate capacitor with plate area A and separation between the plates d , is charged by a constant current i . Consider a plane surface of area $A/2$ parallel to the plates and drawn symmetrically between the plates. Find the displacement current through this area.

Sol. Suppose the charge on the capacitor at time t is Q . The electric field between the plates of the capacitor is $E = \frac{Q}{\epsilon_0 A}$. The flux through the area considered is

$$\Phi_E = \frac{Q}{\epsilon_0 A} \cdot \frac{A}{2} = \frac{Q}{2\epsilon_0}$$

The displacement current is

$$i_d = \epsilon_0 \frac{d\Phi_E}{dt} = \epsilon_0 \left(\frac{1}{2\epsilon_0} \right) \frac{dQ}{dt} = \frac{i}{2}$$

Ex.2 A plane electromagnetic wave propagating in the x -direction has a wavelength of 5.0 mm. The electric field is in the y -direction and its maximum magnitude is 30 V m^{-1} . Write suitable equations for the electric and magnetic fields as a function of x and t .

Sol. The equation for the electric and the magnetic fields in the wave may be written as

$$E = E_0 \sin \omega \left(t - \frac{x}{c} \right)$$

$$B = B_0 \sin \omega \left(t - \frac{x}{c} \right)$$

We have,

$$\omega = 2\pi\nu = \frac{2\pi}{\lambda} c$$

Thus,
$$E = E_0 \sin \left[\frac{2\pi}{\lambda} (ct - x) \right]$$

$$= (30 \text{ V m}^{-1}) \sin \left[\frac{2\pi}{5.0 \text{ mm}} (ct - x) \right]$$

The maximum magnetic field is

$$B_0 = \frac{E_0}{c} = \frac{30 \text{ V m}^{-1}}{3 \times 10^8 \text{ ms}^{-1}} = 10^{-7} \text{ T}$$

So,
$$B = B_0 \sin \left[\frac{2\pi}{\lambda} (ct - x) \right]$$

$$= (10^{-7} \text{ T}) \sin \left[\frac{2\pi}{5.0 \text{ mm}} (ct - x) \right]$$

The magnetic field is along the z -axis.

Ex.3 A light beam travelling in the x -direction is described by the electric field $E_y = (300 \text{ V m}^{-1}) \sin \omega(t - x/c)$. An electron is constrained to move along the y -direction with a speed of $2.0 \times 10^7 \text{ m s}^{-1}$. Find the maximum electric force and the maximum magnetic force on the electron.

Sol. The maximum electric field is $E_0 = 300 \text{ V m}^{-1}$. The maximum magnetic field is

$$B_0 = \frac{E_0}{c} = \frac{300 \text{ V m}^{-1}}{3 \times 10^8 \text{ ms}^{-1}} = 10^{-6} \text{ T}$$

along the z -direction.

The maximum electric force on the electron is

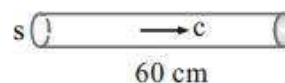
$$F_e = qE_0 = (1.6 \times 10^{-19} \text{ C}) \times (300 \text{ V m}^{-1}) = 4.8 \times 10^{-17} \text{ N}$$

The maximum magnetic force on the electron is

$$F_b = |q\vec{v} \times \vec{B}|_{\text{max}} = qvB_0 = (1.6 \times 10^{-19} \text{ C}) \times (2.0 \times 10^7 \text{ ms}^{-1}) \times (10^{-6} \text{ T}) = 3.2 \times 10^{-18} \text{ N}$$

Ex.4 Find the energy stored in a 60 cm length of a laser beam operating at 4mW.

Sol.



The time taken by the electromagnetic wave to move through a distance of 60 cm is $t = \frac{60 \text{ cm}}{c} = 2 \times 10^{-9} \text{ s}$.

Exercise # 1

SINGLE OBJECTIVE

NEET LEVEL

1. The ionosphere does not allow to pass the waves which are termed as
 (A) microwaves
 (B) visible light waves
 (C) 1 and 2 both
 (D) amplitude modulated waves
2. Practically ozone layer absorbs the radiation of wavelength
 (A) less than 3×10^{-7} m
 (B) greater than 3×10^{-7} m
 (C) equal to 3×10^{-7} m
 (D) all the above
3. The waves which can travel directly along surface of the earth are known as
 (A) ground waves (B) X-rays
 (C) α -rays (D) sky waves
4. The ionosphere bends the e. m. waves having the frequencies
 (A) less than 40MHz
 (B) beyond 40 MHz
 (C) nothing is certain
 (D) depends on the moisture present
5. The S.I unit of displacement current is
 (A) H (B) A
 (C) Fm^{-1} (D) C
6. Transmission of T. V. signals from the surface of the moon can be received on earth. But transmitted T. V. Signals from Delhi can not be received beyond 110 km distance. The reason is
 (A) there is no atmosphere on the moon
 (B) strong gravitational effect on T. V.signals
 (C) T. V. signals travel along a straight line, they do not follow the curvature of earth
 (D) there is atmosphere around the earth
7. The number of radio frequency carrier waves transmitted by a television transmitter is
 (A) three (B) two
 (C) one (D) four
8. The speed of electromagnetic waves is independent of
 (A) wavelength
 (B) frequency
 (C) intensity
 (D) medium, in which it travels
9. An electromagnetic radiation of frequency ν , wavelength λ , travelling with velocity c in air, enters a glass slab of refractive index μ . The frequency, wavelength and velocity of light in the glass slab will be respectively:
 (A) $\frac{\nu}{\mu}$, $\frac{\lambda}{\mu}$ and $\frac{c}{\mu}$ (B) ν , $\frac{\lambda}{\mu}$ and $\frac{c}{\mu}$
 (C) ν , 2λ and $\frac{c}{\mu}$ (D) 2ν , $\frac{\lambda}{\mu}$ and c
10. If ϵ_0 and μ_0 are the electric permittivity and magnetic permeability in free space, ϵ and μ are the corresponding quantities in a medium, then index of refraction of the medium is
 (A) $\sqrt{\frac{\epsilon_0\mu}{\epsilon\mu_0}}$ (B) $\sqrt{\frac{\epsilon}{\epsilon_0}}$
 (C) $\sqrt{\frac{\epsilon_0\mu_0}{\epsilon\mu}}$ (D) $\sqrt{\frac{\epsilon\mu}{\epsilon_0\mu_0}}$
11. Dimension of $\epsilon_0\mu_0$ is:
 (A) LT^{-1} (B) L^{-1}T
 (C) L^2T^{-2} (D) L^{-2}T^2
12. For television transmission, the frequency employed is normally in the range
 (A) 30–300 MHz (B) 30–300 GHz
 (C) 300–300 kHz (D) 30–300Hz
13. Red light differs from blue light in its
 (A) speed. (B) frequency
 (C) intensity (D) amplitude
14. If an electromagnetic wave propagating through vacuum is described by

$$\vec{E} = E_0 \sin(kx - \omega t) \hat{i}; \vec{B} = B_0 \sin(kx - \omega t) \hat{j}$$
 (A) $E_0 k = B_0 \omega$ (B) $E_0 B_0 = \omega k$
 (C) $E_0 \omega = B_0 k$ (D) $E_0 B_0 = \omega / k$

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

- The fundamental source of e. m. waves
 - is varying magnetic field
 - constant magnetic and electric fields
 - are continuous oscillations of electric charge
 - is planets
- The displacement current was first postulated by
 - Ampere
 - Maxwell
 - Hertz
 - Marconi
- An accelerated electric charge emits
 - β -rays
 - γ -rays
 - e.m. waves
 - none of the above
- The speed of e. m. waves is given by the relation
 - $\mu_0 \epsilon_0$
 - $\sqrt{\mu_0 \epsilon_0}$
 - $1/\mu_0 \epsilon_0$
 - $1/\sqrt{(\mu_0 \epsilon_0)}$
- Electromagnetic waves in nature are
 - longitudinal
 - longitudinal stationary
 - transverse
 - transverse – stationary
- An accelerated charge
 - emits an electromagnetic wave
 - does not emit electromagnetic wave
 - produces a gravitational field
 - none of the above
- Electromagnetic waves
 - are longitudinal waves
 - travel in free space at the speed of light
 - are produced by charges moving with uniform velocity
 - travel with the same speed in all media
- Choose the only wrong statement from the following about electromagnetic waves
 - are transverse
 - travels free space at the speed of light
 - are produced by accelerating charges
 - travel with the same speed in all media
- In an electromagnetic wave, electric field E and magnetic field B are
 - mutually perpendicular to each other
 - all parallel
 - at 30° to each other
 - at 60° to each other
- Electromagnetic waves obey the principle of
 - superposition
 - interference
 - 1 and 2 both
 - none of the above
- If E and B be the electric and magnetic fields of electromagnetic waves, then the direction of propagation of e. m. wave is along the direction of
 - E
 - B
 - $E \times B$
 - None of the above
- Which of the following pairs of space and time varying E and B fields would generate a plane electromagnetic wave travelling in the Z-direction
 - E_x, B_y
 - E_y, B_x
 - E_x, B_z
 - E_z, B_x
- Choose the correct statement about electromagnetic waves
 - they are supersonic waves
 - they are the electric charged particles
 - they travel with the speed of light
 - they can only be produced in laboratory.
- Hertz produced electromagnetic waves by using
 - L CR circuit
 - C R circuit
 - LC circuit
 - None of the above
- The shortest wavelength is for
 - γ -rays
 - x-rays
 - ultraviolet rays
 - microwaves
- Visible range of wavelength in cm is
 - 3×10^{-6} to 10^{-10}
 - 7×10^{-5} to 4×10^{-5}
 - 4×10^{-5} to 3×10^{-6}
 - 6×10^4 to 1.5×10^3

Exercise # 3

ASSERTION & REASONING

These questions contains, Statement I (assertion) and Statement II (reason).

- (A) If both assertion and reason are true and the reason is the correct explanation of the assertion.
- (B) If both assertion and reason are true but reason is not the correct explanation of the assertion.
- (C) If assertion is true but reason is false.
- (D) If assertion is false but reason is true.
- (E) If the assertion and reason both are false.

1. **Assertion :** Sound waves are not electromagnetic waves.
Reason : Sound waves require a material medium for propagation.
2. **Assertion :** Displacement current arises on account of change in electric flux.
Reason : $I_d = \epsilon_0 \left(\frac{d\Phi_E}{dt} \right)$
3. **Assertion :** A changing electric field produces a magnetic field
Reason : A changing magnetic field produces an electric field.

4. **Assertion :** In an e.m. wave magnitude of magnetic field vector B is much smaller than the magnitude of vector E .
Reason : This is because in an e.m. wave $E/B = c = 3 \times 10^8 \text{ m/s}$.
5. **Assertion :** Electromagnetic waves exert pressure called radiation pressure.
Reason : This is because they carry energy.
6. **Assertion :** Electromagnetic waves are transverse in nature
Reason : The electric and magnetic fields of an e.m. wave are perpendicular to each other and also perpendicular to the direction of wave propagation.

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. The frequency of γ -rays, X-rays and ultraviolet rays are a, b and c respectively.
Then, [CBSE AIPMT 2000]
(A) $a > b > c$ (B) $a < b < c$
(C) $a = b = c$ (D) $a > c > b$
2. In a certain region of space electric field E and magnetic field B are perpendicular to each other and an electron enters in region perpendicular to the direction of B and E both and moves undeflected, then velocity of electron is [CBSE AIPMT 2001]
(A) $\frac{|E|}{|B|}$ (B) $E \times B$
(C) $\frac{|B|}{|E|}$ (D) $E \cdot B$
3. The velocity of electromagnetic wave is along the direction of [CBSE AIPMT 2002]
(A) $B \times E$ (B) $E \times B$
(C) E (D) B
4. Which of the following has minimum wavelength? [CBSE AIPMT 2002]
(A) X-rays
(B) Ultraviolet rays
(C) γ -rays
(D) Cosmic rays
5. Which of the following rays are not electromagnetic waves? [CBSE AIPMT 2003]
(A) β -rays (C) Heat rays
(C) X-rays (D) γ -rays
6. If λ_v , λ_x and λ_m represent the wavelengths of visible light, X-rays and microwaves respectively, then [CBSE AIPMT 2005]
(A) $\lambda_m > \lambda_x > \lambda_v$
(B) $\lambda_v > \lambda_m > \lambda_x$
(C) $\lambda_m > \lambda_v > \lambda_x$
(D) $\lambda_v > \lambda_x > \lambda_m$
7. The electric field part of an electromagnetic wave in a medium is represented by $E_x = 0$;
$$E_y = 2.5 \frac{N}{C} \cos \left[\left(2\pi \times 10^6 \frac{\text{rad}}{\text{m}} \right) t - \left(\pi \times 10^{-2} \frac{\text{rad}}{\text{s}} \right) x \right]$$

 $E_z = 0$.
The wave is [CBSE AIPMT 2009]
(A) moving along y-direction with frequency $2\pi \times 10^6$ Hz and wavelength 200 m
(B) moving along x-direction with frequency 10^6 Hz and wavelength 100 m
(C) moving along x-direction with frequency 10^6 Hz and wavelength 200 m
(D) moving along - x-direction with frequency 10^6 Hz and wavelength 200 m.
8. Which of the following statement is false for the properties of electromagnetic waves? [CBSE AIPMT 2010]
(A) Both electric and magnetic field vectors attain the maxima and minima at the same place and same time
(B) The energy in electromagnetic wave is divided equally between electric and magnetic vectors
(C) Both electric and magnetic field vectors are parallel to each other and perpendicular to the direction of propagation of wave
(D) These waves do not require any material medium for propagation
9. The decreasing order of wavelength of infrared, microwave, ultraviolet and gamma rays is [CBSE AIPMT 2011]
(A) gamma rays, ultraviolet, infrared, microwaves
(B) microwaves, gamma rays, infrared, ultraviolet
(C) infrared, microwave, ultraviolet, gamma rays
(D) microwave, infrared, ultraviolet, gamma rays

www.blog.neetnearnme.com

BIOTECHNOLOGY & ITS APPLICATIONS

“Greatest discoveries come from passionate scientists with naive curiosity.”

“CRAIG MELLO (1960)”

INTRODUCTION

Biotechnology finds application in medicine, therapeutics, diagnostics, bioremediation, agriculture, waste treatment, food science (processes food) and energy production. It essentially deals with industrial scale production of biopharmaceuticals and biologicals using genetically modified fungi, microbes, plants and animals.

The different research areas of biotechnology includes:

1. Improved organism usually microbe or pure enzyme providing the best catalyst.
2. Creates optimum conditions through genetic engineering for a catalyst to act.
3. Downstream processing technologies to purify the protein or organic compound.

This chapter describes the application of PCR, gene cloning and other DNA analysis techniques in field of medicine, agriculture and biotechnology. Biotechnology is great combination of industry and technology, one of the reasons why biotechnology has received as much attention during the past three decades is because of gene cloning.

Biotechnology and Its Application

Definition –

"**Biotechnology** may be defined as use of micro-organism, animals, or plant cells or their products to generate different products at industrial scale and services useful to human beings."

A powerful industry based on microbes has been developed in recent time. A careful selection of microbial strains, improved method of extraction and purification of the product, have resulted in enormous yields.

The use of living organisms in systems or process for the manufacturer of useful products, It may involve algae, bacteria, fungi, yeast, cells of higher plants & animals or subsystems of any of these or Isolated components from living matter.

Old biotechnology are based on the natural capabilities of micro organisms.

e.g. formation of Citric acid, production of penicillin by *Penicillium notatum*

New biotechnology is based on **Recombinant DNA technology**.

e.g. Human gene producing Insulin has been transferred and expressed in bacteria like *E.coli*.

In, **modern biotechnology**, different types of valuable products are produced with help of microbiology, biochemistry, tissue culture, chemical engineering and genetic engineering, molecular biology and immunology.

BIOTECHNOLOGICAL APPLICATIONS IN AGRICULTURE :-

Three options that can be thought for increasing food production

- (i) agro-chemical based agriculture;
- (ii) organic agriculture; and
- (iii) genetically engineered crop-based agriculture.

Plants, bacteria, fungi and animals whose genes have been altered by manipulation are called **Genetically Modified Organisms (gmo)**.

Genetically modified crops –

A **transgenic crop** is a crop that contains and expresses a **transgene**. This crop is known as genetically modified crops or **GM crops**.

Two unique advantages :-

- (i) Any gene (from any organism or a gene synthesised chemically) can be used for transfer, and
- (ii) The change in genotype can be precisely controlled since only the transgene is added into the crop genome. For example – **Hirudin** is a protein that prevents blood clotting. The gene encoding hirudin was chemically synthesized and transferred into **Brassica napus**. Where hirudin accumulates in seeds. The hirudin is purified and used in medicine.

A soil bacterium **Bacillus thuringiensis**, produces **crystal [Cry] protein**. This Cry protein is toxic to Larvae of certain insects. Each Cry protein is toxic to a different group of insects. The gene encoding cry protein is called "**cry gene**". This Cry protein isolated and transferred into several crops. A crop expressing a cry gene is usually resistant to the group of insects for which the concerned Cry protein is toxic. There are a number of them, for example, the proteins encoded by the genes cryIAC and cryIIAb control the cotton bollworms, that of cryIAb controls corn borer.

However, gene symbol italics, e.g., cry. The first letter or the protein symbol, on the other hand, is always capital and the symbol is always written in roman letters, e.g., Cry.

Bt Cotton :

Some strains of *Bacillus thuringiensis* produce proteins that kill certain insects such as lepidopterans (tobacco budworm, armyworm), coleopterans (beetles) and dipterans (flies, mosquitoes). *B. thuringiensis* forms protein crystals during a particular phase of their growth. These crystals contain a toxic **insecticidal protein**. The Bt toxin protein exist as inactive protoxins but once an insect ingest the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the gut which solubilise the crystals. The activated toxin binds to the surface of midgut epithelial cells and create pores that cause cell swelling and lysis and eventually cause death of the insect.

Transgenic variety of **Tomato – Flavr Savr** due to the inhibition of **polygalacturonase enzyme** which degrades pectin.

BIOLOGY FOR NEET & AIIMS

1. Application in agriculture :

→ Three options that can be thought for increasing food production

1. Agro-chemical based agriculture.
2. Organic agriculture.
3. Genetically engineered crop based agriculture.

→ Plants, bacteria, fungi and animals whose genes have been altered by manipulation are called Genetically Modified Organisms (GMO).

→ Genetic modifications in plants has

- (1) Made crops more tolerant to abiotic stresses (cold, drought, salt, heat)
- (2) Reduce reliance on chemical pesticides (pest - resistant plants)
- (3) Helped to reduce post harvest losses.
- (4) Increased efficiency of mineral usage by plants.
- (5) Enhanced nutritional value of food. (Golden rice)

Bt Cotton:

→ Some strains of *Bacillus thuringiensis* (Bt) produce proteins that kill certain insects such as

→ Lepidopterans (Tobacco budworm, armyworm)

→ Colepterans (Beetles)

→ Dipterans (Flies, mosquitoes)

→ Bt forms protein crystals, (Toxic insecticidal protein) during a particular phase of their growth.

→ This toxin exist as inactive protoxins but once ingested by insect it is converted into an active form of toxin due to alkaline pH of the gut. The activated toxin binds to surface of midgut epithelial cells and create pores that causes death of the insect.

→ Specific Bt toxin genes were isolated from Bt and incorporated into the several crop plants (eg. Cotton, Corn etc.)

→ The choice of genes depends upon the crop and the targeted pest as most Bt toxins are insect group specific.

→ The toxin is coded by cry gene.

→ Protein encoded by gene cry IAc & cry IIAb control cotton bollworm and cry I Ab controls corn borer.

→ Pest resistant plants :

→ Several nematodes parasite affect plants and animals.

→ A nematode *Meloidogyne incognita* infects the roots of tobacco plants and greatly reduce the yield.

→ To prevent infestation RNA interference. (RNAi) strategy was adopted.

→ RNAi is a method of cellular defense in all eukaryotic organism.

→ In this method nematode specific genes (DNA) that produced both sense and anti-sense RNA was introduced into the host plant.

→ The two RNA's being complementary to each other formed double stranded RNA (dsRNA) that initiated RNAi and allowed silencing of specific m-RNA of the nematodes. As a result parasite could not survive in transgenic host plant.

2. Application in medicine :

→ Genetically engineered insulin

→ In mammals insulin is synthesised as a prohormone (which contains A, B & C peptide) during maturation C-peptide is removed so C-peptide is absent in mature insulin.

→ The main challenge for production of insulin using r-RNA technique was getting insulin assembled into a mature form.

SOLVED EXAMPLE

Ex.1 Hybridomas are employed for
 (A) Synthesis of antibiotics
 (B) Killing cancer cells
 (C) Synthesis of monoclonal (somaclonal) antibodies
 (D) Production of somatic hybrids

Sol. (C) : Monoclonal/Magic antibodies (Mabs) are the specialize antibodies, which are obtained through Clonal culture of hybridoma.

Ex.2 Nuclear transplantation technique was discovered by
 (A) Briggs (B) Ian Wilmut
 (C) Gurdon (D) Griffith

Sol. (A)

Ex.3 A genetically engineered micro-organism used successfully in bioremediation of oil spills is a species of
 (A) Pseudomonas (B) Trichoderma
 (C) Xanthomonas (D) Bacillus

Sol. (A)

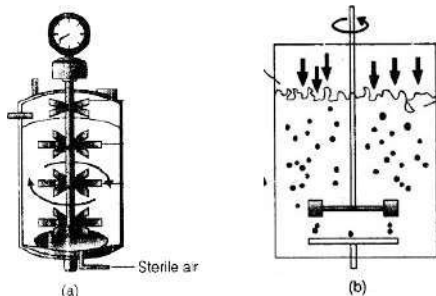
Ex.4 The vaccine of Hepatitis-B is a
 (A) First generation vaccine
 (B) Interferon
 (C) Second generation vaccine
 (D) Third generation vaccine

Sol. (C) : Second generation vaccines are produced by recombinant DNA technology or genetic engineering e.g., vaccine for Herpes virus and Hepatitis-B.

Ex.5 Which one of the following is now being commercially produced by biotechnological procedures
 (A) Nicotine (B) Morphine
 (C) Quinine (D) Insulin

Sol. (D)

Ex.6 The following apparatus are used for fermentation process Identify A and B respectively



- (A) Stirred tank and sparged tank bioreactor
- (B) Respirometer and sparged tank bioreactor
- (C) Stirred tank and Gene gun
- (D) None of these

Sol. (A)

Ex.7 Choose the correct statement with refernce to “Dolly”

- (A) She was created bytaking nucleus from unfertilised egg
- (B) She was created by taking nucleus from udder cell and cytoplasm from unfertilised egg
- (C) She was created by taking cytoplasm from udder cells and nucleus from fertilised egg
- (D) She was created in the test tube

Sol. (B) : Dolly has nuclear genes from the ewe whos supplied the udder cell and mitochondrial genes from the egg cytoplasm of the second ewe.

Ex.8 GEAC stands for

- (A) Genome Engineering Action Committee
- (B) Ground Environment Action Committee
- (C) Genetic Engineering Approval Committee
- (D) Genetic and Environement Approval Committee

Sol. (C)

Ex.9 A probe which is a molecule used to locate homologous sequence in a mixture of DNA or RNA molecules could be

- (A) A ssRNA
- (B) A ssDNA
- (C) Either RNA or DNA
- (D) Can be ssDNA but not ssRNA

Sol. (C)

Ex.10 The trigger for activation of toxin of Bacillus thuringiensis is

- (A) Acidic pH of stomach
- (B) High temperature
- (C) AlkalinepH of gut
- (D) Mechanical action in the insect gut

Sol. (C)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. When and where first time word "biotechnology" was used
(A) In 1950 in England (B) In 1960 in Holland
(C) In 1920 in U.N. (D) In 1910 in Germany
2. In olden days cheese was prepared by
(A) Aspergillus (B) Rennet enzyme
(C) Clostridium bacteria (D) None of the above
3. Who first realized the use of yeast in fermentation
(A) Christian Hansen (B) Louis Pasteur
(C) A. Spike (D) D.A. Jackson
4. Beer is obtained by the fermentation of seeds of
(A) Hordeum vulgare (B) Rice
(C) Maize (D) All the above
5. Wine is prepared by fermentation of grape juice by
(A) Bacillus liquifaciens
(B) Penicillium roqueforti
(C) Saccharomyces cerevisiae
(D) Streptococcus aureus
6. Curding of milk takes place by
(A) Streptococcus lactis
(B) Streptococcus thermophilus
(C) Lactobacillus lactis
(D) All the above
7. In India, first time an international meeting on biotechnology was held in
(A) 1986 (B) 1987
(C) 1988 (D) 1989
8. Lactic acid is produced by
(A) Lactobacillus bulgaricus
(B) Streptococcus lactis
(C) Rhizopus oryzae (D) All the above
9. Who coined the term "antibiotics"
(A) Flemming (B) Florey
(C) Chain (D) S. Waksman
10. Lal Bahadur Shastri biotechnological centre is in
(A) Bombay (B) Calcutta
(C) Delhi (D) Kanpur
11. Which protein production was successfully introduced in E. coli
(A) Interferon (B) Xanthotoxin
(C) Somatostatin (D) Relaxin
12. Vinegar is produced from sugars with the help of
(A) Lactobacillus (B) Acetobacter
(C) Nitrosomonas (D) Salmonella
13. First antibiotic isolated was
(A) Terramycin (B) Neomycin
(C) Penicillin (D) Streptomycin
14. Yeast is used in the production of
(A) Ethyl alcohol (B) Acetic acid
(C) Cheese (D) Curd
15. Which micro-organism is used in the formation of cheese
(A) Streptococcus (B) Aspergillus
(C) Acetic acid bacteria (D) Lactic acid bacteria
16. Streptomycin was first isolated in 1944-45 by
(A) Leeuwenhoek (B) Burkholder
(C) Alexander Fleming (D) Waksman
17. What is interferon
(A) A type of plasmid (B) A type of protein
(C) A type of gene (D) A type of hormone
18. In the production of leavened bread, the following is used
(A) Bacterium (B) Yeast
(C) Rhizopus (D) None of the above
19. Biotechnology is the modern branch of biology which deals with
(A) Genetic engineering (B) Biochemistry
(C) Microbiology (D) All the above
20. Micro-organism used in the production of yoghurt is
(A) Salmonella sp.
(B) Lactobacillus bulgaricus
(C) Streptococcus thermophilus
(D) Both (B) and (C)
21. For the manufacture of gluconic acid and citric acid, which of the following micro-organism is used
(A) Lactobacillus bulgaricus
(B) Acetobacter sp.
(C) Aspergillus niger
(D) Gluconobacter sp.
22. Raw cheese is known as
(A) Blue cheese (B) Cottage cheese
(C) Swiss cheese (D) None of these

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Use of living organisms or their substances in industrial processes is called
(A) Microbiology
(B) Biotechnology
(C) Industrial engineering
(D) Genetic engineering
2. Sodium chloride is added during preparation of cheese as it
(A) Gives flavour
(B) Controls moisture
(C) Hardens cheese
(D) Controls moisture and gives flavour
3. Rennin used in cheese industry is
(A) Antibiotic (B) Alkaloid
(C) Enzyme (D) Inhibitor
4. Which one of the following is not used in the production of yoghurt
(A) Streptococcus lactis
(B) Streptococcus thermophilus
(C) Lactobacillus bulgaricus
(D) Acetobacter aceti
5. A compound which is produced by an organism and inhibits the growth of other organisms is called
(A) Antigen (B) Antibody
(C) Antibiotic (D) Antiallergic
6. Which of the following enzyme is secreted by yeast, responsible for fermentation
(A) Enolase (B) Dehydrogenase
(C) Zymase (D) Invertase
7. Which one of the following is used in the baking of bread
(A) Rhizopus stolonifer
(B) Zygosaccharomyces octosporous
(C) Saccharomyces cerevisiae
(D) Saccharomyces ludwigii
8. Chloromycetin is produced by
(A) Bordetella pertusis
(B) Streptomyces venezuelae
(C) Streptomyces rimosus
(D) Clostridium botulinum
9. The phenomenon of antibiotic was discovered by
(A) Fleming (B) Pasteur
(C) Waksman (D) Babes
10. Rennet enzyme was purified by
(A) A. Flemming (B) S.A. Waksman
(C) Payen and Persoz (D) Christian Hansen
11. Which of the following enzymes are used for converting corn starch into high fructose syrup
(A) Glucoisomerases (B) Glucoamylases
(C) Amylases (D) All of these
12. Which of the following participates in the manufacturing of dextrans
(A) Lactobacillus (B) Leuconostoc
(C) Pseudomonas (D) Mucor
13. Steroids are used in
(A) Birth control
(B) Treatment of hormonal balance
(C) Treatment of auto-immune diseases
(D) All of these
14. Vaccine for smallpox was developed by
(A) Cesar Milstein (B) Louis Pasteur
(C) Edward Jenner (D) Salman Waksman
15. Which of the following is used in biotechnology
(A) Cattle
(B) Yeast
(C) Both cattle and yeast
(D) Neither cattle nor yeast
16. Woodruff (1941) were responsible for the isolation of
(A) Neomycin (B) Actinomycin
(C) Penicillin (D) Streptomycin
17. Waksman got Nobel Prize for the discovery of
(A) Chloromycetin (B) Neomycin
(C) Streptomycin (D) Penicillin
18. nif genes occur in
(A) Rhizobium (B) Penicillium
(C) Aspergillus (D) Streptococcus
19. Neomycin is extracted from
(A) Streptomyces griseus
(B) Streptomyces venezuelae
(C) Streptomyces fradiae
(D) Streptomyces rimosus
20. Interferons are
(A) Antiviral proteins
(B) Complex proteins
(C) Anti-bacterial proteins
(D) Anti-cancer proteins

Exercise # 3**PART - 1****MATRIX MATCH COLUMN**

1. Match Column - I with Column - II and select the correct answer from the codes given below.

Column - I

- (A) α -1- antitrypsin
(B) Transposon
(C) ELISA
(D) Retroviral
(A) A- (i), B - (iii), C - (ii), D - (iv)
(C) A- (i), B - (ii), C - (iii), D - (iv)

Column - II

- (i) AIDS
(ii) Gene therapy
(iii) Emphysema
(iv) Mobile genetic element
(B) A- (iii), B - (iv), C - (i), D - (ii)
(D) A- (iii), B - (i), C - (ii), D - (iv)

2. Match Column - I containing transgenic organisms with their specific characteristics in Column - II and select the correct answer from codes given below.

Column - I

- (A) Golden rice
(B) Bt cotton
(C) Flave Savr
(D) Rosie cow
(A) A- (iii), B - (iv), C - (ii), D - (i)
(C) A- (ii), B - (iv), C - (iii), D - (i)

Column - II

- (i) Protein - enriched milk
(ii) Increased shelf life
(iii) Enriched with vitamin A
(iv) High yield and pest resistant
(B) A- (iii), B - (ii), C - (iv), D - (i)
(D) A- (i), B - (iv), C - (ii), D - (iii)

3. Match Column - I with Column - II and select the correct answer from the codes given below.

Column - I

- (A) Biopiracy
(B) Biopatent
(C) Gene therapy
(D) RNAi
(A) A- (iv), B - (ii), C - (i), D - (iii)
(C) A- (iii), B - (iv), C - (i), D - (ii)

Column - II

- (i) Effort to fix the non-functional gene
(ii) Gene silencing
(iii) Illegal removal of biological materials
(iv) Right granted for biological entities
(B) A- (ii), B - (iv), C - (i), D - (iii)
(D) A- (iii), B - (iv), C - (ii), D - (i)

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. The first successfully cloned mammals (animal) that gained worldwide publicity was
 (A) Molly (a sheep) (B) Polly (asheep)
 (C) Chance (a bull) (D) Dolly (sheep)
2. Producing a giant mose in the laboratory was possible through
 (A) gene mutation (B) genemanipulation
 (C) gene synthesis (D) gene duplication
3. Introduction of food plants developed by genetic engineering is not desirable because
 (A) economy of developing countries may suffer
 (B) these products are less tasty as compared to the already existing products
 (C) this method is costly
 (D) there is danger of introduction viruses and toxins with introduced crop
4. Production of a human protein in bacteria by genetic engineering is possible because
 (A) bacterial cell can carry out the RNA splicing reactions
 (B) the human chromosome can replicate in bacterial cell
 (C) the mechanism of gene regulation is identical in humans and bacteria
 (D) the genetic code is universal
5. Human insulin is being commercially produced from a transgenic species of
 (A) *Rhizobium* (B) *Saccharomyces*
 (C) *Escherichia* (D) *Mycobacterium*
6. A transgenic food crop which may help in solving the problem of night blindness in developing countries is
 (A) Bt soyabean (B) golden rice
 (C) *flavr savr tomatoes* (D) starlinkmaize
7. Transgenic plants are the ones
 (A) generated by introducing foreign DNA into a cell and regenerating a plant from that cell
 (B) produced after protoplast fusion in artificial medium
 (C) grown in artificial medium after hybridisation in the field
 (D) produced by a somatic embryo artificial
8. An improved variety of transgenic basmatirice
 (A) does not require chemical fertilisers and growth hormones
 (B) gives high yield and is rich in vitamin-A
 (C) is completely resistant to all insect pests and diseases of paddy
 (D) gives high yield but has no characteristic aroma
9. Some of the characteristics of Bt cotton are
 (A) long fibre and resistance to aphids
 (B) medium yield, long fibre and resistance to beetle pests
 (C) high yield and production of toxic protein crystals which kill dipteran pests
 (D) high yield and resistance to bollworms
10. Genetic engineering has been successfully used for producing
 (A) transgenic mice for testing safety of polio vaccine before use in humans
 (B) transgenic models for studying new treatments for certain cardiac diseases
 (C) transgenic cow Rosie which produces high fat milk for making ghee
 (D) animals like bulls for farm work as they have super power
11. The Genetically Modified (GM) brinjal in India has been developed for
 (A) insect resistance (B) enhancing self life
 (C) enhancing mineral content
 (D) drought-resistance
12. Continuous addition of sugars in 'fed batch' fermentation is done to
 (A) produce methane (B) obtain antibiotics
 (C) purify enzymes (D) edgrade sewage
13. The process of RNA interference has been used in the development of plants resistant to
 (A) nematodes (B) fungi
 (C) viruses (D) insects
14. Maximum number of existing transgenic animals is of
 (A) fish (B) mice
 (C) cow (D) pig

MOCK TEST

- Golden rice is a genetically modified crop plant where the incorporated gene is meant for biosynthesis of
(A) Omega 3 (B) Vitamin A (C) Vitamin B (D) Vitamin C
- What is true of Bt toxin ?
(A) The concerned Bacillus has antitoxins.
(B) Bt protein exists as active toxin in the Bacillus.
(C) The inactive protein gets converted into active form in the insect gut.
(D) Activate toxin enters ovaries of pest and sterilise them
- A transgenic food crop which may help in solving the problem of night blindness in developing countries is
(A) Golden rice (B) Flavr Savr tomatoes (C) Starlink maize (D) Bt soyabean.
- A dicotyledonous plant forms crown gall when
(A) Agrobacterium tumefaciens comes in contact with the plant.
(B) Agrobacterium rhizogenes comes in contact with the plant.
(C) A specific part of DNA from the Ti plasmid gets integrated with the plant chromosome.
(D) A specific part of DNA from the Ri plasmid gets integrated with the plant chromosome.
- Which of the following genes do not occur naturally in living organisms ?
(A) Bt genes (B) RNAi genes
(C) Cry genes (D) Endogenous cytoplasmic defense genes
- Bacillus thuringiensis (Bt) strains have been used for designing novel
(A) Bio-fertilisers (B) Bio- Insecticidal plants
(C) Bio-insecticidal plants (D) Bio-metallurgical techniques.
- A transgenic plant is one into which
(A) A gene from another plant is introduced (B) A gene from an animal is introduced
(C) A gene from a microorganism is introduced (D) Both (A) and (C)
- Which kind of therapy was given in 1990 to a four- year-old girl with adenosine deaminase (ADA) deficiency?
(A) Gene therapy (B) Chemotherapy (C) Immunotherapy (D) Radiation therapy
- What is the advantage in clinical use of humulin (human insulin produced through rDNA technique) over use of conventional ox or pig insulin ?
(A) It does not cause immunological problems (B) It is cheaper for the patient
(C) It is produced by E.coli in our own intestine (D) There is no advantage.
- Gene therapy is a treatment that can be done with
(A) adults only (B) child or embryo only
(C) pregnant mothers only (D) persons of any age and any condition
- Ernst Chain and Howard Florey's contribution was
(A) Discovery of streptokinase
(B) Establishing the potential of penicillin as an effective antibiotic
(C) Discovery of the DNA sequencer
(D) Production of genetically engineered insulin.
- Human proteins can be produced in the milk or semen of farm animals . True or false ?
(A) True (B) False, proteins cannot be produced in milk
(C) False, proteins cannot be produced in semen (D) False, animals are not used for protein production

EVOLUTION

*“My own suspicion is that the universe is not only queerer than we suppose, but queerer than we *can* suppose.”*

“J.B.S. HALDANE (1892-1964)”

INTRODUCTION

Evolutionary Biology is the study of history of life forms on earth. Our earth is full of living and non-living matter. This matter undergoes various changes from time to time, like living organisms take birth, grow, become old and ultimately at the end they die off. This is the life history of a particular organism. So to understand the changes in flora and fauna that have occurred over millions of years on earth, we must have an understanding of the context of origin of life i.e., evolution of earth, of stars and indeed of the universe itself.

In this Chapter, we will deal with the various aspects of evolutionary biology like origin and evolution of life forms, the evidences of evolution. mechanism of evolution with special focus on evolution and origin of man.

Evolution

Origin of Life : This term is called Biopoiesis

Biogeny means Origin of first life.

1. Theory of Special Creation

Almighty created everything including universe, earth, rocks, rivers, oceans, plants, animal and human beings. According to the Bible, the world was created within six days by God. The first man was Adam and first woman was Eve. According to Hindu mythology, the world was created by God Brahma. The first man was Manu.

2. Abiogenesis or Auto biogenesis/Theory of Spontaneous generation

This theory states that living beings were formed spontaneously from non-living things like rain, mud, air, dung, etc. This theory has no scientific explanation and hence discarded. It was proposed by **Anaximander** and supported by **Aristotle** etc. **Von Helmont** (1577 - 1644) propounded origin of mice from human sweat & wheat grains kept in dark for 21 days.

3. Theory of Biogenesis

According to this theory, life originated from pre-existing life. This theory was developed by **Francesco Redi** and was subsequently supported by **Spallanzani** and **Louis Pasteur**. This theory was also not accepted.

(i) **Francesco Redi** : (1688). Put dead snake, fish meat and eel in separate wide mouthed flasks, some without cover, others covered with fine muslin and parchment paper. After a few days, he observed that maggots (larvae) did not appear in covered flasks but were present in uncovered flasks which were regularly visited by flies. Eggs and maggots of the flies were found to be present over muslin cover but not inside the covered flasks. Apparently the visiting flies laid eggs in the uncovered flasks from which maggots developed.

(ii) **Lazzaro Spallanzani** : (1765) Boiled nutrition broth in glass flasks. The flasks were sealed immediately. Broth remained clear indefinitely in the sealed flasks, showing that organisms do not arise through spontaneous generation.

(iii) **Louis Pasteur** : (1864) Boiled broth in flasks having bent swan or S-shaped neck. No microorganisms were observed in broth after keeping for several days though, broth was connected to air through the bent neck. It is because the dirt carrying microorganisms got settled in the bent part of neck. When the neck was broken, colonies of microorganisms soon developed over the broth showing that microorganisms have come from air.

4. Cosmozoic theory

According to Richter, life came to earth from some heavenly body such as spores through meteorites. Arrhenius supported by theory of panspermia.

5. Theory of Catastrophism

Proposed by Cuvier. A catastrophe completely destroys the life and each creation consisted of life quite different from that of previous one.

6. Modern theory of life

Oparin theory or Oparin & Haldane theory ; Book of Oparin “The origin of life”.

They described that life originated in 8 steps.

Step-1 Atomic Stage :

Earth was formed about 4600 million years ago Temperature of earth was 5000 – 6000°C. As earth cooled stratification of elements occurred. The atoms of Nitrogen, Hydrogen, Oxygen, Carbon etc. formed the primitive atmosphere.

Step-2 Molecular Stage :

As the earth began to cool, its matter began to condense. But still it was so hot that water could exist only as vapour. Large quantities of H₂, N₂, Water vapour, CO₂, CH₄ and NH₃ were present, but free oxygen was not present. The atmosphere was reducing because H atoms were most numerous and most reactive in the primitive atmosphere.



ED OS KEY POINTS

- (1) Organic evolution states “**Descent with modification**” according to which present day complex living organisms have evolved from earlier simpler organisms by small and gradual changes over millions of years.
- (2) Lamarck was first to propose an extensive theory of evolution.
- (3) Charles Darwin explained “Theory of natural selection” in his book entitled “On the Origin of Species by Means of Natural Selection”.
- (4) Hugo de Vries (1901) proposed **Mutation theory of Evolution**.
- (5) Modern Theory of evolution is a modified version of natural selection and is a reconciliation between Darwinism and Mutation theory.
- (6) Seymouria (Extinct reptile) is a connecting link between reptiles and mammals
- (7) Limulus (Arthropoda), Latimera (bony fish) are living fossils.

- Evolutionary biology is the study of history of life forms on earth.
- Universe originated about 20 Billion years ago by thermo-nuclear explosion called Big-Bang.
- Earth originated about 4.5 Billion year ago.
- Stellar distances are measured in light years.
- Life appeared 500 million years after the formation of earth i.e. almost four billion years back.
- According to theory of spontaneous generation life came out of decaying and rotting matter like straw, mud etc.
- Louis Pasteur by careful experimentation demonstrated that life comes only from pre-existing life.
- Oparin and Haldane proposed that the first form of life could have come from pre-existing non-living organic molecules and that formation of life was preceded by chemical evolution.
- To prove chemical evolution in 1953, Miller created electric discharge in a closed flask containing CH_4 , H_2 , NH_3 and water vapour at 800°C . He observed formation of amino acids.
- The first non-cellular forms of life could have originated 3 billion years ago.
- Theory of special creation has three connotations:
 - All living organisms that we see today were created as such.
 - The diversity was always the same since creation and will be the same in future.
 - The earth is about 4000 years old.
- All these ideas were strongly challenged during the nineteenth century based on observations made during a sea voyage in a sail ship called H.M.S. Beagle round the world, Charles Darwin concluded that existing living forms share similarities to varying degrees not only among themselves but also with life forms that existed million of years ago.
- The fitness, according to Darwin, refers ultimately and only to reproductive fitness.
- Alfred Wallace a naturalist who worked in Malay Archipelago. "According to 'Panspermia theory' units of life called 'spores' were transferred to different planets including earth
- The geological history of earth closely correlates with the biological history of earth.
- Fossils are remains of hard parts of life forms found in rocks.
- Different aged rock sediments contain fossils of different life forms who probably died during the formation of the particular sediment.
- Fossils represent extinct organisms (e.g. Dinosaurs) Paleontology - study of fossils.
- Homology present in organisms shows divergent evolution and analogy shows convergent evolution.
- The same structure developed along different divergent evolution and these structures are homologous. Homology indicates common ancestry.
 - e.g. - Forelimbs of all mammals.
 - Visceral organs of vertebrates like heart, brain.
 - Thorn and tendrils of Bougainvillea and cucurbita.
- Analogous structures are a result of convergent evolution. Different structures evolving for the same function. Similar habitat has resulted in selection of similar adaptive features in different groups of organisms.
 - e.g. - Eyes of octopus and mammals.
 - Flippers of Penguins and Dolphins.
 - Wings of butterfly and birds.
 - Potato and Sweet potato.
- Proteins and genes performing a given function among diverse organisms give clues to common ancestry.
- According to industrial melanisation phenomenon in a mixed population, those that can better adapt, survive and increase in a population size. No variant is completely wiped out.

SOLVED EXAMPLE

Ex.1 Which of the following was most likely to have been absent in free form in the primordial atmosphere at the time of origin of life

Or

Miller performed experiment to prove abiogenic molecular evolution of life. Which molecule was not present in Miller's experiment

- (A) O₂ (B) CH₄
(C) H₂ (D) NH₃

Sol. (A)

Ex.2 The complex organic compounds that may have first evolved in the direction of origin of life on earth, may have been

- (A) Protein and amino acids
(B) Protein and nucleic acids
(C) Urea and nucleic acids
(D) Urea and ammonia acids

Sol. (B)

Ex.3 In his classic experiment on the formation of amino acids, Stanley Miller passed an electric discharge in a mixture of

Or

Stanley Miller had put the Oparin-Haldane theory to test in 1953 by creating in the laboratory, the probable condition of the primitive earth. In the experiment, simple amino acids were synthesized from which of the following mixture as observed after 18 days

- (A) Steam, CH₄, H₂ and NH₃
(B) CH₄, CO₂, O₂ and H₂
(C) NH₃, O₂, H₂ and steam
(D) CH₄, H₂, N₂ and steam

Sol. (A)

Ex.4 Which one of the following is incorrect about the characteristics of protobionts (coacervates and microspheres) as envisaged in the abiogenic origin of life)

- (A) They were partially isolated from the surrounding
(B) They could maintain an internal environment
(C) They were able to reproduce
(D) They could separate combinations of molecules from the surrounding

Sol. (C)

Ex.5 The greatest evolutionary change enabling the land vertebrates to be completely free from water, was the development of

- (A) Four legs
(B) Lungs
(C) Shelled eggs and internal fertilization
(D) Four chambered heart

Sol. (C)

Ex.6 Evolution means

- (A) History of race
(B) Development of race
(C) History and development of race with variations
(D) Progressive development of the race

Sol. (C)

Ex.7 Which one of the following are analogous structures

- (A) Thorns of Bougainvillea and tendrils of Cucurbita
(B) Flippers of dolphin and legs of horse
(C) Wings of bat and wings of pigeon
(D) Gills of prawn and lungs of man

Sol. (C,D) : Wings of bat are skin folds stretched mainly between elongated finger but the wings of birds are a feather covering all along the arm. They look similar because they have a common use for flying, but their origin are not common. This makes them analogous characteristics rather than homologous characteristics.

Ex.8 Which one of the following in birds, indicates their reptilian ancestry

- (A) Two special chambers crop and gizzard in their digestive tract
(B) Eggs with a calcareous shell
(C) Scales on their hindlimbs
(D) Four chambered heart

Sol. (C)

Ex.9 Organs that have different embryonic origin but perform similar functions are

- (A) Homologous organs
(B) Analogous organs
(C) Vestigial organs
(D) Atavism

Sol. (B) : Analogous organs have different embryonic origin but perform similar functions. These organs are developed in organisms, widely different phylogenetically due to similar habitats and modes of life.

Exercise # 1

SINGLE OBJECTIVE

NEET LEVEL

1. Biogenesis means
 (A) Origin of life from non-living organisms
 (B) Origin of life from living organisms
 (C) Origin of viruses and microbes
 (D) None of these
2. About how long ago was the earth formed.
 (A) 4.6 billion years ago (B) 10 billion years ago
 (C) 3.0 billion years ago (D) 20 billion years ago
3. Type of nutrition in the primitive cells
 Or
 It is believed that the organisms first inhabited earth's surface were
 (A) Heterotrophic or holozoic
 (B) Heterophytic or holophytic
 (C) Saprophytic
 (D) Saprozoic
4. Louis Pasteur's view on the origin of life is that
 (A) Life originated within six days
 (B) Life originated spontaneously from the living organisms only
 (C) Life originated spontaneously from the non-living substances
 (D) Life came from other planet
5. Source of energy at the time of origin of life
 (A) Heat, cosmic rays and lightning
 (B) Heat only
 (C) Cosmic rays only
 (D) Lightning only
6. Select the correct statement from the following
 (A) Darwinian variations are small and directionless
 (B) Fitness is the end result of the ability to adapt and gets selected by nature
 (C) All mammals except whales and camels have seven cervical vertebrae
 (D) Mutations are random and directional
7. The organism which appeared first on earth is known as
 (A) Eubiont (B) Probiont
 (C) Eobiont (D) Truebiont
8. The concept of chemical evolution is based on
 (A) Crystallization of chemicals
 (B) Interaction of water, air and clay under intense heat
 (C) Effect of solar radiation on chemicals
 (D) Possible origin of life by combination of chemicals under suitable environmental conditions
9. Which one of the following amino-acids was not found to be synthesized in Miller's experiment
 (A) Glutamic acid (B) Alanine
 (C) Glycine (D) Aspartic acid
10. There is no life on moon because there is no
 (A) Carbon (B) Nitrogen
 (C) Water (D) Silicates
11. According to available evidence life evolved through the process of
 (A) Abiogenesis
 (B) Biogenesis
 (C) Special creation
 (D) Spontaneous generation
12. In the early earth, water and CO₂ were produced by the combination of O₂ with
 (A) Ammonia and methane
 (B) Hydrogen
 (C) Organic matter
 (D) Sulphates and nitrates
 (E) Hydrogen sulphide
13. The prebiotic atmosphere of the earth was of a reducing nature. It was transformed into an oxidizing atmosphere of present day due to the emergence of
 (A) Cyanobacteria
 (B) Angiosperms
 (C) Photosynthetic bacteria
 (D) Eukaryotic algae
14. Formation of which complex molecules was noticed by Urey and Miller when they subjected substances like NH₃, CH₄, H₂O etc. to electric discharge
 (A) Aquaregia (B) H₂SO₄
 (C) HCN (D) Aminoacids
15. The idea that life originates from pre-existing life is referred as
 (A) Biogenesis theory
 (B) Special creation theory
 (C) Abiogenesis theory
 (D) Extraterrestrial theory

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

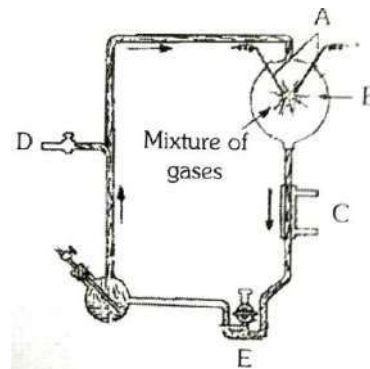
1. Hot dilute soup was given by
(A) Oparin (B) Haldane
(C) Urey (D) None of these
2. Which is responsible for origin of life
(A) Spontaneous generation
(B) Special creation
(C) Catastrophy
(D) Chemosynthesis
3. Life originated in
(A) Precambrian era (B) Proterozoic era
(C) Mesozoic era (D) Caenozoic era
4. Origin of life took place in/on
(A) Water (B) Air
(C) Mountains (D) Land
5. The presence of salts (NaCl and others) in animal body fluid gives an inference that life originated in the
(A) Salf solutions (B) Rain water
(C) Primitive ocean (D) None of the above
6. According to one of the most accepted theory the earth almospere before any life had originated consisted of
 H_2O, H_2, NH_2
(A) CH_4 (B) O_2
(C) N_2 (D) None of these
7. Under certain conditions scientists have obtained cell - like structures. These are known as
(A) Microbes (B) Protists
(C) Coacervates (D) Prebiotic soup
8. Chemical theory of origin of life was given by
Or
Who proposed that the first form of life could have come from pri-existing living organic molecules
(A) Stanley Miller (B) Oparin and Haldane
(C) Louis Pasteur (D) Spallanzani
9. The abiogenesis occurred about how many billion years ago
(A) 1.2 billion (B) 1.5billion
(C) 2.5 billion (D) 3.5billion
10. Theory of special creation was given by
(A) Weismann (B) Helmont
(C) Manpertuis (D) Father Saurez

11. The spark-discharge apparatus to test chemical evolution of life was designed by

Or

the first experiment on chemical evolution and origin of life was carried out by

- (A) Oparin and Haldane (B) Miller and Urey
- (C) Jacob and Monad (D) Dixon and Jolley
12. Coacervates are
(A) Colloid droplets
(B) Contain nucleoprotein
(C) Both (A) and (B)
(D) Protobiont
13. Theory of catastropism was supported by
(A) Louis Pasteur (B) A.I. Oparin
(C) Cuvier (D) Haldane
14. The diagram represents Miller's experiment. Choose the correct combination of labelling



- (A) A-electrodes, B - $NH_3 + H_2 + H_2O + CH_4$, C - cold water, D-vacuum, E-U trap
- (B) A-electrodes, B - $NH_4 + H_2 + CO_2 + CH_3$, C - hot water, D-vacuum, E-U trap
- (C) A-electrodes, B - $NH_3 + H_2O$ C - hot water, D-tap, E-U trap
- (D) A-electrodes, B - $NH_3 + H_2 + H_2O + CH_4$, C - steam, D - vacuum, E-U trap

15. Coacervates were experimentally produced by
(A) Urey and Miller
(B) Jacob and Monad
(C) Fischer and Huxley
(D) Sidney Fox and Oparin

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match the scientists and their contributions in the field of evolution

Column - I

Name of the scientist

- A. Charles Darwin
- B. Lamarck
- C. Hugo de Vries
- D. Ernst Haeckel
- E. August Weismann

Column - II

Contribution

- i. Mutation theory
- ii. Germ plasma theory
- iii. Philosophie Zoologique
- iv. The Origin of species
- v. Biogenetic law
- vi. Eassy on population

(A) A - iv, B - iii, C - i, D - v, E - ii

(B) A - iv, B - iii, C - v, D - i, E - vi

(C) A - iv, B - iv, C - v, D - iii, E - i

(D) A - ii, B - iii, C - i, D - v, E - ii

(E) A - iii, B - iv, C - i, D - v, E - ii

2. Match the scientists listed under column - 'I' with ideas listed Column - 'II'

Column - I

- A. Darwin
- B. Oparin
- C. amarck
- D. Wagner

Column - II

- i. Abigogenesis
- ii. Use and disuse of organs
- iii. Continental drift theory
- iv. Evolution by natural selection

Options :

(A) A - i., B - iv, C - ii, D - iii (B) A iv, B - i., C - ii, D - iii

(C) A - ii, B - iv, C - iii, D - i. (D) A - iv, B - iii, C - ii, D - i.

3. Match the evolution concepts and their proposers and select the right option

Column - I

- A. Saltation
- B. Formation of life was proceeded by chemica evolution
- C. Reproductive fitness
- D. Life comes from pre-existing life

Column - II

- i. Darwin
- ii. Louis Pasteur
- iii. De vries
- iv. Oparin and Haldane

(A) A - iii; B - iv; C - i; D - ii

(B) A - iv; B - iii; C - ii; D - i

(C) A - iv; B - ii; C - iii; D - i

(D) A - ii; B - iii; C - i; D - iv

(E) A - i; B - iv; C - iii; D - ii

4. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Francesco Redi
- B. L. Pasteur
- C. Richter
- D. Oparin

Column - II

- i. Theory of chemical evolution of life
- ii. Disproval of spontaneous generation
- iii. Swan necked flask experiment
- iv. Mutation
- v. Panspermia

(A) A - v; B - i.; C - iv; D - ii

(B) A - ii; B - iii; C - v; D - i.

(C) A - v; B - iv; C - ii; D - i.

(D) A - i.; B - ii; C - iii; D - iv

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. Darwin's finches provide an excellent evidence in favour of evolution. This evidence comes from the field of [CBSE AIPMT 2000]
(A) Biogeography (B) Anatomy
(C) Embryology (D) Palaeontology
2. Which is not a vestigial part in humans ? [CBSE AIPMT 2000]
(A) Segmental muscles of abdomen
(B) Finger nails
(C) Third molar
(D) Coccyx
3. Which of the following primate is the closest relative of humans ? [CBSE AIPMT 2000]
(A) Rhesus monkey (B) Orangutan
(C) Gorilla (D) Gibbon
4. Which one of the following features is closely related with the evolution of humans ? [CBSE AIPMT 2000]
(A) Loss of tail (B) Shortening of jaws
(C) Binocular vision (D) Flat nails
5. Homo sapiens evolved during [CBSE ATPMT 2000]
(A) Pleistocene (B) Oligocene
(C) Pliocene (D) Miocene
6. Occurrence of endemic species in South-America and Australia is due to [CBSE ATPMT 2001]
(A) these species have been extinct from other
(B) continental separation
(C) there is no terrestrial route to these places
(D) retrogressive evolution
7. Half-life period of C^{14} is about [CBSE ATPMT 2001]
(A) 500 yr (B) 5730 yr
(C) 50 yr (D) 5×10^4 yr
8. Darwin's theory of pangenesis shows similarity with theory of inheritance of acquired characters then what will be correct according to it ? [CBSE ATPMT 2001]
(A) Useful organs become strong and developed while useless organs become extinct. These organs help in struggle for survival
(B) Size of organs increase with ageing
(C) Development of organs is due to will power
(D) There should be some physical basis of inheritance
9. Which of following is closest relative of man ?
(A) Chimpanzee (B) Gorilla
(C) Orangutan (D) Gibbon
10. Reason of diversity in living beings is [CBSE ATPMT 2001]
(A) mutation
(B) gradual change
(C) long term evolutionary change
(D) short term evolutionary change
11. Similarities in organisms with different genotype indicates [CBSE ATPMT 2001]
(A) micro-evolution (B) macro-evolution
(C) convergent evolution (D) divergent evolution
12. Which of the following is correct order of evolutionary history of man ? [CBSE AIPMT 2001]
(A) Peking man, Homo sapiens, Neanderthal, Cro-magnon
(B) Peking man, Neanderthal, Homo sapiens, Cro-magnon
(C) Peking man, Heidelberg man, Neanderthal, Cro-magnon
(D) Peking man, Neanderthal, Homo sapiens, Heidelberg man
13. Two different species cannot live for long duration in the same niche or habitat' This law is [CBSE AIPMT 2002]
(A) Allen's law (B) Gause's hypothesis
(C) Dollo's rule (D) Weismann's theory
14. Sequence of which of the following is used to know the phylogeny ? [CBSE AIPMT 2002]
(A) mRNA (B) rRNA
(C) tRNA (D) DNA
15. In which era reptiles were dominant ? [CBSE AIPMT 2002]
(A) Coenozoic era (B) Mesozoic era
(C) Palaeozoic era (D) Archaeozoic era
16. According to fossils discovered up to present time origin and evolution of man was started from it [CBSE AIPMT 2002]
(A) France (B) Java
(C) Africa (D) China
17. In which condition the gene ratio remains constant for any species ? [CBSE AIPMT 2002]
(A) Sexual selection (B) Random mating
(C) Mutation (D) Gene flow

MOCK TEST

- Which of the following is the correct sequence of events in the origin of life ?
I. Formation of protobionts
II. Synthesis of organic monomers
III. Synthesis of organic polymers
IV. Formation of DNA based genetic system
(A) I, II, III, IV (B) I, III, II, IV (C) II, III, I, IV (D) II, III, IV, I
- Following are the two statements regarding the origin of life
(A) The earliest organisms that appeared on the earth were non-green and presumably anaerobes
(B) The first autotrophic organisms were the chemoautotrophs that never released oxygen of the above statements which one of the following option is correct ?
(A) Both (A) and (B) are correct
(B) Both (A) and (B) are false
(C) (A) is correct but (B) is false
(D) (B) is correct but (A) is false
- According to the theory of spontaneous generation
(A) life originated from outer space
(B) life originated from decaying and rotting matter like straw, mud etc.
(C) life came from pre-existing life
(D) life came from both living and non-living matter
- The idea of 'Natural Selection' as the fundamental process of evolutionary changes was reached
(A) independently by Charles Darwin and Alfred Russel Wallace in 1859
(B) by Charles Darwin in 1866
(C) by Alfred Russel Wallace in 1901
(D) independently by Charles Darwin and Alfred Russel Wallace in 1859
- Match the Column-I with Column-II and choose the right option

Column-I	Column-II
I. Thomas Malthus	A. Branching descent
II. Hugo de Vries	B. Studies on populations
III. Charles Darwin	C. Use and disuse theory
IV. Lamarck	D. Saltation

(A) I - D, II - A, III - C, IV - B
(B) I - B, II - D, III - A, IV - C
(C) I - B, II - D, III - C, IV - A
(D) I - C, II - B, III - A, IV - D
(E) I - B, II - A, III - C, IV - D
- Match the evolution concepts and their proposers and select the right option

Column-I	Column-II
I. Saltation	A. Darwin
II. Formation of life was preceded by chemical evolution	B. Louis Pasteur
III. Reproductive fitness	C. de Vries
IV. Life comes from pre-existing life	D. Oparin and Haldane

(A) I - C, II - D, III - A, IV - B
(B) I - D, II - C, III - B, IV - A
(C) I - D, II - B, III - C, IV - A
(D) I - B, II - C, III - A, IV - D
(E) I - A, II - D, III - C, IV - B

www.blog.neetnearme.com

HUMAN REPRODUCTION

“Man perfected by society is the best of all animals he is the most terrible of all when he lives without law, and without justice”.

“HANS SPEMANN (1869-1941)”

INTRODUCTION

The living world around us exhibits a vast range of life forms which make this planet a wonderful and amazing place to reside. The variety of living organism flourishing on earth is infinite. Similarly variety of relationships are known to occur at micro level, i.e. cellular level too. Such molecular interactions occur inside, around and among the cells, which reveal astonishing facts about life. The Second approach is philosophical one, which mainly focuses on purpose of life to living organisms. Biological classification is the scientific procedure to classify the organisms into different groups on the basis of their similarities and dissimilarities also placing the groups in a hierarchy of categories.

Life is a characteristic quality that differentiates an inanimate (non-living) object from the animate (living) forms. It is a unique, complex organisation of molecules that expresses itself through chemical reactions which lead to growth, development, responsiveness, adaptation and reproduction. The objects exhibiting growth, development, responsiveness and other characteristics of life are designated as **living beings**.

BIOLOGY FOR NEET & AIIMS

INTRODUCTION

An organism to continue its own race go through the process of reproduction, produces off springs like its own. On combining, in sexual reproduction the organisms produce male and female gametes develop into a new individual. The formation of gametes takes place in the reproductive organs.

PRIMARY SEX ORGAN

Essential organs which form the gametes. In males, the gamete forming organs are the testes. In females, the corresponding organs are ovaries.

1. The male gametes is the spermatozoan.
2. The female gamete is the ovum.

SECONDARY SEX ORGAN

These form the passage for the gametes to help the union of male & female gametes.

In male , the secondary sex organs are epididymis, vas deferens, seminal vesicles, prostate, bulbourethral glands & penis while in female - Fallopian tube, uterus & vagina. (Breast is an accessory sex organ)

DEVELOPMENT OF SEX ORGAN

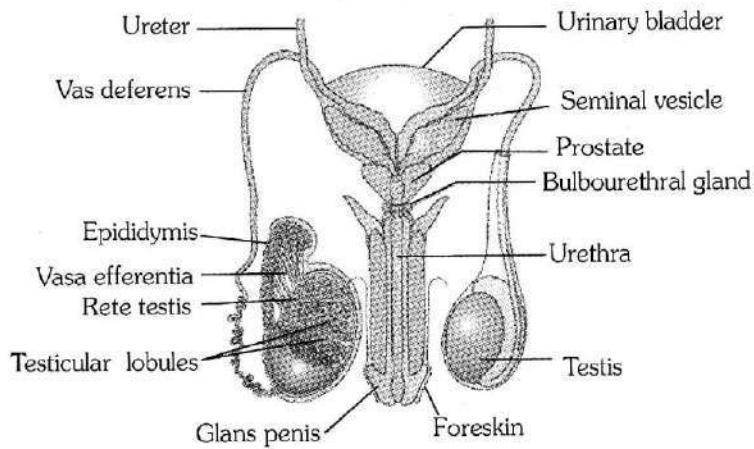
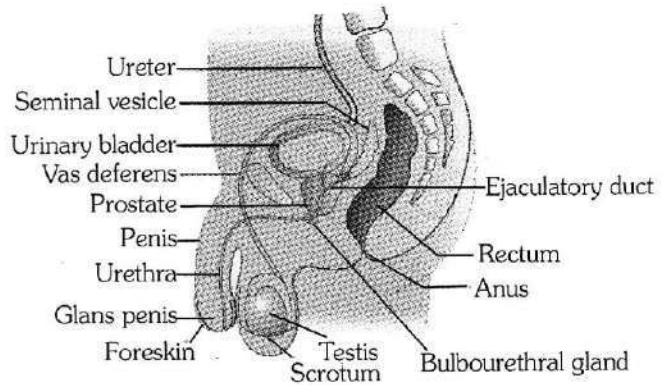
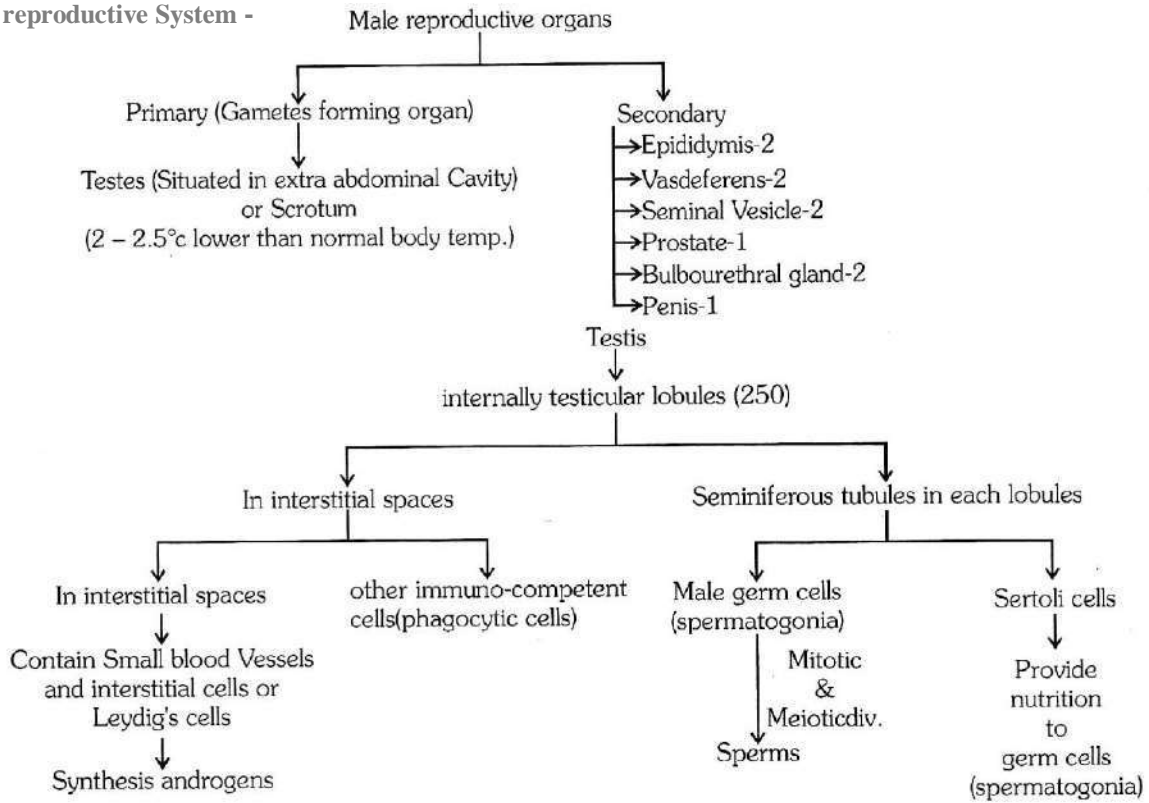
During intra uterine life (IUL) testis & ovary develop from mesoderm. They develop in abdominal cavity. At the time of birth, testes descend down into scrotal sac but ovaries remain in abdominal cavity.

MALE REPRODUCTIVE SYSTEM

- In man, one pair of testes are the main or primary reproductive organ. Size 4-5 cm × 2-3cm
- The testes are located in a small bag like structure which is situated out side & below the abdominal cavity are called as scrotum or scrotal sac. The temperature of scrotal sac is 2 to 3°C lesser than body temperature.
- Scrotal sac is lined by **spermatic fascia & dartos muscle** internally.
Dartos muscle helps in regulation of the temperature with in the scrotum during cold season, During warm season, it becomes relaxed & during cold season, it becomes contract.
Cremaster muscles line inside the wall of scrotal & inguinal canal region. It helps in elevation of testes.
- Each testis is attached to the dorsal body wall of the abdominal-cavity through a cord termed as the **Spermatic cord**. This cord is made up of elastin fibres & spermatic fascia. The contents of cord are vas deferens, gonadal veins, gonadal arteries, nerves and lymphatics.
During embryonic stage, testes develop in abdominal cavity & they descend to reach the scrotum at the time of birth. When the testes does not descend to reach the scrotum but remain in abdominal cavity at the time of birth this conditions is called **undescended testes**. Such testis cannot develop and function properly and may develop malignancy. It is also called **cryptorchidism**.
Orchiopexy : When the undescended testes are brought into scrotal sac by surgical process during childhood this process called as orchiopexy.
Castration : Crushing of testes in bulls to convert them to bullocks. (This makes them more obidient due to fall in the level of testosterone)
- Each testis is attached to the walls of the scrotal-sac through flexible, elastic fibres. This group of fibres is called Gubernaculum.

Tips *ules*

Male reproductive System -



SOLVED EXAMPLE

Ex.1 In human, the unpaired male reproductive structure is

Or

Which of the following is an accessory reproductive gland in male mammals

- (A) Seminal vesicle (B) Prostate
(C) Bulbourethral gland (D) Testes
(E) Vas deferens

Sol. (B)

Ex.2 The abdominal passage which connects to the abdominal cavity with the scrotal sac in mammals is known as

- (A) Spermatic canal (B) Neurenteric canal
(C) Inguinal canal (D) Haversian canal

Sol. (C) : Through this testes descend into scrotal sacs.

Ex.3 Sperm cells are produced in

- (A) Seminiferous tubules (B) Interstitial cells
(C) Epididymis (D) Prostate gland

Sol. (A)

Ex.4 Secretions from which one of the following are rich in fructose, calcium and some enzymes

- (A) Male accessory glands (B) Liver
(C) Pancreas (D) Salivary glands

Sol. (A) : Male accessory glands include a pair of seminal vesicles, a prostate gland, and pair of bulbourethral glands. Their secretions are called as seminal plasma, which is rich in fructose, has calcium and some enzymes.

Ex.5 The correct sequence of spermatogenic stages leading to the formation of sperms in a mature human testis is

- (A) Spermatocyte - spermatogonia-spermatid-sperms
(B) Spermatogonia-spermatocyte-spermatid-sperms
(C) Spermatid-spermatocyte-spermatogonia-sperms
(D) Spermatogonia-spermatid-spermatocyte-sperms

Sol. (B)

Ex.6 Which one of the following statements is false in respect of viability of mammalian sperm

- (A) Sperm is viable for only up to 24 hours
(B) Survival of sperm depends on the pH of the medium and is more active in alkaline medium
(C) Viability of sperm is determined by its motility
(D) Sperms must be concentrated in a thick suspension

Sol. (D)

Ex.7 In the absence of acrosome, the sperm

- (A) Cannot penetrate the egg
(B) Cannot get energy
(C) Cannot get food
(D) Cannot swim

Sol. (A)

Ex.8 Supporting cells found in between the germinal epithelium of testes are called

Or

Which of the following cells are present in mammalian testes and help to nourish sperms

- (A) Interstitial cells of Leydig
(B) Sertoli cells
(C) Granular cells
(D) Phagocytes

Sol. (B) : The germinal epithelium lining of the seminiferous tubules is made of two kinds of cell. A few larger cell columnar supporting cells are called sertoli cells or sustentacular cells or nurse cells.

Ex.9 Sertoli cells are found in

- (A) Pancreas and secrete cholecystokinin
(B) Ovaries and secrete progesterone
(C) Adrenal cortex and secrete and adrenaline
(D) Seminiferous tubules and provide nutrition to germ cells

Sol. (D)

Ex.10 What happens during fertilisation in humans after many sperms reach close to the ovum

- (A) Cells of corona radiata trap all the sperms except one
(B) Only two sperms nearest the ovum penetrate zona pellucida
(C) Secretions of acrosome helps one sperm enter cytoplasm of ovum through zona pellucida
(D) All sperms except the one nearest to the ovum lose their tails

Sol. (C)

Ex.11 Withdrawal of which of the following hormones is the intermediate cause of menstruation

Or

Menstruation is triggered by an abrupt decline in the amount of

Or

Which hormone level reaches peak during luteal phase of menstrual cycle

- (A) FSH-RH (B) Progesterone
(C) Estrogen (D) FSH

Sol. (B)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Cryptorchidism is the condition in man when
 - (A) There are two testis in each scrotum
 - (B) Testis do not descent into the scrotum
 - (C) Testis enlarge in the scrotum
 - (D) Testis degenerate in the scrotum
2. Bulbourethral gland is also known as
 - (A) Prostate gland
 - (B) Cowper's gland
 - (C) Perineal gland
 - (D) Meibomian gland
3. Which of the following is an accessory reproductive gland in male mammals
 - (A) Prostate gland
 - (B) Gastric gland
 - (C) Mushroom shaped gland
 - (D) Inguinal gland
4. Cowper's glands are present in
 - (A) Female mammals
 - (B) Male mammals
 - (C) Both (A) and (B)
 - (D) None
5. Seminiferous tubules develop central lumen after
 - (A) Birth
 - (B) Prepuberal time
 - (C) Puberty
 - (D) Old age
6. There are some special types of cells found in the seminiferous tubules known as sertoli cells. These are
 - (A) Germinal cells
 - (B) Reproductive cells
 - (C) Somatic cells
 - (D) Protective cells
7. There is a connective tissue cord extending between the testis and abdominal wall called
 - (A) Testis cord
 - (B) Gubernaculum
 - (C) Mesentric cord
 - (D) Spermatic cord
8. The elastic tissue connecting the cauda epididymis to the scrotal sac is
 - (A) Gubernaculum
 - (B) Tendinous cord
 - (C) Scrotal ligament
 - (D) Caput epididymis
9. The seminiferous tubules of the testis are lined by the germinal epithelium consisting of
 - (A) Cells of Sertoli
 - (B) Spermatoocytes
 - (C) Spermatogonium
 - (D) Spermatids
10. By the contraction of spermatic cord the testis of man are not taken to the abdominal cavity. It is due to the following structure
 - (A) Narrowness of inguinal canal
 - (B) Attachment of testis by gubernaculum testis to the scrotal sac only
 - (C) Both (A) and (B)
 - (D) Fat bodies and gubernaculum present over the testis
11. Which cells in the testis secrete testosterone
 - (A) Interstitial cells or cells of Leydig
 - (B) Cells of the germinal epithelium
 - (C) Sertoli cells
 - (D) Secondary spermatocytes
12. If the vas deferens of a man is surgically disconnected
 - (A) Sperms in the semen will be without nuclei
 - (B) Semen will be without sperms
 - (C) Spermatogenesis will not occur
 - (D) Sperms in the semen will be non-motile
13. The capsule enclosing testis of mammal is called as
 - (A) Tunica albuginea
 - (B) Tunica membrana
 - (C) Tunica vaginalis
 - (D) Tunica vesiculosa
14. The abdominal passage which connects the abdominal cavity with the scrotal sac in mammals is known as
 - (A) Spermatic canal
 - (B) Neurenteric canal
 - (C) Inguinal canal
 - (D) Haversion canal
15. If Cowper's glands are removed. They will affect
 - (A) Erection of penis
 - (B) Sperms
 - (C) Sex recognition
 - (D) Sexual behaviour
16. Gubernaculum cordis is a contractile structure that
 - (A) Pulls down the testis during breeding season into the scrotal sac
 - (B) Allows daily migration of the testis from the abdominal cavity into the scrotum
 - (C) Facilitates ejaculation of spermatozoa from the testis
 - (D) Keeps the testis in position
17. In man the two vasa deferentia open into
 - (A) Urinary bladder
 - (B) Rectum
 - (C) Urethra
 - (D) Penis

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Functions of seminal fluid is/are
(A) Maintains the viability of sperms
(B) Maintains motility of sperms
(C) Provides proper *pH* and ionic strength
(D) All the above
2. In which animal the testes are abdominal during embryonic stages but migrate to scrotum just before birth where they remain throughout life
(A) Elephants (B) Men
(C) Rats (D) Whales
3. Ducts leading from the testes of rabbit are called
(A) Genital ducts (B) Spermatic ducts
(C) Urinary ducts (D) Vasa efferentia
4. The scrotal sac of a male mammal is homologous to
(A) Clitoris (B) Labia majora
(C) Vagina (D) Uterus
5. Which of the following is similar in function to Cowper's gland
(A) Bartholin's gland (B) Perineal gland
(C) Prostate gland (D) Rectal gland
6. Testes in rabbit are
(A) Inside the body
(B) On the sides of the kidneys
(C) In scrotal sacs
(D) On either side of dorsal aorta
7. Supporting cells found in between the germinal epithelium of testes are called
(A) Interstitial cells of Leydig
(B) Sertoli cells
(C) Granular cells
(D) Phagocytes
8. The testes of a great majority of mammals are typically enclosed in an extra abdominal sac, the scrotum. The temperature inside the scrotum is lower than that in the abdomen. What will happen if the temperature of the scrotum is artificially maintained to the level of abdominal temperature
(A) The germinal epithelium will produce a large quantity of androgen secretion
(B) The germinal epithelium of the testes will divide faster, thus producing more sperms
(C) The germinal epithelium of the testes will degenerate, resulting in sterility
(D) The germinal epithelium will carry out normal spermatogenesis
9. From the seminiferous tubules the spermatozoa pass into
(A) Epididymis (B) Vas deferens
(C) Seminal vesicle (D) Rete testis
10. Seminiferous tubules are found in
(A) Testis (B) Ovary
(C) Kidney (D) Lung
11. Cells of Leydig are found in
(A) Kidney of rabbit (B) Kidney of frog
(C) Testis of frog (D) Testis of rabbit
12. Bidder's canal is found in
(A) Testes of frog (B) Kidney of frog
(C) Ovary of mammal (D) Kidney of mammal
13. Sertoli cells are found in
(A) Kidney of rabbit (B) Ovary of frog
(C) Testes of rabbit (D) Ovary of rabbit
14. In rabbit, head of the epididymis present at the head of the testis is called
(A) Vas deferens (B) Cauda epididymis
(C) Gubernaculum (D) Caput epididymis
15. Which of the following is the endocrine tissue of testes
(A) Epidermis (B) Inguinal canal
(C) Leydig cells (D) Spermatic cord
16. Phallic organs in cockroach are related to
(A) Male excretory system
(B) Male reproductive system
(C) Female excretory system
(D) Female reproductive system
17. In which of the following organism testes descend into scrotum in breeding season but in non-breeding season goes up
(A) Frog (B) Kangaroo
(C) Shrew (D) Bat
18. In most mammals, the testes are located in scrotal sac for
(A) Spermatogenesis
(B) Sex differentiation
(C) More space to visceral organs
(D) Independent functioning of kidney

1. Column -I contains terms and Column -II contains definitions. Match them correctly and choose the right answer
- | | |
|-------------------|---|
| Column - I | Column - II |
| A. Parturition | i. Attachment of zygote to endometrium |
| B. Gestation | ii. Release of egg from Graafian follicle |
| C. Ovulation | iii. Delivery of baby from uterus |
| D. Implantation | iv. Duration between pregnancy |
| E. Conception | v. Stoppage of ovulation and menstruation |
- (A) A -ii; B - iv; C - i; D - v; E - iii
(B) A -iv; B - iii; C - i; D - v; E - ii
(C) A -v; B - i; C - ii; D - iii; E - iv
(D) A -iii; B - iv; C - ii; D - i; E - v
2. Match between the following representing parts of the sperm and their functions and choose the correct option
- | | |
|-------------------|----------------------|
| Column - I | Column - II |
| A. Head | i. Enzymes |
| B. Middle piece | ii. Sperm motility |
| C. Acrosome | iii. Energy |
| D. Tail | iv. Genetic material |
- Options :**
(A) A - ii; B - iv; C - i; D - iii
(B) A - iv; B - iii; C - i; D - ii
(C) A - iv; B - i; C - ii; D - iii
(D) A - ii; B - i; C - iii; D - iv
3. Match the following and choose the correct options
- | | |
|--------------------|--|
| Column - I | Column - II |
| A. Trophoblast | i. Embedding of blastocyst in the endometrium |
| B. Cleavage | ii. Group of cells that would differentiate as embryo |
| C. Inner cell mass | iii. Outer layer of blastocyst attached to the endometrium |
| D. Implantation | iv. Mitotic division of zygote |
- Options :**
(A) A - ii; B - i; C - iii; D - iv
(B) A - iii; B - iv; C - ii; D - i
(C) A - iii; B - i; C - ii; D - iv
(D) A - ii; B - iv; C - iii; D - i
4. Match Column -I with Column - II and select the correct option from the codes given below.
- | | |
|-------------------|-----------------------|
| Column - I | Column - II |
| A. Cleavage | i. Fertilization |
| B. Morula | ii. Mitotic divisions |
| C. Polyspermy | iii. Endometrial |
| D. Implantation | iv. Little mulberry |
- (A) A - ii; B - iv; C - i; D - iii
(B) A - i; B - iv; C - ii; D - iii
(C) A - iv; B - ii; C - i; D - iii
(D) A - ii; B - iv; C - iii; D - i
5. Match the column - I with column - II and select the correct option from the codes given below.
- | | |
|----------------------|--------------------|
| Column - I | Column - II |
| A. Hypothalamus | i. Sperm lysins |
| B. Acrosome | ii. Estrogen |
| C. Graafian follicle | iii. Relaxin |
| D. Leydig's cells | iv. GnRH |
| E. Parturition | v. Testosterone |
- (A) A - iv; B - i; C - ii; D - iii; E - v
(B) A - ii; B - i; C - iv; D - iii; E - v
(C) A - ii; B - i; C - v; D - iv; E - iii
(D) A - iii; B - iv; C - ii; D - i; E - v

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. Cleavage in mammalian egg is
[CBSE AIPMT 2000]
(A) Equal holoblastic
(B) Unequal holoblastic
(C) Superficial meroblastic
(D) Discoidal meroblastic
2. Which set is similar ? [CBSE AIPMT 2001]
(A) Corpus luteum – Graafian follicle
(B) Sebum – Sweat
(C) Bundle of His – Pacemaker
(D) Vit-B₇ – Niacin
3. What is true for cleavage ? [CBSE AIPMT 2002]
(A) Size of embryo increases
(B) Size of cells decreases
(C) Size of cells increases
(D) Size of embryo decreases
4. During embryonic development, the establishment of polarity along anterior/ posterior, dorsal/ventral or medial/lateral axis is called [CBSE AIPMT 2003]
(A) Anamorphosis (B) Pattern formation
(C) Organiser phenomena (D) Axis formation
5. Bartholin's glands are situated
[CBSE AIPMT 2003]
(A) On either side of vagina in humans
(B) On either side of vas deference in humans
(C) On the sides of the head of some amphibians
(D) At the reduced tail end of birds
6. Ovulation in the human female normally takes place during the menstrual cycle - [CBSE AIPMT 2004]
(A) At the mid secretory phase
(B) Just before the end of the secretory cycle
(C) At the beginning of the proliferative phase
(D) At the end of the proliferative phase
7. Grey crescent is the area - [CBSE AIPMT 2004]
(A) At the point of entry of sperm into ovum
(B) Just opposite to the site of entry of sperm into ovum
(C) At the animal pole
(D) At the vegetal pole
8. If mammalian ovum fails to get fertilised, which one of the following is unlikely
(A) Corpus luteum will disintegrate
(B) Estrogen secretion further vdecreases
(C) Primary follicle starts developing
(D) Progesterone secretion rapidly declines
9. Which part of ovary in mammals acts as an endocrine gland after evolution? [CBSE AIPMT 2007]
(A) Graafian follicle (B) Stroma
(C) Germinal epithelium (D) Vitelline membrane
10. In humans, at the end of the first meiotic division, the male germ cells differentiate into the:
[CBSE AIPMT 2008, 1994]
(A) secondary spermatocytes
(B) primary spermatocytes
(C) spermatogonia
(D) spermatids
11. Which extra embryonic membrane in humans prevents desiccation of the embryo inside the uterus?
[CBSE AIPMT 2008]
(A) Chorion (B) Allantois
(C) Yolk sac (D) Amnion
12. Which one of the following statements is incorrect about menstruation? [CBSE AIPMT 2008]
(A) During normal menstruation about 40 ml blood is lost
(B) The menstrual fluid can easily clot
(C) At menopause in the female, there is especially abrupt increase in gonadotropic hormones
(D) The beginning of the cycle of menstruation is called menarche
13. Which of the following is the correct matching of the events occurring during menstrual cycle?
[CBSE AIPMT 2009]
(A) Ovulation LH and FSH attain peak level and sharp fall in the secretion of progesterone
(B) Proliferative phase Rapid regeneration of myometrium and maturation of Graafian follicle
(C) Development of corpus luteum Secretory phase and increased secretion of progesterone
(D) Menstruation Breakdown of myometrium and ovum not fertilized

1. Which of the following depicts the correct pathway of transport of sperms?
(A) Rete testis → Efferent ductules → Epididymis → Vas deferens
(B) Rete testis → Epididymis → Efferent ductules → Vas deferens
(C) Rete testis → Vas deferens → Efferent ductules → Epididymis
(D) Efferent ductules → Rete testis → Vas deferens → Epididymis
2. Which one of these is not an accessory glands in male reproductive system?
(A) Cowper's gland (B) Prostate gland (C) Bartholin's gland (D) Seminal vesicle
3. Vasa efferentia are muscular tubes, each of which connects
(A) an epididymis to vas deferens (B) vas deferens to seminal vesicle
(C) rete testis to vas deferens (D) rete testis to epididymis
4. In human, the unpaired male reproductive structure is
(A) seminal vesicle (B) prostate (C) bulbourethral gland (D) testes
(E) vas deferens
5. The part of Fallopian tube closest to the ovary is
(A) infundibulum (B) isthmus (C) ampulla (D) cervix
6. Bartholin's glands are homologous to
(A) bulbourethral glands (B) seminal vesicle (C) prostate gland (D) glans penis
7. Changes in GnRH pulse frequency in females is controlled by circulating levels of
(A) progesterone only (B) progesterone and inhibin
(C) estrogen and progesterone (D) estrogen and inhibin
8. Identify the correct statement on 'inhibin'.
(A) Is produced by granulosa cells in ovary and inhibits the secretion of LH
(B) Is produced by nurse cells in testes and inhibits the secretion of LH
(C) Inhibits the secretion of LH, FSH and prolactin
(D) Is produced by granulosa cells in ovary and inhibits the secretion of FSH
9. Human primary spermatocyte contains
(A) 22 autosomes and an X-chromosome (B) 22 autosomes and a Y-chromosome
(C) 22 autosomes and an X or Y chromosome (D) 22 pairs of autosomes and XY chromosomes.
10. Select the incorrect statement.
(A) LH and FSH decrease gradually during the follicular phase.
(B) LH triggers secretion of androgens from the Leydig cells.
(C) FSH stimulates the Sertoli cells which help in spermiogenesis.
(D) LH triggers ovulation in ovary.
11. Which of the following is responsible for the production of progesterone, (the hormone responsible for the maintenance of endometrium)?
(A) Uterus (B) Graafian follicle (C) Corpus luteum (D) Ovary
12. Corpus luteum is maintained in a woman, under the effect of
(A) prolactin (B) progesterone
(C) human chorionic gonadotropin (D) somatomammotropin

www.blog.neetnarme.com

RESPIRATION IN PLANTS

“Biochemistry has an important bearing on the progress of medicine. But because of this, it must itself remain a pure science, whose initiates are inspired by a craving for understanding and by nothing else.”

“ OTTO FRITZ MEYERHOF (1884-1951)”

INTRODUCTION

Why is breathing so essential for life? What happens when we breathe? When it comes to life, respiration is considered as one of the basic features which helps the organism to survive. Respiration provides energy for carrying out daily life activities, be it absorption, transport, movement, reproduction or even breathing.

The process of breathing is very much connected to the process of release of energy from food. All the energy required for 'life process' is obtained by oxidation of some macromolecules that we call as 'food'. The gaseous exchange i.e., intake of oxygen and release of carbon dioxide is called breathing while respiration includes biological oxidation of organic molecules i.e. breaking of C-C bonds by using enzymes and results in the release of energy in the form of ATP. The oxidation of macromolecules that takes place inside the body is called as "FOOD". Only green plants prepare their own food through photosynthesis but only those cells which contain chloroplast show photosynthesis. In eukaryotes, photosynthesis takes place in chloroplast and respiration in cytoplasm and mitochondria. The compounds subjected to biological oxidation is called **Respiratory substrate**. These may be carbohydrates, fats, proteins or organic acids.

ENZYME

Enzymes are proteinaceous, biocatalysts.

Term **enzyme** was given by **Kuhne**.

First of all isolated & discovered by **Buchner**

Zymase (from yeast) was the **first discovered enzyme**. (**Buchner**)

The first purified and crystalized enzyme was **urease** (by **J.B.Sumner**) from **Canavalia/Jack Bean** (**Lobia** plant).

Proteinaceous nature of enzyme was suggested by **Northrop** and **Sumner**.

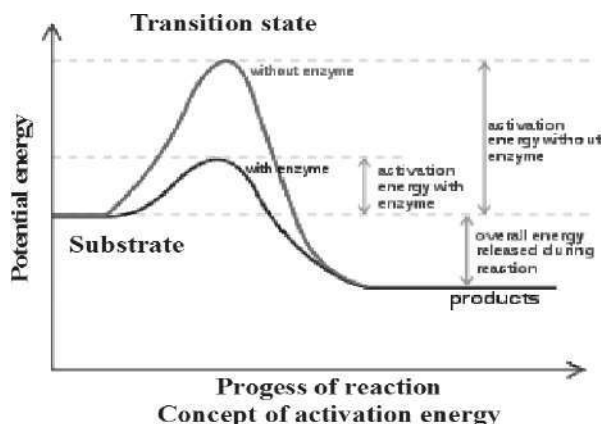
DEFINITION

Enzymes are **biocatalysts made up of proteins (except ribozyme)**, which increases the rate of **bio-chemical reactions** by **lowering down the activation energy**.

First discovered **ribozyme** was **L19 RNAase** by **T.Cech** from rRNA of a protozoan **Tetrahymena thermophila** and **RNAase P** or **Ribonuclease P** by **Altman** in prokaryotic cell (Nobel prize).

CHARACTERISTICS OF ENZYMES

1. All enzymes are proteins, but all proteins are not enzymes.
2. Enzymes accelerate the rate of reaction, without undergoing any change in themselves.
3. Molecular weight of enzymes ranges from 6000 (bacterial fd) to 46 lakh (Pyruvate dehydrogenase comp.)
4. Enzymes are colloidal substances, which are very sensitive to **pH & temperature**. Optimum temperature for enzymes is 20-35°C.
5. Most of enzymes are active at neutral pH, **hydrolytic enzymes** of lysosomes are active on acidic pH (5).
6. All enzymes are **tertiary & globular proteins** (Isoenzymes quarternary protein)
7. Enzymes **lower down the activation energy** of substrate or reactions.
8. Enzymes are required in very minute amount for bio-chemical reactions. Their catalytic power is represented by **Michaelis Menten** constant or **Km constant** and **turn over number**.
"The number of substrate molecules converted into products per unit time by one molecule of the enzyme in favourable conditions is called **turn over number**." The maximum turn over number is of **Carbonic anhydrase**, is 360 lakh, for **Catalase** is 50 lakh, for **flavoprotein** is 50 & for **lysozyme** is 30 per minute.
9. Enzymes are very specific to their substrate or reactions.
10. Enzymes are **macromolecules of amino acids**, which are **synthesized on ribosomes** under the control of genes.



- In cellular respiration, carbohydrates are primary respiratory substrates. Others are Fats, organic acids and proteins. Organic acids are used in CAM plants.
- Cellular respiration is a multistep process so that energy released in some steps can be used for ATP synthesis. If it occurs in single step, all the energy may be released as heat.
- ATP - energy currency of the cell .
- Reasons behind absence of specialised respiratory organs in plants -
 - Very little transport of gases required as each plant part takes care of its own gas exchange needs.
 - Plants have slow respiration rate.
 - In plants, most of the living cells located quite close to the surface of the plants.

1. Glycolysis - Greek words Glycos = Sugar, Lysis = Splitting.

- Also called EMP pathway (E = Embden, M = Meyerhof, P = Parnas)
- Common in both aerobic and anaerobic respiration.
- Occurs in cytoplasm and it is the partial oxidation of hexose (glucose or fructose) into two molecules of pyruvic acid.
- No use of O_2 and no release of CO_2 .
- Net or total ATP gain - 6 ATP or 8 ATP (2 $NADH = 4$ or 6 ATP + 2 ATP by SLP = Substrate level)
- Direct gain of ATP = 2 ATP (by SLP) [Not count the ATP from $NADH$]
- In glycolysis during anaerobic respiration, net or total or direct gain of ATP = 2 ATP [as $NADH_2$ not enter into the ETS]
 - Conversion of pyruvic acid to Acetyl CoA (Link reaction) is an oxidative decarboxylation catalysed by pyruvic dehydrogenase. (Occurs in the matrix of the mitochondria)

2. Krebs Cycle-

- Also called TCA (Tri Carboxylic Acid) Cycle or CA (Citric Acid) Cycle.
- Occurs in the matrix of the mitochondria.
- Involve 4 dehydrogenations (3 $NADH$ and 1 $FADH$) and 2 decarboxylations (2 CO).
- Net or total ATP gain - 12 ATP (3 $NADH = 9$ ATP + 1 $FADH = 2$ ATP + 1 $GTP = 1$ ATP).
 - [If Question is asked for 1 glucose or fructose - in above point no. - (iii) and (iv) calculation will be double as Krebs cycle occurs two times during complete oxidation of 1 molecule of glucose or fructose.]
- Cycle has single 5 carbon compound - α -ketoglutaric acid.

3. Electron transport system (ETS) and oxidative phosphorylation -

- ETS is present in the inner mitochondrial membrane.
- Five complexes - $NADH$ dehydrogenase (I), $FADH_2$ (II), Cytochrome bc₁ (III), Cytochrome a₃ & C centres (IV) and ATP synthase (V).
- In respiration the energy of oxidation - reduction utilised in production of proton gradient to synthesis ATP (Oxidative phosphorylation).
- Molecular Oxygen (O_2) act as the final/ ultimate hydrogen (electron) acceptor and it get reduce, to water.
- Mobile electron carrier - Cytochrome C and ubiquinone (UQ) / CoQ.

In aerobic respiration, net or total gain of ATP from one glucose or fructose - 36 ATP or 38 ATP.

In aerobic respiration in prokaryotes - 38 ATP.

Respiration is an amphibolic pathway (involved in both anabolism and catabolism).

SOLVED EXAMPLE

Ex.1 The energy releasing process in which the substrate is oxidised without an external electron acceptor is called

- (A) Aerobic respiration (B) Glycolysis
(C) Fermentation (D) Photorespiration

Sol. (C)

Ex.2 How many ATP molecules are obtained from fermentation of 1 molecule of glucose

- (A) 2 (B) 4
(C) 3 (D) 5

Sol. (A)

Ex.3 During cellulose fermentation by anaerobic bacteria in rumen and reticulum, cellulose is majority converted into

- (A) Lactic acid (B) Ethyl alcohol
(C) Volatile fatty acids (D) CO₂

Sol. (C)

Ex.4 Aerobic respiratory pathway is appropriately termed

- (A) Catabolic (B) Parabolic
(C) Amphibolic (D) Anabolic

Sol. (C)

Ex.5 How many ATP molecules will be generated in a plant system during complete oxidation of 40 moles of glucose ?

- (A) 190 (B) 380
(C) 1520 (D) 3040

Sol. (C)

Ex.6 How much of the energy released during aerobic respiration is approximately conserved in the form of ATP

- (A) 20 % (B) 40 %
(C) 60 % (D) 100 %

Sol. (B)

Ex.7 Chemiosmotic theory of ATP synthesis in the chloroplasts and mitochondria is based on

- (A) Proton gradient
(B) Accumulation of K ions
(C) Accumulation of Na ions
(D) Membrane potential

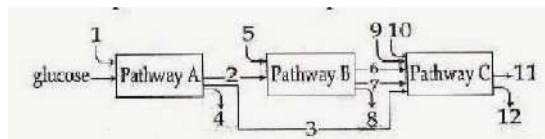
Sol. (A)

Ex.8 Which of the option is correct for photorespiration

- (A) In chloroplast, glycerate forms glycine
(B) In peroxisome, glycerate forms phosphoglycolate
(C) In mitochondria, glycine forms serine
(D) In bundle sheath, serine form glycine

Sol. (C) : Two molecules of glycine form a molecule of serine, CO₂ and NH₃ in mitochondria.

Ex.9 The three boxes in this diagram represent the three major biosynthetic pathway in aerobic respiration. Arrows represent net reactants or products.



Arrow numbered 4, 8 and 12 can all be

- (A) FAD⁺ or FADH₂ (B) Unused
(C) ATP (D) H₂O

Sol. (C)

Ex.10 How many ATP are formed from NADPH⁺ to NAD⁺

- (A) 2 ATP (B) 3 ATP
(C) 6 ATP (D) 4 ATP

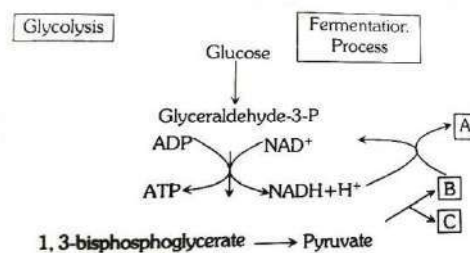
Sol. (B)

Ex.11 The net gain of energy from one gram molecule of glucose when oxidized is

- (A) 2 ATP (B) 36 ATP
(C) 38 ATP (D) 15 ATP

Sol. (C)

Ex.12 Choose the correct combination of labelling the molecules involved in the pathway of anaerobic respiration in yeast



- (A) A - Ethanol B - CO₂ C - Acetaldehyde
(B) A - CO₂ B - Ethanol C - Acetaldehyde
(C) A - CO₂ B - Acetaldehyde C - Ethanol
(D) A - Acetaldehyde B - CO₂ C - Ethanol
(E) A - Ethanol B - Acetaldehyde C - CO₂

Sol. (E)

Exercise # 1

SINGLE OBJECTIVE

NEET LEVEL

1. The end products of respiration in plants are
(A) CO₂, H₂O and energy (B) Starch and O₂
(C) Sugar and oxygen (D) H₂O and energy
2. The incomplete breakdown of sugars in anaerobic respiration results in the formation of
(A) Fructose and water
(B) Glucose and carbon dioxide
(C) Alcohol and CO₂
(D) Water and CO₂
3. Common immediate source of energy in cellular activity is
(A) glucose (B) aldohexose
(C) ATP (D) NAD
4. Different steps in respiration are controlled by
(A) Enzymes (B) Auxins
(C) Sugars (D) Kinins
5. A.T.P. is
(A) A hormone (B) A protein
(C) An enzyme which brings about oxidation
(D) A molecule which contain high energy bond
6. In anaerobic respiration seeds respire
(A) In presence of O₂ (B) In presence of CO₂
(C) In absence of O₂ (D) In absence of CO₂
7. The following is required both by the process of respiration and photosynthesis
(A) Carbohydrates (B) Sunlight
(C) Chlorophyll (D) Cytochromes
8. The net gain of ATP molecules by glycolysis is
(A) Zero (B) Two
(C) Four (D) Eight
9. Which one of the following is not true for iso enzymes ?
(A) iso enzymes are quaternary proteins
(B) all forms synthesized by different genes'
(C) increase activation energy of substrate.
(D) All the above
10. Number of every cytochrome molecule require for transfer of 2e⁻ in ETS :
(A) 2 (B) 4 (C) 1 (D) 10
11. The respiration in germinating seeds produces energy, which can be deflected in the form of
(A) water (B) O₂
(C) Heat (D) CO₂
12. In respiration pyruvic acidis
(A) Formed only when oxygen is available
(B) One of product of Krebs cycle
(C) Broken down into Acetyl Co-A and CO₂
(D) a result of protein break down
13. Most of the energy of the carbohydrates is released by oxidation when
(A) Pyruvic acid is converted into CO₂ and H₂O
(B) Pyruvic acid is converted into acetylCo-A
(C) Sugar is converted into pyruvic acid
(D) Glucose is converted into alcohol and CO₂
14. Glycolysis takes place in
(A) Cytoplasm (B) Chloroplast
(C) Ribosome (D) Mitochondria
15. The end product of fermentation when sugar are used as raw materials are
(A) Alcohol and CO₂ (B) Alcohol, Pyruvate
(C) CO₂ (D) Alcohol
16. Fermentation is conducted by
(A) All bacteria
(B) All fungi
(C) Some fungi and some bacteria
(D) All microorganism
17. In the process of Respiration in plants 180 gm of Glucose plus 192 gm of oxygen produce –
(A) 132 gm of CO₂, 54 gm of H₂O & 483 Cal .E.
(B) 264 gm of CO₂, 216 gm of H₂O, & 686 K.Cal E.
(C) 200 gm of C₂H₅OH, 72 gm of H₂O & 21 K. Cal E.
(D) None
18. Respiration is an
(A) Exothermic proces
(B) Endothermic process
(C) Anabolic process
(D) None of these

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

- What is the importance of respiration in organisms?
(A) It provides oxygen to plant
(B) It liberates energy
(C) It liberates CO₂
(D) All the above
- An indispensable role in energy metabolism is played by
(A) Phosphorus (B) Lithium
(C) Sodium (D) Calcium
- Which component of ETS is mobile, e⁻ carrier ?
(A) UQ(CO-Q) (B) Cyto a
(C) Cyto - b (D) Cyto - f
- Which of the following is the source of respiration?
(A) Stored food (B) RNA
(C) DNA (D) ATP
- R.Q. is less than one at the time of respiration of –
(A) Starch (B) Sugarcane
(C) Glucose (D) Ground nut
- In succulent plants R.Q. is less than one because of
(A) Complete oxidation
(B) Complete Reduction
(C) Incomplete reduction
(D) Incomplete oxidation
- The link between Glycolysis and Krebs cycle is
(A) Citric acid (B) Malic acid
(C) Fumaric acid (D) Acetyl co-enzyme
- Aerobic respiration of glucose produces energy
(A) 637 K.Cal (B) 640K.cal
(C) 686 K.cal (D) 693K.cal
- Succinyl Co-A is related to :
(A) Krebs cycle (B) Calvin cycle
(C) Glycolate cycle (D) HMP-cycle
- According to chemiosmotic theory of P. Mitchell (1978), ATPs are synthesised on membranes due to the :
(A) Proton gradient (B) Electron gradient
(C) Osmosis (D) From H₂SO₄
- A reduction of NADP to NADP.H₂ is associated with
(A) EMP-pathway (B) HMP-shunt
(C) Calvin cycle (D) Glycolysis
- Cut surfaces of fruits and vegetables often become dark because
(A) Dirty knife makes it dark
(B) Oxidation of tannic acid in the presence of trace of iron from the knife makes it dark
(C) Dust of the air makes it dark
(D) None of the above
- An example of competitive inhibition of an enzyme is the inhibition of :
(A) Succinic dehydrogenase by malonic acid
(B) Cytochrome oxidase by cyanide
(C) Hexokinase by glucose - 6 phosphate
(D) Carbonic anhydrase by carbon - dioxide
- If the temperature is increased above 35°C
(A) Rate of decline of respiration will be earlier than decline of photosynthesis
(B) Rate of decline of photosynthesis will be earlier than decline of respiration
(C) Both decline simultaneously
(D) Both do not show any fixed pattern
- In hexose monophosphate shunt the number of CO₂ molecules evolved is
(A) Same as in glycolysis
(B) Less than glycolysis
(C) More than glycolysis
(D) Much less than glycolysis
- Conversion of pyruvic acid into ethyl alcohol is mediated by –
(A) Phosphatase
(B) Dehydrogenase
(C) Decarboxylase & dehydrogenase
(D) Catalase
- The formation of Acetyl Co-A from pyruvic acid is the result of its
(A) Reduction
(B) Dehydration
(C) Phosphorylation
(D) Oxidative decarboxylation

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Wine
- B. Cider
- C. Beer
- D. Rum
- (A) A-(ii), B-(iv), C-(iii), D-(i)
- (C) A-(iv), B-(iii), C-(ii), D-(i)

Column - II

- (i) Apples
- (ii) Grapes
- (iii) Molasses
- (iv) Cereals
- (B) A-(ii), B-(i), C-(iv), D-(iii)
- (D) A-(iv), B-(ii), C-(iii), D-(i)

2. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Fats made of three fatty-acid
- B. Glycolysis metabolite made
- C. Storage form of glucose
- D. Result of running reactions
- (A) A-(iv), B-(ii), C-(i), D-(iii)
- (C) A-(iv), B-(iii), C-(i), D-(ii)

Column - II

- (i) Glycogen chains attached to glycerol
- (ii) Glyceraldehyde from glycerol
- (iii) Triglycerides
- (iv) Glucose of glycolysis in reverse
- (B) A-(iii), B-(ii), C-(i), D-(iv)
- (D) A-(i), B-(ii), C-(iii), D-(iv)

3. Match Column-I with Column-II and select the correct option from the codes given below.

Column-I

- A. TCA cycle
- B. $F_0 - F_1$ particles
- C. End product of
- D. Pyruvate
- (A) A-(ii), B-(i), C-(iv), D-(iii)
- (C) A-(ii), B-(iii), C-(iv), D-(i)

Column - II

- (i) Inner mitochondrial membrane
- (ii) Hans Krebs
- (iii) Oxidative decarboxylation glycolysis
- (iv) Pyruvic acid dehydrogenase
- (B) A-(i), B-(ii), C-(iv), D-(iii)
- (D) A-(iii), B-(ii), C-(i), D-(iv)

4. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. R.Q
- B. Mitchel
- C. Cytochromes
- D. Lactic acid
- E. Yeast
- (A) A-(v), B-(i), C-(iii), D-(ii), E-(iv)
- (C) A-(i), B-(v), C-(ii), D-(iii), E-(iv)

Column - II

- (i) Chemiosmotic ATP synthesis
- (ii) Muscle fatigue
- (iii) Inner mitochondrial membrane
- (iv) Alcoholic fermentation
- (v) Respirometer
- (B) A-(v), B-(i), C-(iii), D-(iv), E-(ii)
- (D) A-(v), B-(ii), C-(iv), D-(iii), E-(i)

5. Match Column-I with Column-II and select the correct option from the codes given below.

Column-I

- A. Glycolysis
- B. TCA cycle
- C. ETS
- (A) A-(iii), B-(i), C-(ii)
- (C) A-(i), B-(ii), C-(iii)

Column-II

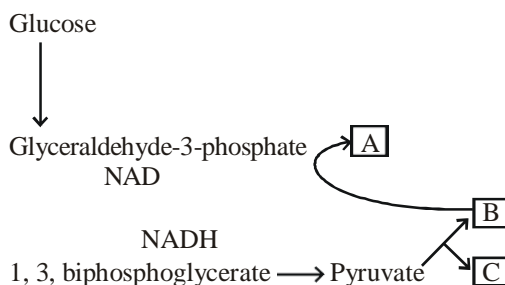
- (i) Inner mitochondrial membrane
- (ii) Mitochondrial matrix
- (iii) Cytoplasm
- (B) A-(iii), B-(ii), C-(i)
- (D) A-(ii), B-(i), C-(iii)

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. How many ATP molecules produced by Aerobic oxidation of one molecule of glucose : -
[CBSE AIPMT 2002]
(A) 2 (B) 4
(C) 38 (D) 34
2. In which one of the following do the two names refer to one and the same thing : -
[CBSE AIPMT 2003]
(A) Tricarboxylic acid cycle and urea cycle
(B) Kreb's cycle and Calvin cycle
(C) Tricarboxylic acid cycle and citric acid cycle
(D) Citric acid cycle and Calvin cycle
3. Which one of the following concerns photophosphorylation : -
[CBSE AIPMT 2003]
(A) $\text{AMP} + \text{Inorganic PO}_4 \xrightarrow{\text{Light energy}} \text{ATP}$
(B) $\text{ADP} + \text{AMP} \xrightarrow{\text{Light energy}} \text{ATP}$
(C) $\text{ADP} + \text{Inorganic PO}_4 \xrightarrow{\text{Light energy}} \text{ATP}$
(D) $\text{ADP} + \text{Inorganic PO}_4 \longrightarrow \text{ATP}$
4. In alcoholic fermentation :-
[CBSE AIPMT 2003]
(A) Oxygen is the electron acceptor
(B) Triose phosphate is the electron donor while acetaldehyde is the electron acceptor
(C) Triose phosphate is the electron donor while pyruvic acid is the electron acceptor
(D) There is no electron donor
5. In glycolysis, during oxidation electrons are removed by -
[CBSE AIPMT 2004]
(A) ATP
(B) Glyceraldehyde-3-phosphate
(C) NAD^+
(D) Molecular oxygen
6. Chemiosmotic theory of ATP synthesis in the chloroplasts and mitochondria is based on
[CBSE AIPMT 2005]
(A) Membrane potential
(B) Accumulation of Na^+ ions
(C) Accumulation of K^+ ions
(D) Proton gradient
7. During which stage in the complete oxidation of glucose are the greatest number of ATP molecules formed from ADP -
[CBSE AIPMT 2005]
(A) Glycolysis
(B) Krebs cycle
(C) Conversion of pyruvic acid to acetyl Co - A
(D) Electron transport chain
8. How many ATP molecules could maximally be generated from one molecule of glucose, if the complete oxidation of one mole of glucose to CO_2 and H_2O yields 686 kcal and the useful chemical energy available in the high energy phosphate bond of one mole of ATP is 12 kcal ? [CBSE AIPMT 2006]
(A) 30 (B) 57
(C) 1 (D) 2
9. All enzymes of TCA cycle are located in the mitochondrial matrix except one which is located in inner mitochondrial membranes in eukaryotes and in cytosol in prokaryotes. This enzyme is:
[CBSE AIPMT 2007]
(A) lactate dehydrogenase
(B) isocitrate dehydrogenase
(C) malate dehydrogenase
(D) succinate dehydrogenase
10. The overall goal of glycolysis, Krebs cycle and the electron transport system is the formation of:
[CBSE AIPMT 2007]
(A) ATP in small stepwise units
(B) ATP in one large oxidation reaction
(C) Sugars
(D) Nucleic acids
11. The chemiosmotic coupling hypothesis of oxidative phosphorylation proposes that Adenosine Tri- Phosphate (ATP) is formed because:
[CBSE AIPMT 2008]
(A) High energy bonds are formed in mitochondrial proteins
(B) ADP is pumped out of the matrix into the inter- membrane space
(C) A proton gradient forms across the inner membrane
(D) There is a change in the permeability of the inner mitochondrial membrane toward Adenosine Di-Phosphate (ADP)

MOCK TEST

- Which enzyme helps in transfer of phosphate group from ATP to a carbohydrate?
 (A) Phosphatase (B) ATPase (C) Phosphorylase (D) Catalase
- During glycolysis, fructose 1, 6-bisphosphate is split into
 (A) dihydroxyacetone phosphate and 2-phosphoglyceraldehyde
 (B) dihydroxyacetone phosphate and 1-phosphoglyceraldehyde
 (C) dihydroxyacetone phosphate and 2-phosphoglycerate
 (D) dihydroxyacetone phosphate and 3-phosphoglyceraldehyde
- Select the correct order of reactions in glycolysis.
 A. Conversion of 3-phosphoglyceraldehyde to 1,3-bisphosphoglycerate
 B. Conversion of 3-phosphoglyceric acid to 2-phosphoglycerate
 C. Conversion of BPGA to 3-phosphoglyceric acid
 D. Splitting of fructose 1,6-bisphosphate into dihydroxy acetone phosphate and 3-phosphoglyceraldehyde
 (A) D, C, A, B (B) B, C, A, B (C) B, D, A, C (D) A, D, C, B
 (E) D, A, C, B
- In glycolytic pathway which of the following steps shows reduction of co-enzyme?
 (A) 1, 3-diphosphoglycerate to 3-phosphoglycerate
 (B) Glucose 6-phosphate to fructose 6-phosphate
 (C) Glyceraldehyde 3-phosphate to 1, 3-diphospho-Glycerate
 (D) 3-phosphoglycerate to 2-phosphoglycerate
- Conversion of pyruvic acid into ethyl alcohol is facilitated by the enzymes
 (A) carboxylase (B) phosphatase
 (C) dehydrogenase (D) decarboxylase and dehydrogenase
- Choose the correct combination of labelling the molecules involved in the pathway of anaerobic respiration in Yeast.



- (A) A- Acetaldehyde, B- CO₂, C - Ethanol
 (B) A - Ethanol, B-CO₂, C-Acetaldehyde
 (C) A - Ethanol, B-Acetaldehyde, C - CO₂
 (D) A - CO₂, B - Ethanol, C - Acetaldehyde
- During alcoholic fermentation by yeast two molecules of glucose produce
 (A) 2 molecules of ethanol + 2 molecules of CO₂ (B) 4 molecules of ethanol + 4 molecules of CO₂
 (C) 6 molecules of ethanol + 6 molecules of CO₂ (D) 3 molecules of ethanol + 3 molecules of CO₂

www.blog.neetnearme.com

REPRODUCTIVE HEALTH

“Nothing is constant but change! All existence is a perpetual flux of “being and becoming!” That is the broad lesson of the evolution of the world.”.

“ERNST HAECKEL (1834-1919)”

INTRODUCTION

Reproductive Health refers to healthy reproductive organs with normal functions. According to WHO (World Health Organisation), reproductive health means well being in physical, emotional, behavioural and social aspects of reproduction. Therefore, reproductively, a healthy society comprises of people having physically and functionally normal reproductive organs and normal emotional and behavioural interactions among them in all sex-related aspects. This chapter deals with the problems and strategies for reproductive health, various options of contraception, knowledge of sexually transmitted diseases, causes and remedy of infertility and assisted reproductive technologies.

In this chapter you will also see that various methods are now available to help couples who have problem in conceiving. In vitro fertilisation followed by transfer of embryo into the female genital tract is one such method and is commonly known as the “ Test Tube baby” Programme.

REPRODUCTIVE HEALTH

Reproductive Health

- Reproductive Health means the health of reproductive organs with its normal functions and also it includes the emotional & social aspects of reproduction.
- According to WHO, reproductive health means a total well-being in all aspects of reproduction, i.e. physical, emotional, behavioural & social. 'Family Planning Programmes' were initiated in 1951.
- India was the first nation in the world to initiate various action plans at national level towards attaining a reproductively healthy society.
- Reproductive & Child Health Care (RCH) is currently in operation.
- Counselling and creating awareness among people about reproductive organs, adolescence and associated changes, safe and hygienic sexual practices, sexually transmitted diseases (STD's) including AIDS etc. is the primary step towards reproductive health.
- Its main aspect is to provide medical facilities and care to the problems like menstrual irregularities, pregnancy related aspects, delivery, medical termination of pregnancy, STD's, birth control, infertility, post natal child and maternal management.

Methods of contraception

An ideal contraceptive should be user-friendly, easily available, effective and reversible with no or least side-effects. It also should in no way interfere with the sexual drive, desire and/or the sexual act of the user. A wide range of contraceptive methods are presently available which could be broadly grouped into the following categories, namely Natural/Traditional, Barrier, IUDs, Oral contraceptives, Injectables, Implants and Surgical methods.

(1) Natural methods:

work on the principle of avoiding chances of ovum and sperms meeting. **Periodic abstinence** is one such method in which the couples avoid or abstain from coitus from day 10 to 17 of the menstrual cycle when ovulation could be expected. As chances of fertilisation are very high during this period, it is called the fertile period. Therefore, by abstaining from coitus during this period, conception could be prevented.

Withdrawal or **coitus interruptus** is another method in which the male partner withdraws his penis from the vagina just before ejaculation so as to avoid insemination.

Lactational amenorrhea (absence of menstruation) method is based on the fact that ovulation and therefore the cycle do not occur during the period of intense lactation following parturition. Therefore, as long as the mother breast-feeds the child fully, chances of conception are almost nil. However, this method has been reported to be effective only upto a maximum period of six months following parturition. As no medicines or devices are used in these methods, side effects are almost nil. Chances of failure, though, of this method are also high.

→ Population explosion and Birth control Growth of population. Increased health facilities & better living conditions.
World population

1900	2 billion
2000	6 billion

India

1947 - 35 crore (350 million)

→ May 2000 - 1 billion (Every sixth person is an Indian) Probable reason :

- (1) Rapid decline in death rate
- (2) MMR (Maternal mortality rate)
- (3) IMR (Infant mortality rate)
- (4) Increase in number of people in reproductive age

→ RCH programme (Reproductive & child health care) :

→ Bring down the population growth rate it was only marginal.

Census	-	Population growth rate
2001	-	1.7% (17/1000/year)

(Rate at which over population could double in 33 years)

→ This alarming growth rate lead to scarcity of food, shelter, Clothing.

→ Types of Contraceptive methods :

- Natural / Traditional Barrier
- Oral contraceptives Implants
- Surgical methods.

Natural method :

→ Periodic abstinence - Avoiding coitus during unsafe period

→ Withdrawal coitus interruptus - Withdrawal of penis from vagina just before ejaculation. Lactational amenorrhea - This method is effective only upto a maximum period of six month following parturition.

Barrier method :

→ Condom : Made up of latex sheath (Both male and female condom)

→ It is used to cover penis & ejaculate semen remain in condom & not enter in female reproductive tract.

→ Diaphragm, cervical cap and vaults : are made up rubber, used to cover the cervix during coitus.

→ Intra uterine device (IUD):

→ Non medicated IUDs (Lippes loop) - Increase phagocytosis of sperms within the uterus.

→ Copper releasing IUDs (CUT, CU7, Multiload 375) - Suppress sperm motility.

→ Hormone releasing IUDs (Progestasert, LNG - 20) - Make uterus unsuitable for implantation & cervix hostile to sperm.

→ Oral contraceptive pills (OCP) :

→ Contain small doses of either Progesterone- estrogen combination inhibit ovulation. Daily pills - Mala D, Mala N (Taken daily from 5th day to 21 days after gap of 7 days again repeated) Weekly pill - Saheli / Centachroman (Non steroidal, very few sideeffect) and high contraceptive value.

→ Injection or Implants : Mode of action is similar to pills effective is much longer.

→ Surgical method / Terminal method :

SOLVED EXAMPLE

- Ex.1** The term 'Health' is defined in many ways. The most accurate definition of the health would be
- (A) Health is the state of body and mind in a balanced condition
 - (B) Health is the reflection of a smiling face
 - (C) Health is a state of complete physical, mental and social well-being
 - (D) Health is the symbol of economic prosperity.

Sol. (C) : World Health Organisation (W.H.O) has defined reproductive health as a total well being in physical, emotional, behavioural and social aspects of reproduction.

- Ex.2** The sexually transmitted disease, that can affect both the male and the female genitals and may damage the eyes of babies born of infected mothers is

Or

It is a disease which mainly affects mucous membrane of urinogenital tract. In males, burning feeling on passing urine, after a yellow discharge occurs, that is accompanied by fever, headache and feeling of illness. Its name is

- (A) AIDS
- (B) Syphilis
- (C) Gonorrhoea
- (D) Hepatitis

Sol. (C) : Gonorrhoea is caused by bacterium Neisseria gonorrhoea. The bacterium lives in genital tubes produces pus containing discharge, pain around genitalia and burning sensation during urination. It may lead to arthritis and eye infection in children of gonorrhoea affected mothers. It is spread through sexual contact common toilets and under-clothes.

- Ex.3** Which one of the following groups includes are sexually transmitted diseases

- (A) AIDS, syphilis, cholera
- (B) HIV, malaria, trichomoniasis
- (C) Gonorrhoea, hepatitis-B, chlamydia
- (D) Hepatitis-B, haemophilia, AIDS

Sol. (C) : Sexually Transmitted Diseases (STD) are a group of communicable diseases that are transmitted by sexual contact and caused by wide range of bacterial, viral, protozoal and fungal agents and ectoparasites.

Examples : Gonorrhoea, syphilis, chancroids, Genital chlamydial infection, Genital Herpes, Hepatitis, AIDS Trichomoniasis etc.

- Ex.4** Consider the statements given below regarding contraception and answer as directed thereafter
- A. Medical Termination of Pregnancy (MTP) during first trimester is generally safe
 - B. Generally chances of conception are nil until mother breast-feeds the infant upto two years
 - C. Intrauterine devices like copper-T are effective contraceptives.
 - D. Contraception pills may be taken upto one week after coitus to prevent conception

Which two of the above statements are correct

- (A) A,C
- (B) A,B
- (C) B,C
- (D) C,D

Sol. (A)

- Ex.5** Test tube baby means a baby born when

- (A) It develops from a non-fertilized egg
- (B) It develops in a test tube
- (C) It is developed through tissue culture method
- (D) The ovum is fertilised externally and thereafter implanted in the uterus

Sol. (D) : Test tube baby means ovum fertilised outside the mother body and then implanted in uterus for growth and development.

- Ex.6** Cu ions released from copper-releasing Intra Uterine Devices (IUDs)

- (A) Prevent ovulation
- (B) Make uterus unsuitable for implantation
- (C) Increase phagocytosis of sperms
- (D) Suppress sperm motility

Sol. (C,D) : Intra Uterine Devices (IUDs) are inserted by doctors in the uterus through Vagina. These Intra Uterine Device are available as the non-medicated IUDs. (e.g. Lippes, loop) copper releasing IUDs (CuT, Cu7, multiload 375) and the hormone releasing IUDs (Progestasert, LNG-20). IUDs increase phagocytosis of sperm within the uterus and the Cu ions released suppress sperm motility and the fertilizing capacity of sperm.

- Ex.7** From the sexually transmitted diseases mentioned below, identify the one which does not specifically affect the sex organs

- (A) Ovariectomy
- (B) Hysterectomy
- (C) Vasectomy
- (D) Castration

Sol. (B)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Increased IMR and decreased MMR in a population will
 - (A) Cause rapid increase in growth rate
 - (B) Result in decline in growth rate
 - (C) Not cause significant change in growth rate
 - (D) Result in an explosive population/exp
2. A national level approach to build up a reproductively healthy society was taken up in our country in
 - (A) 1950s
 - (B) 1960s
 - (C) 1980s
 - (D) 1990s
3. A stable population is one which has got
 - (A) No growth of population in the last decade
 - (B) Constant rate of growth of population in the last decade
 - (C) Slow growth of population in the last decade
 - (D) Growth of 20% in excess than the last decade
4. If India's population is increasing at the rate of 13.6 million per year, then what percentage of total increase in world's population in one calendar year is contributed by the Indians
 - (A) 10%
 - (B) 17%
 - (C) 15%
 - (D) 20%
5. One of these causes nongonococcal urethritis
 - (A) *Treponema pallidum*
 - (B) *Neisseria gonorrhoeae*
 - (C) *Chlamydia trachomatis*
 - (D) HSV-I
6. Profuse, yellowish, greenish frothy smelling discharge from vagina is due to infection of
 - (A) *Treponema pallidum*
 - (B) *Chlamydia*
 - (C) *Trichomonas*
 - (D) *Neisseria*
7. Which of these is used to control human population
 - (A) Estrogen + progesterone
 - (B) IUCD and MTP
 - (C) Tubectomy and Vasectomy
 - (D) All of these
8. What is the function of copper - T
 - (A) Checks mutation
 - (B) Stops fertilization
 - (C) Stops zygote formation
 - (D) Stops obliteration of blastocoel
9. Which of the following wrongly matched
 - (A) IUI - semen collected from husband or donor is artificially introduced either into the bagina or into the uterus
 - (B) GIFT - transfer of embryos with more than 8 blastomeres into the Fallopian tube
 - (C) ICSI - sperm directly injected into the ovum
 - (D) ZIFT - transfer of embryos with upto 8 blastomeres into the Fallopian tube
 - (E) IVF - fertilization outside the body in almost similar condition as that in the body
10. Which one of the following is tested by the technique of amniocentesis

Or

The permissible use of the technique amniocentesis is for
 - (A) Biochemical abnormalities in the foetus
 - (B) Errors of metabolism in the foetus
 - (C) Chromosomal abnormalities (genetic abnormality) in the foetus (Karyotype)
 - (D) All of the above
11. Foetal sex can be determined by examining cells from amniotic fluid by looking for
 - (A) Barr bodies
 - (B) Autosomes
 - (C) Chiasmata
 - (D) Kinetochores
12. The technique called gamete intrafallopian transfer (GIFT) is recommended for those females
 - (A) Whose cervical canal is too narrow to allow passage for the sperms
 - (B) who can not provide suitable environment for fertilisation
 - (C) Who can not produce an ovum
 - (D) Who can not retain the foetus inside uterus
13. Which one of the following is the most widely accepted method of contraception in India, as at present
 - (A) IUDs' (Intra uterine devices)
 - (B) Cervical caps
 - (C) Tubectomy
 - (D) Diaphragms
14. One of the following is not a method of contraception which one
 - (A) Condoms
 - (B) Pills of a combination of oxytocin and vasopressin
 - (C) Lippes loop
 - (D) Tubectomy

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. World health day is celebrated every year on
(A) 7th March (B) 7th April
(C) 7th July (D) 7th May
2. Now-a-days India is under which stage of demographic cycle
(A) Early expanding (B) Late expanding
(C) Phase of decline (D) High stationary
3. The age group in a population are classified by
(A) Reproduction rate (B) Death rate
(C) Age of marriage (D) Sex ratio
4. 'Sex ratio' means
(A) Number of males/ 1000 females
(B) Number of females/ 1000 males
(C) Both
(D) None
5. From the sexually transmitted diseases mentioned below, identify the one which does not specifically affect the sex organs.
(A) Syphilis (B) AIDS
(C) Gonorrhoea (D) Genital warts
6. Which of the following is not a sexually transmitted disease
(A) Acquired Immuno Deficiency syndrome (AIDS)
(B) Trichomoniasis
(C) Encephalitis
(D) Syphilis
7. Genital warts are due to sexually transmitted disease spread by
(A) Herpes virus (B) Papilloma virus
(C) Hepatitis A (D) Trichomonas
8. Which one of the following correctly matches a sexually transmitted disease with its pathogen
(A) Urethritis - Bacillus anthracis
(B) Soft sore - Bacillus brevis
(C) Syphilis - treponema pallidum
(D) Gonorrhoea - Entamoeba histolytica
9. Which one of the following statements is correct regarding Sexually Transmitted Diseases (STD)
(A) A person may contact syphilis by sharing milk with one already suffering from the disease
(B) Hemophilia is one of the STD
(C) Genital herpes and sickle - cell anaemia are both STD
(D) The chances of a 5 year boy contacting a STD are very little
10. Assisted reproductive technology, IVF involves transfer of
(A) Zygote into the uterus
(B) Embryo with 16 blastomeres into the fallopian tube
(C) Ovum into the fallopian tube
(D) Zygote into the fallopian tube
11. Surgical removal or cutting and ligation of the ends of oviduct or small part of the fallopian tube is removed or tied up is known as
(A) Tubectomy (B) Oviductomy
(C) Vasectomy (D) Ovariectomy
12. Surgical removal of testes is known
(A) Testectomy (B) Gonadectomy
(C) Castration (D) None
13. Progesterone pill helps in preventing pregnancy by not allowing
(A) Ova formation (B) Fertilization
(C) Implantation (D) None of these
14. Surrogate mother is used for
(A) Induction of lactation
(B) Artificially inseminated female
(C) Future mother with transplanted embryo
(D) Artificial in semination
15. Surgical removal of uterus is called
(A) Vasectomy (B) Tubectomy
(C) Hysterectomy (D) Anatomy
16. Which of the following birth control measure can be considered as the safest
(A) The rhythm method
(B) The use of physical barriers
(C) Termination of unwanted pregnancy
(D) Sterilization techniques
17. The success of birth control programmes in controlling population growth is dependent on
(A) Use of contraceptives
(B) Tubectomy
(C) Vasectomy
(D) Acceptability of the above by the people
18. Trade name of weekly oral contraceptive pill is
(A) Mala (B) Saheli
(C) Mala A (D) Mala D
19. Daily oral contraceptive pill is
(A) Mala C (B) Mala N and Mala D
(C) Mala A (D) Mala D

Exercise # 3**PART - 1****MATRIX MATCH COLUMN**

1. Given below are four methods (A-D) and their modes of action (a-d) in achieving contraception. Select their correct matching from the four options that follow

Method

- A. The pill
B. Condom
C. Vasectomy
D. Copper T

- (A) A - iii; B - iv; C - i; D - ii
(C) A - iii; B - i; C - iv; D - ii

Mode of Action

- i. Prevent sperms reaching cervix
ii. Prevents implantation
iii. Prevents ovulation
iv. Semen contains no sperms

- (B) A - ii; B - iii; C - i; D - iv
(D) A - iv; B - i; C - ii; D - iii

2. Match the contraceptive methods given under Column I with their examples given under Column II. Select the correct choice from those given below

Column - I

- A. Chemical
B. IUDs
C. Barriers
D. Sterilization

- (A) A = iv, B = ii, C = iii, D = i
(C) A = i, B = iii, C = ii, D = v

Column - II

- i. Tubectomy and Vasectomy
ii. Copper T and Loop
iii. Condom and Cervical cap
iv. Spermicidal jelly and foam
v. Coitus interruptus and calendar method

- (B) A = iv, B = v, C = ii, D = iii
(D) A = iv, B = ii, C = v, D = i

3. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Natural methods
B. IUDs
C. Barrier methods
D. Surgical methods
E. Oral contraceptives

- (A) A - i; B - ii, iv, ix; C - iii, vi; D - vii, viii; E - v
(C) A - i; B - ii, iv, ix; C - iii, ix; D - vii, viii; E - v, vi

Column - II

- i. Coitus interruptus
ii. LNG - 20
iii. Diaphragms
iv. Multiload 375
v. Saheli
vi. Nirodh
vii. Sterilization
viii. Vasectomy
ix. CuT

- (B) A - i; B - ii, iv; C - iii, vi, ix; D - vii, viii; E - v
(D) A - i; B - iv, ix; C - ii, iii, vi; D - vii, viii; E - v

4. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Syphilis
B. Chancroid
C. AIDS
D. Genital warts

- | | |
|---------|----|
| A | B |
| (A) iii | ii |
| (B) ii | i |
| (C) iv | ii |
| (D) i | iv |

Column - II

- i. Human papilloma virus
ii. Haemophilus ducreyi
iii. Treponema pallidum
iv. HIV

- | | |
|-----|-----|
| C | D |
| iv | i |
| iii | iv |
| i | iii |
| iii | ii |

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. Progesterone, which is the most important component of oral contraceptive pills, prevents pregnancy by [CBSE AIPMT 2000]
 - (A) Preventing the formation of egg
 - (B) Preventing the cleavage of the fertilised egg
 - (C) Creating unfavourable chemical environment for the sperms to survive in the female reproductive tract
 - (D) Blocking ovulation
2. In a population, unrestricted reproductive capacity is called as - [CBSE AIPMT 2002]
 - (A) Biotic potential
 - (B) Fertility
 - (C) Carrying capacity
 - (D) Birth rate
3. Test tube baby means a baby born when [CBSE AIPMT 2003]
 - (A) The ovum is fertilised externally and thereafter implanted in the uterus
 - (B) It develops from a non-fertilised egg
 - (C) It is developed in a test-tube
 - (D) It is developed through tissue culture method
4. Certain characteristic demographic features of developing countries are - [CBSE AIPMT 2004]
 - (A) High fertility, low or rapidly falling mortality rate, rapid population growth and a very young age distribution
 - (B) High fertility, high density, rapidly rising mortality rate and very young age distribution
 - (C) High infant mortality, low fertility, uneven population growth and a very young age distribution
 - (D) High mortality high density, uneven population growth and a very old age distribution
5. Given below are four methods (A-D) and their modes of action (i-iv) in achieving contraception. Select their correct matching from the four options that follow: [CBSE AIPMT 2008]

Method	Mode of Action
A. The pill	(i) Prevents sperms reaching cervix
B. Condom	(ii) Prevents implantation
C. Vasectomy	(iii) Prevents ovulation
D. Copper-T	(iv) Semen contains no sperms

A	B	C	D
(A)	(iii)	(iv)	(i) (ii)
(B)	(ii)	(iii)	(i) (iv)
(C)	(iii)	(i)	(iv) (ii)
(D)	(iv)	(i)	(ii) (iii)
6. Consider the statements given below regarding contraception and answer as directed thereafter:
 1. Medical Termination of Pregnancy (MTP) during first trimester is generally safe
 2. Generally chances of conception are nil until mother breast-feeds the infant upto two years
 3. Intrauterine devices like copper-T are effective contraceptives
 4. Contraception pills may be taken upto one week after coitus to prevent conception
 Which two of the above statement are correct? [CBSE AIPMT 2008]
 - (A) 1, 3
 - (B) 1, 2
 - (C) 2, 3
 - (D) 3, 4
7. Cu ions released from copper-releasing Intra Uterine Devices (IUDs) ? [CBSE AIPMT 2010, 2000]
 - (A) make uterus unsuitable for implantation
 - (B) increase phagocytosis of sperms
 - (C) suppress sperm motility
 - (D) prevent ovulation
8. The permissible use of the technique amniocentesis is for ? [CBSE AIPMT 2010]
 - (A) Detecting sex of the unborn foetus
 - (B) Artificial insemination
 - (C) Transfer of embryo into the uterus of a surrogate mother
 - (D) Detecting any genetic abnormality
9. In vitro fertilisation is a technique that involves transfer of which one of the following into the fallopian tube? [CBSE AIPMT 2010]
 - (A) Embryo only, upto 8 cell stage
 - (B) Either zygote or early embryo upto 8 cell stage
 - (C) Embryo of 32 cell stage
 - (D) Zygote only
10. Medical Termination of Pregnancy (MTP) is considered safe up to how many weeks of pregnancy? [CBSE AIPMT 2011]
 - (A) Eight weeks
 - (B) Twelve weeks
 - (C) Eighteen weeks
 - (D) Six weeks
11. Which one of the following is the most widely accepted method of contraception in India, as at present? [CBSE AIPMT 2011]
 - (A) Cervical caps
 - (B) Tubectomy
 - (C) Diaphragms
 - (D) IUDs' (Intra uterine devices)

- Match the following.

<p>List I</p> <p>A. Contraceptive pill B. Condom C. Vasectomy D. Copper T</p> <p>(A) A-(iv), B-(i), C-(ii), D-(iii) (C) A-(ii), B-(i), C-(iii), D-(iv) (E) A-(ii), B-(i), C-(iv), D-(iii)</p>	<p>List II</p> <p>(i) Prevents sperms reaching the female reproductive tract (ii) Inhibits ovulation and implantation (iii) Increases phagocytosis of sperms (iv) Blocks gamete transport</p> <p>(B) A-(i), B-(ii), C-(iii), D-(iv) (D) A-(iv), B-(iii), C-(i), D-(ii)</p>
---	---
- Which of the following is hormone-releasing IUD?
 (A) LNG-20 (B) Multiload 375 (C) Lippes loop (D) Cu7
- Given below are four methods (A-D) and their modes of action (i-iv) in achieving contraception. Select their correct matching from the four options that follow.

<p>Method</p> <p>A. The pill B. Condom C. Vasectomy D. Copper T</p> <p>(A) A-(ii), B-(iii), C-(i), D-(iv) (C) A-(iii), B-(iv), C-(i), D-(ii)</p>	<p>Mode of action</p> <p>(i) Prevents sperms reaching cervix (ii) Prevents implantation (iii) Prevents ovulation (iv) Semen contains no sperms</p> <p>(B) A-(iii), B-(i), C-(iv), D-(ii) (D) A-(iv), B-(i), C-(ii), D-(iii)</p>
---	--
- Which of the following is incorrect regarding vasectomy?
 (A) No sperm occurs in seminal fluid (B) No sperm occurs in epididymis
 (C) Vasa deferentia is cut and tied (D) Irreversible sterility
- IUDs which are used by females
 (A) are implanted under the skin and they release progestogen and estrogen
 (B) act as spermicidal jellies
 (C) release copper ions in the uterus that increase phagocytosis of sperm
 (D) block the entry of sperms into vagina
- The hormone-releasing IUD is
 (A) LNG-20 (B) Lippes loop (C) Cu T (D) Multiload 375
 (E) Cu7
- Oral contraceptive prevents pregnancy by
 (A) Killing the ovum (B) Blocking fertilisation
 (C) Preventing ovulation (D) Preventing implantation
- Read the statements A and B and identify the correct choice from those given.
Statement A : Women are at the peak of conception on the 14th day of menstrual cycle.
Statement B : Vasectomy is the method normally employed to avoid conception in females.
 (A) Statement A is wrong, B is right. (B) Statement A is right, B is wrong.
 (C) Both the statements are right. (D) Both the statements are wrong.
- Which one of the following is not a method of contraception?
 (A) Condom (B) Pills having oxytocin and vasopressin
 (C) Lippes loop (D) Tubectomy

www.blog.neetnearme.com

HUMAN HEALTH AND DISEASES

“If conservation of natural resources goes wrong, nothing else will go right.”

“M.S. SWAMINATHAN (1925)”

INTRODUCTION

The early Greek like Hippocrates (father of medicine) and Indian Ayurveda system asserted that Health, for a long time was considered as a state of body and mind where there was a balance of certain ‘humors’. It was thought that persons, who are with ‘Blackbile’ belonged to hot personality and can have or might have fevers.

This idea was arrived at by pure reflective thought.

The discovery of blood circulation using experimental method and the demonstration of normal body temperature in persons with blackbile using thermometer disapproved the ‘good humor’ hypothesis of earth was given by **William Harvey**.

Then in later years, biology stated the mind influences, thorough neural system and endocrine system, our immune system and then our immune system maintains our health. Hence, mind and mental state can affect our health.

Human Health & Disease

The term health is very frequently used by everybody. Health does not simply mean 'absence of disease' or 'physical' fitness. It could be defined as state of complete physical, mental and social well-being. When people are healthy, they are more efficient at work. This increases productivity and brings economic prosperity. Health also increases longevity of people and reduces infant and maternal mortality.

Balanced diet, personal hygiene and regular exercise are very important to maintain good health. Yoga has been practised since time immemorial to achieve physical and mental health. Awareness about diseases and their effect on different bodily functions, vaccination (immunisation) against infectious diseases, proper disposal of wastes, control of vectors and maintenance of hygienic food and water resources are necessary for achieving good health.

When the functioning of one or more organs or systems of the body is adversely affected, characterised by various signs and symptoms, we say that we are not healthy, i.e., we have a disease. Diseases can be broadly grouped into infectious and non-infectious. Diseases which are easily transmitted from one person to another, are called infectious diseases. Infectious diseases are very common and every one of us suffers from these at sometime or other. Some of the infectious diseases like AIDS are fatal. Among non-infectious diseases, cancer is the major cause of death. Drug and alcohol abuse also affect our health adversely.

- (1) **Disease** Any change from the normal state that causes **discomfort or disability** or **impairs** the health is called as disease.
- (2) **Health** Health is a state of complete **physical, mental and social well being**, and not merely an absence of disease or infirmity (W.H.O - 1948)
- (3) **Prophylaxis or preventive measures** Preventive measure for a disease is called prophylaxis.
- (4) **Epidemiology** The study of **causes and spread** of disease is called Epidemiology.
(epi = among, demos = Human, logy = study)
- (5) **Etiology** Study of the **cause** of disease is called Etiology.
- (6) **Incubation period** Time **interval between** the entry of pathogen and appearance of symptoms is called incubation period.
- (7) **Chemotherapy** : Treatment with chemicals (Medicine)
 - (A) **Antibiotics** : Substances which are secreted by microorganism that inhibit the growth or destroy the other microorganism are called antibiotics. This term was given by Walksman (Streptomycin—first bacterial antibiotic obtained from bacteria - *Streptomyces griseus*).
 - Example** - Bacteriostatic-Tetracycline, Chloramphenicol,
Bacteriolytic or Bacteriocidal-Streptomycin, Ciprofloxacin, Ampicillin.
 - (B) **Analgesics** : Substance that **relieves pain**.
Example - Opioid analgesics - Morphine, Codeine, Diclofenac sodium, Nemuslide
 - (C) **Antipyretics (Antifebrile)** : (Pyrexia - Fever) Substance that **reduces temperature** or fever of body.
Example - Aspirin (Acetyl salicylic acid)- (It produces gastric ulcer so not extensively recommended as a analgesic), Ibuprofen, Paracetamol, Nemuslide.
 - (D) **Antihistaminic drug** : These drugs give relief from allergies by neutralizing histamines that is released from the ruptured mast cell. e.g. cetirizine
 - (E) **Tranquillisers and Hypnotics and Sedative drug** :
 - (i) **Tranquilliser drug** : A drug that act to reduce mental tension and anxiety without interfering with normal mental activity.
 - (ii) **Sedative drug** : A drug that calms the subject without inducing sleep but if used in high dose can cause sleep.
 - (iii) **Hypnotic drug** : A drug that induces sleep.
 - (F) **Antiseptic and Disinfectant** : Agent that inhibit or kill microbes on contact. Conventionally agents used on

BIOLOGY FOR NEET & AIIMS

→ Allergy

- (1) Exaggerated response of immune response to certain antigens present in the environment. IgE antibodies are formed against allergens like mites in dust, pollens, animal dander etc. Symptoms = Sneezing, Watery eyes, running nose, difficulty in breathing etc.
- (2) Allergy is due to Histamine + Serotonin secreted by mast cells. Antibodies produce during the allergy is IgE type. So antihistamine, adrenaline, steroids drugs are used for symptomatic relief.
- (3) Metro cities life style has lowering immunity and more sensitivity to allergens.

→ Autoimmunity

When antibodies attack self cells or proteins due to genetic and other unknown reason, then it is called eg. Rheumatoid arthritis.

→ AIDS (Acquired Immuno Deficiency Syndrome)

Not a congenital disease, because deficiency of immune system, acquired during the life-time of an individual. Caused by HIV which is retrovirus.

HIV transmits :

- (a) by sexual contact with infected persons.
- (b) by transfusion of contaminated blood
- (c) by sharing needles (infected)
- (d) from infected mother to her child.

→ HIV AIDS is not spread = by mere touch or physical contact

→ HIV spread "only through body fluid"

→ Incubation period usually 5-10 years.

→ Diagnostic test is ELISA (Enzyme Linked Immuno Sorbent Assay)

→ Treatment by anti-retroviral drugs.

→ AIDS has no cure so prevention is best.

Cancer

→ Most dreaded disease of human beings.

→ Develops due to Oncogenic transformation.

Smoking

→ Tobacco contains nicotine (an alkaloid) which stimulates adrenal gland to release adrenaline + nor-adrenaline, due to this BP and heart rate increases.

→ Drugs and Alcohol abuse

→ Causes which motivates youngsters, towards drug and alcohol use are:

→ Curiosity

→ Need for adventure

→ Excitement

→ Experimentation

→ Pressures to excel in academics/ examination

→ Perception of 'Cool/Progress'

→ Unsupportive family structure or "Peer pressure"

→ Addiction:

→ Because of perceived benefits, drugs are frequently used repeatedly

→ It is psychological attachment of certain effects like 'Euphoria'

→ Use of drugs even once, can be a fore-runner to addiction.

SOLVED EXAMPLE

Ex.1 Which one of the following provide non specific pathogen defence for the body
 (A) T-cells (B) B-cells
 (C) Phagocytes (D) Stem cells

Sol. (C)

Ex.2 Which one of the following statements is correct with respect to immunity
 (A) Preformed antibodies need to be injected to treat the bite by a viper snake
 (B) The antibodies against small pox pathogen are produced by T-lymphocytes
 (C) Antibodies are protein molecules, each of which has four light chains
 (D) Rejection of a kidney graft is the function of B-lymphocytes

Sol. (A) : Preformed antibodies need to be injected to treat the bite by a viper snake. It is also a type of immunisation which is called as passive immunization.

Ex.3 B. C. G. vaccine is used against
 (A) T. B. (B) Leprosy
 (C) Food poisoning (D) None of these

Sol. (A)

Ex.4 Read the following four statements (A-D)
 (A) Colostrum is recommended for the new born because it is rich in antigens
 (B) Chikenguniya is caused by a Gram negative bacterium
 (C) Tissue culture has proved useful in obtaining virus-free plants
 (D) Beer is manufactured by distillation of fermented grape juice

Sol. (A) : Colostrum is recommended for the new born because it is rich in antibodies (B) Chickengunya is caused by a virus.

Ex.5 At which stage of HIV infection does one usually show symptoms of AIDS
 (A) Within 15 days of sexual contact with an infected person
 (B) When the infecting retrovirus enters host cells
 (C) When viral DNA is produced by reverse transcriptase
 (D) When HIV replicates rapidly in helper T-lymphocytes and damages large number of these

Sol. (D) : Symptoms of AIDS appear when there is depletion of helper T-cells.

Ex.6 A certain patient is suspected to be suffering from Acquired Immuno Deficiency Syndrome. Which diagnostic technique will you recommend for its detection
 (A) ELISA (B) Australian antigen
 (C) HIV test (D) None of these

Sol. (A)

Ex.7 HIV causes reduction in
 Or
 HIV virus affects in AIDS patient
 (A) T-helper cells only (B) All T-cells
 (C) B-cells only (D) Both B and T-cell

Sol. (A)

Ex.8 The immunoglobulin abundant in colostrum is
 Or
 The yellowish fluid colostrum has abundant antibodies to protect the infant
 (A) Ig G (B) Ig M
 (C) Ig D (D) Ig E

Sol. (E)

Ex.9 Which of the following is an autoimmune disease
 (A) Rheumatoid arthritis
 (B) Grave's disease
 (C) Hashimoto's disease
 (D) All of the above

Sol. (D)

Ex.10 Select the correct statement with respect to diseases and immunisation
 (A) Certain protozoans have been used to mass produce hepatitis B vaccine
 (B) Injection of snake antivenom against snake bite is an example of active immunisation
 (C) If due to some reason B and T-lymphocytes are damaged, the body will not produce antibodies against a pathogen
 (D) Injection of dead/inactivated pathogens causes passive immunity

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Sensitivity to any allergen is related to
(A) Deviation from the process of immunity
(B) Age of the person
(C) Eating habit
(D) Rise in environmental temperature
2. Passive immunity was discovered by
(A) Robert Koch (B) L. Pasteur
(C) Edward Jenner (D) Eemil Von Behring
3. Antibodies fight against
(A) Infection (B) Thirst
(C) Starvation (D) Stress
4. Which of the following is responsible for cellular immunity
(A) B-lymphocyte (B) T-lymphocyte
(C) Erythrocytes (D) Thrombocytes
5. HIV causes reduction in
(A) T-helper cells only (B) All T-cells
(C) B-cells only (D) Both B and T-cells
6. A molecule that elicits an immune response is called
(A) Antibody (B) Antigen
(C) Mutagen (D) Carcinogen
7. Vaccines are prepared from immune
(A) Vitamins (B) Blood
(C) Serum (D) Plasma
8. AIDS can be transmitted by
(A) Blood circulation (B) Hand shake
(C) Courtship (D) All of the above
9. The antibodies are
(A) Egamma-globulins (B) Albumins
(C) Vitamins (D) Sugar
10. The factor responsible for cirrhosis of liver is
(A) Sugar (B) Vitamins
(C) Fats and oils (D) Alcoholism
11. 'Chicken pox' is caused by
(A) Adeno virus (B) Varicella virus
(C) SV-40 virus (D) Bacteriophage T-2
12. Out of the following one disease is caused by virus
(A) Malaria (B) Influenza
(C) Diphtheria (D) Typhoid
13. 'Dengue fever' is caused by
(A) Bacteria (B) *Plasmodium*
(C) Virus (D) *Entamoeba histolytica*
14. 'Encephalitis' in man is a viral disease and is transmitted by
(A) Anopheles (B) Culex
(C) Aedes (D) Culex and Aedes
15. Which of the disease is not transmitted by house flies
(A) Typhoid (B) Yellow fever
(C) Cholera (D) Dysentery
16. The disease caused by viruses is
(A) Tuberculosis (B) Smallpox
(C) Cholera (D) Typhoid
17. Which one of the following is a common disease caused by virus
(A) Yellow fever (B) Typhoid
(C) Syphilis (D) Tetanus
18. Which virus, for the first time, was synthesised in the form of non-living crystals
(A) Bacteriophage
(B) Flu virus
(C) Pox virus
(D) Tobacco mosaic virus
19. The smallest virus one, which causes
(A) Measles (B) Mumps
(C) Rabies (D) Poliomyelitis
20. Interferons curb infection of
(A) Bacteria (B) Fungi
(C) Cancer (D) None of the above
21. 'Plague' is transmitted by
(A) House fly (B) Tse-tse fly
(C) Rat flea (D) Mosquito
22. The test for 'syphilis' was developed by
(A) Robert Koch (B) Edward Jenner
(C) Wasserman (D) Louis Pasteur
23. Which one of the following sets includes the bacterial disease
(A) Cholera, typhoid, mumps
(B) Tetanus, tuberculosis, measles
(C) Malaria, mumps, poliomyelitis
(D) Diphtheria, leprosy, plague

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. Full form of AIDS is
(A) Anti immune deficiency syndrome
(B) Auto immune deficiency syndrome
(C) Acquired immune deficiency syndrome
(D) Acquired immune disease symptom
2. AIDS causing factors are associated with
(A) RNA virus (B) DNA virus
(C) Bacteria (D) Protozoa
3. The term 'active immunity' means
(A) Resistance developed after disease
(B) Resistance developed before disease
(C) Resistance rate of heart beat
(D) Increasing quantity of blood
4. The antibodies are
(A) Lipids (B) Germs
(C) Proteins (D) Carbohydrates
5. The AIDS test is known as
(A) ELISA (B) Australian antigen
(C) HIV test (D) None of these
6. Which one of the following pairs of disease can spread through blood transfusion
(A) Cholera and hepatitis
(B) Hepatitis and AIDS
(C) Diabetes mellitus and malaria
(D) Hay fever and AIDS
7. 'ELISA' test is done for the diagnosis of
(A) Anthrax (B) HIV
(C) Hepatitis (D) Malaria
8. Humoral immunity is due to
(A) B-lymphocytes (B) T-lymphocytes
(C) L-Lymphocytes (D) P- Lymphocytes
9. The term "antibiotic" was coined by
(A) Alexander Fleming (B) Edward Jenner
(C) Louis Pasteur (D) Selmán Waksman
10. Which cell of immune system cause pore formation at the surface of the plasma membrane
(A) Helper T-cell (B) Killer T-cell
(C) Suppressor T-cell (D) B-cell
11. Common symptoms of measles are
(A) Dew drop-like rashes on skin and high fever
(B) Erupting of small red spots and inflammation of mucous membrane of nose
(C) Lacerating ulcers
(D) None of the above
12. The region in the body where the polio virus multiplies is
(A) Nerve cells (B) Intestinal cells
(C) Muscle cells (D) None of these
13. The biological agents of disease include
(A) Minerals, vitamins, proteins and carbohydrates
(B) Viruses, bacteria, fungi, helminths and other organisms
(C) Heat, cold, humidity pressure, radiations
(D) All the above
14. The pathogen of bubonic plague is transmitted through the bite of
(A) *Pediculus humanus* (B) *Glossina palpalis*
(C) *Aedes* (D) *Xenopsylla cheopis*
15. A kind of allergy is
(A) Asthma (B) Yellow eyes
(C) Typhoid (D) Mumps
16. Mumps is a
(A) Viral disease (B) Fungal disease
(C) Bacterial disease (D) Protozoan disease
17. A cell-coded protein that is formed in response to infection with most animal viruses is called
(A) Antigen (B) Interferon
(C) Histone (D) Antibody
18. Pulse-Polio programme is organised in our country
(A) To cure polio (B) To eradicate polio
(C) To spread polio (D) None of these
19. Which one of the following is a pair of viral disease
(A) Tetanus and typhoid
(B) Syphilis and AIDS
(C) Whooping cough and sleeping sickness
(D) Measles and rabies
20. In human beings retrovirus is considered as a cause of cancer because
(A) In their genome oncogene is present
(B) Their hereditary material made up of single stranded RNA
(C) They have a gene for reverse transcriptase

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match the type of immunity listed in column I with the examples listed in column II. Choose the answer that gives the correct combination of alphabets of the two columns

Column - I

Types of immunity

- A. Natural active
- B. Artificial active
- C. Artificial passive
- D. Natural passive

Column - II

Example

- i. Immunity developed by heredity
- ii. From mother to foetus
- iii. Injection of antivenom
- iv. Fighting infection naturally
- v. Induced by vaccination

- (A) A - iv; B - v; C - ii, D - i
- (B) A - v; B - iv; C - r, D - i
- (C) A - i; B - ii; C - r, D - v
- (D) A - iv; B - r; C - v, D - ii

2. Match each disease with its correct type of vaccine

Column - I

- A. Tuberculosis
- B. Whooping cough
- C. Diphtheria
- D. Polio

Column - II

- i Harmless virus
- ii Inactivated toxin
- iii Killed bacteria
- iv Harmless bacteria

	A	B	C	D
(A)	iii	ii	iv	i
(B)	iv	iii	ii	i
(C)	i	ii	iv	iii
(D)	ii	i	iii	iv

3. Match Column - I with Column - II and select the correct answer from codes given below.

Column - I

- A. Sporozites
- B. Filariasis
- C. Typhoid
- D. Chikungunya

Column - II

- i. Infectious form
- ii. Aedes mosquitoes
- iii. Wuchereria
- iv. Widal test

- (A) A - iv; B - ii; C - i; D - iii
- (B) A - iii; B - iv; C - ii; D - i
- (C) A - ii; B - iii; C - i; D - iv
- (D) A - i; B - iii; C - iv; D - ii

4. Match Column - I with Column - II and select the correct answer from codes given below.

Column - I

- A. Amoebiasis
- B. Diphtheria
- C. Cholera
- D. Syphilis

Column - II

- i. Treponema pallidum
- ii. Use only sterilized food and water
- iii. DPT vaccine
- iv. Oral rehydration therapy

	A	B	C	D
(A)	ii	i	iii	iv
(B)	ii	iii	iv	i
(C)	i	ii	iii	iv
(D)	ii	iv	i	iii

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. Bovine spongiform encephalopathy is a bovine disease. To which of the following human diseases it is related ? [CBSE ATPMT 2000]
 - (A) Kala-azar
 - (B) Encephalitis
 - (C) Cerebral spondylitis
 - (D) Creutzfeldt Jacob disease
2. Small proteins produced by vertebrate cells naturally in response to viral infections and which inhibit multiplication of viruses are called [CBSE ATPMT 2000]
 - (A) immunoglobulins
 - (B) interferons
 - (C) antitoxins
 - (D) lipoproteins
3. Which of these is most infectious disease ? [CBSE AIPMT 2001]
 - (A) Hepatitis-B
 - (B) AIDS
 - (C) Cough and cold
 - (D) Malaria
4. Salmonella is related with [CBSE AIPMT 2001]
 - (A) typhoid
 - (B) polio
 - (C) TB
 - (D) tetanus
5. LSD is [CBSE AIPMT 2001]
 - (A) hallucinogenic
 - (B) sedative
 - (C) stimulant
 - (D) tranquiliser
6. Which one of the following is correct match ? [CBSE AIPMT 2001]

(A) Reserpine	-	Tranquiliser
(B) Cocain	-	Opiatic narcotic
(C) Morphine	-	Hallucinogenic
(D) Bhang	-	Analgesic
7. Reason of lung cancer is [CBSE AIPMT 2001]
 - (A) coal mining
 - (B) calcium fluoride
 - (C) cement factory
 - (D) bauxitemining
8. Interferons are synthesised in response to [CBSE AIPMT 2001]
 - (A) Mycoplasma
 - (B) bacteria
 - (C) viruses
 - (D) fungi
9. Cancerous cells can easily be destroyed by radiation due to [CBSE AIPMT 2002]
 - (A) rapid cell division
 - (B) lack of nutrition
 - (C) fast mutation
 - (D) lack of oxygen
10. ELISA is used to detect viruses where the key reagent is [CBSE AIPMT 2003]
 - (A) DNA probe
 - (B) RNase
 - (C) alkaline phosphatase
 - (D) catalase
11. Which one of the following conditions though harmful in itself, is also a potential saviour from a mosquito borne infectious disease ? [CBSE AIPMT 2003]
 - (A) Pernicious anaemia
 - (B) Leukaemia
 - (C) Thalassemia
 - (D) Sickle-cell anaemia
12. Carcinoma refers to [CBSE AIPMT 2003]
 - (A) malignant tumours of the colon
 - (B) benign tumours of the connective tissue
 - (C) malignant tumours of the connective tissue
 - (D) malignant tumours of the skin or mucous membrane
13. The term 'antibiotic' was coined by [CBSE AIPMT 2003]
 - (A) Selman Waksman
 - (B) Alexander Fleming
 - (C) Edward Jenner
 - (D) Louis pasteur
14. What is true about T-lymphocytes in mammals ? [CBSE AIPMT 2004]
 - (A) They scavenge damaged cells and cellular debris
 - (B) These are produced in thyroid
 - (C) There are three main types-cytotoxic T-cells, helper T-cells and suppressor T-cells
 - (D) These originate in lymphoid tissues
15. Which one of the following pairs is not correctly matched ? [CBSE AIPMT 2004]

(A) Streptomyces	-	Antibiotic
(B) Serratia	-	Drug addiction
(C) Spirulina	-	Single cell protein
(D) Rhizobium	-	Biofertiliser
16. Which one of the following is not correctly matched ? [CBSE AIPMT 2005]

(A) Glossrina palpalis	-	Sleeping sickness
(B) Culex pipiens	-	Filariasis
(C) Aedes aegypti	-	Yellow fever
(D) Anopheles culicifacies	-	Leishmaniasis
17. Which one of the following depresses brain activity and produces feelings of calmness, relaxation and drowsiness ? [CBSE AIPMT 2005]
 - (A) Valium
 - (B) Morphine
 - (C) Hashish
 - (D) Amphetamines

MOCK TEST

- Internal bleeding, muscular pain, blockage of the intestinal passage and anaemia are some of the symptoms caused due to infection by
(A) Ascaris (B) Wuchereria (C) Plasmodium (D) Trichophyton
- Which of the following sets of diseases is caused by bacteria ?
(A) Cholera and tetanus (B) Typhoid and smallpox
(C) Tetanus and mumps (D) Herpes and influenza
- Some of the events occur during life cycle of Plasmodium are given below. Identify the correct statement
(A) Female mosquito take up sporozoites with blood meal
(B) The sporozoites reproduce sexually in liver cells.
(C) When mosquito bites a man, gametocytes are injected.
(D) The gametocytes develop in RBS
- Which one of the following is the correct statement regarding the particular psychotropic drug specified ?
(A) Morphine leads to delusions and disturbed emotions.
(B) Barbiturates cause relaxation and temporary euphoria.
(C) Hashish causes after thought perceptions and Hallucinations.
(D) Opium stimulates nervous system and causes hallucinations.
- The time interval of appearance of fever in the malarial patients depends on the types of malaria. The research evidence suggest that such time intervals are - (1) 36 to 48 hours, (2) 48 hours, and (3) 72 hours. If any such patient experiences fever at an interval of 48 hours, then the said patient suffers from
(A) Only benign tertian malaria
(B) Quartan malaria or mild tertian malaria
(C) Malignant tertian malaria or benign tertian malaria
(D) mild tertian malaria or benign tertian malaria.
- Common cold differs from pneumonia in that
(A) Pneumonia is a communicable disease whereas the common cold is a nutritional deficiency disease
(B) Pneumonia can be prevented by a live attenuated bacterial vaccine whereas the common cold has no effective vaccine
(C) Pneumonia is caused by a virus while the common cold is caused by the bacterium Haemophilus influenzae
(D) Pneumonia pathogen infects alveoli whereas the common cold affects nose and respiratory passage but not the lungs.
- Infection of Ascaris usually occurs by
(A) Tse-tse fly (B) mosquito bite
(C) drinking water containing eggs of Ascaris (D) Eating imperfectly cooked pork
- Which one of the following options gives the correct matching of a disease with its causative organism and mode of infection?

Disease	Causative organism	Mode of infection
(A) Typhoid	Salmonella typhi	With inspired air
(B) Pneumonia	Streptococcus pneumoniae	Droplet infection
(C) Elephantiasis	Wuchereria bancrofti	With infected water and food
(D) Malaria	Plasmodium vivax	Anopheles mosquito

www.blog.neetnearme.com

PHOTOSYNTHESIS IN HIGHER PLANTS

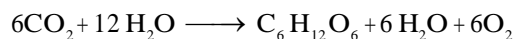
“Will is nothing more than a particular case of the general doctrine of association of ideas, and therefore a perfectly mechanical thing”.

“JOSEPH PRIESTLEY (1733-1804)”

INTRODUCTION

The process in which green parts of the manufacture or synthesize complex organic food substances using carbon dioxide and water in the presence of sunlight and release oxygen as a by-product. In this process, energy from the sun is converted into chemical energy. It is endergonic, anabolic and oxido-reduction process. Photosynthesis is important due to two reasons: it is the primary source of all food on earth . It is also responsible for the release of oxygen into the atmosphere by green plants.

A simple equation reperesening the process is:



PHOTOSYNTHESIS IN HIGHER PLANTS

History of Photosynthesis

- **Aristotle and Theophrastus (320 BC)** :- Stated that plants absorb all food matter from **soil** (Humus theory).
- **Van Helmont (1648)** :- By weighing the Willow plant, concluded that plant take up their food mostly from **soil water**.
- **J. Woodbard (1699)** :- Besides water, soil also increases the weight of plants.
- **Stephen Hales (1727)** :- Recognised the importance of **air (CO₂)** and **light** for photosynthesis (nourishment) in plants. He is considered as discoverer of photosynthesis and "**Father of plant physiology**".
- **J. Priestley (1772)** :- He carried out very interesting **experiment on Bell jar**, Rat, Pudina & Candle. He came to conclude that plants purify air (burning of candles) and gaseous exchange occurs during photosynthesis.
- **Jan Ingenhousz (1779)** :- He explained the importance of **light and green colour** and also suggested the O₂ releases in the presence of light by green parts.
- **Senebier (1782)** :- Green plants absorb CO₂ from atmosphere and when the concentration of CO₂ increases the rate of O₂ evolution also increases.
- **N. De-Saussure (1804)** :- Clarified that released O₂ is equal to the absorbed CO₂. He realised the **significance of H₂O in this process**. De-Saussure stated that O₂ comes from CO₂ during photosynthesis. (Later on it was disproved by VanNiel)
- **Pallatier & Caventou (1818)** :- They named green pigment as '**Chlorophyll**' and isolated the chlorophyll with the help of alcohol.
- **Englemann (1888)** :- Described **action spectrum** of photosynthesis with the help of **Spirogyra/Cladophora** and **aerobic bacteria** experiment.
- **Mayer (1845)** :- Green plants convert **solar energy into chemical (potential) energy** in the form of organic substance. He gave law of conservation of energy. Formation of organic matter recognised by Mayer.
- **Liebig (1845)** :- Organic matter are derived from CO₂ and H₂O, during the process of photosynthesis.
- **J. V. Sachs (1862)** :- Recognised the relation among photosynthesis, chloroplast and starch. First visible product of photosynthesis is starch. Founder of modern concept of photosynthesis. Some people consider Sachs as father of plant physiology. Three cardinal point concept was also given by him.
- **Willstater, Stall Fisher** :- Chemistry, structure and properties of Chl-a, and nobel prize winner.
- **F. F. Blackman (1905)** :- **Dark reaction** associated with **light reaction** in photosynthesis and **law of limiting factors**.
- **Warburg (1920)** :- **Intermittent or flash light experiment on Chlorella** and proved that dark reaction exists in photosynthesis.
- **Emerson and Arnold (1932)** :- Concept of **two pigment system** (photosystem) in light reaction. **Red drop & Emerson enhancement effect**.
- **Van Niel** :- O₂ releases from water and O₂ of glucose comes from CO₂.



- **Robert Hill & Bendal (1937)** :- Detailed study of light reaction in isolated chloroplast of **stellaria**. **Photolysis of H₂O** is the chief role of chloroplast and evolution of O₂ only in the presence of suitable e⁻ acceptor, from water in photosynthesis. (**Hill-reaction**)
- **Ruben, Hassid & Kamen (1941)** :- Used O₁₈ to experimentally show that O₂ in photosynthesis released from water.



ED OS KEY POINTS

"Photosynthesis is a photo-biochemical process, in which organic compounds are synthesized from the inorganic raw materials (H_2O & CO_2) in presence of light energy and pigments (chl.) gas-oxygen evolved as byproduct."

First true & oxygenic photosynthesis started in **cyanobacteria (BGA)**.

Roots of **Tinospora** and **Trapa** are photosynthetic.

Modern view about photosynthesis is conversion of **light/radiant energy into biochemical or potential energy**.

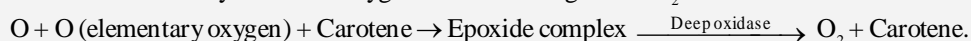
Absorption spectrum for photosynthesis in visible light is **blue & red** wavelength.

Action spectrum is **red & blue** light in which rate of photosynthesis is higher.

(But rate of photosynthesis is highest in white light than monochromatic light).

Function of accessory pigment carotene is –

1. Converts elementary or nasent oxygen to molecular/gaseous O_2 .



2. Protects photooxidation (photodamaging) of pigment system.

3. Precursor of vit.-A.

4. Oxidation to form ABA hormone in guard cells.

Chlorophyll pigment soluble in organic solvents like acetone, ether etc. (anthocyanin is non photosynthetic water soluble pigment, which present in vacuole).

Chloroplast in bundle sheath of **Burmuda** grass is also granal type.

Photolysis of water occurs at $+0.8 E^\circ$

In cyanobacteria (BGA), photosynthesis occurs on **chlorosomes** or **lamellisome** or **carboxysome**.

PS-I is strong reductant as PS-I has good ability to reduce $NADP^+$, while PS-II is a strong oxidant, because it has extreme power of oxidation & photolysis of water molecule.

264 gm. CO_2 and 216 gm. water produced, 108 gm. water, 192 gm. O_2 and 180 gm. glucose.

Annual production of photosynthesis is 170 billion tones of carbohydrate.

Wilmott's bubbler apparatus proves that oxygen is evolved during photosynthesis.

Cytochromes are Iron – porphyrin protein discovered by MacMunn (termed by Keilin).

Pigments except chlorophyll, presents in Quantasomes are called as **accessory or antenna pigment** of light harvesting complex (LHC).

Electroosmotic theory - By **Spanner** and **Jones** for translocation of sugars.

Chollet and Ogren (1975) - Recognised 3 categories of C_4 plants.

- (i) **Maize and Sugarcane type** : In this category malate transported to bundle sheath cells and its decarboxylation gives CO_2 for C_3 cycle.

- (ii) **Panicum and Chloris type** :- In this category malate transported into bundle sheath cells, but this changes into **oxaloacetate**, which gives CO_2 for C_3 cycle.

- (iii) **Atriplex type** :- In this category the aspartate transported into bundle sheath cells, where it changes into malate, which provides CO_2 for C_3 cycle.

Mg^{++} required for Rubisco & PEPcase

I^{st} formed unstable 6-C compound during Calvin cycle is **carboxy ketoribitol biphosphate**.

Significance of photosynthesis –

Photosynthesis is vital process for life on planet earth as it is the only process, that links the physical and biological world by conversation of solar energy into organic matter, which make bulk of the dry matter of any organism.

Presence of O_2 in the atmosphere is also an outcome of photosynthesis. This oxygen is helpful to living organisms in two ways :

1. Oxidative break down of organic food matter (respiration)
2. Making ozone (O_3), in outer layer of atmosphere, which helps in stopping the highly destructive U.V. rays.

Efficiency of photosynthesis –

One quantum of red light = 47.6 Kcal (One red photon or quantum = 47.6 Kcal)

One glucose = 686 Kcal. ($1 CH_2O = 114.3$ Kcal)

8 Quantum \times 47.6 Kcal = 381 Kcal energy require for fixation of one CO_2

- It is an physicochemical process .
- Half leaf experiment showed that CO_2 is required for photosynthesis .
- Joseph Priestley -Proposed the Concept of gaseous exchange by plants with the help of bell jar experiment.
- Jan Ingenhousz -Showed the importance of Sunlight and Green colour in photosynthesis by using a similar setup as the one used by Priestley.
- Julius von Sachs -Provided evidence for production of glucose and its storage as starch.
- T.W. Engelmann -Proposed action spectrum of photosynthesis i.e. Red -blue. Experiment on green filamentous alga *Cladophora*.
- Cornelius Van Niel -Suggested that O_2 evolved during photosynthesis comes from H_2O , not from CO_2 . Experiments on purple and green sulphur bacteria.

- There is a clear division of labour (distribution of work) within the chloroplast i.e. membrane system (grana thylakoids and stroma lamellae) is responsible for light reaction and stroma for dark reaction.
- In the chromatogram, chlorophyll 'a' shows bright or blue green colour, chlorophyll 'b' shows yellow green colour, xanthophyll - yellow & carotenes - yellow - orange.
- Absorption spectrum of photosynthesis - blue red.
- Action spectrum of photosynthesis - red blue.

- Accessory pigments (chlorophylls other than reaction centre, xanthophylls and carotenoids) absorb light and transfer the energy to chlorophyll a (reaction centre) thus enhance the efficiency and range of absorption for photosynthesis. →These pigments also protect chlorophyll a from photo-oxidation.
- One molecule of chlorophyll a (reaction centre) + Antennae molecules (LHC = Light Harvesting Complex) = Photosystem.
PS-I - Reaction centre (Chi 'a' 700 or P700)
PS-II - Reaction centre (Chi 'a' 680 or P 680)
P = Peak of absorption

- Noncyclic photophosphorylation is called the Z scheme (due to characteristic shape on a redox potential scale) Water splitting (Photolysis of water) occurs on the inner side (lumen side) of the thylakoid membrane . Products of noncyclic photophosphorylation - ATP , $\text{NADPH} + \text{H}^+$ and O_2 .
- Product of cyclic photophosphorylation - ATP .
- Products of light reaction which are utilised in dark reaction - ATP & $\text{NADPH} + \text{H}^+$.
- In grana thylakoid - both noncyclic & cyclic process occurs .
- In stroma thylakoid - only cyclic process occurs because stroma thylakoid / lamellae lack PS-II as well as NADP reductase enzyme.
- Primary electron acceptor from PS-I : - Fe-S protein (FRS)
- Primary electron acceptor from PS-II : - Pheophytin .
- The chemiosmotic hypothesis has been put forward by Peter Mitchell to explain the mechanism of ATP synthesis in chloroplast (Photophosphorylation) and Mitochondria (oxidative phosphorylation). According to this hypothesis, ATP synthesis is linked to development of a proton gradient across a membrane (Thylakoid membrane in chloroplast and Inner membrane in mitochondria).

SOLVED EXAMPLE

Ex.1 The law of limiting factor for photosynthesis was enunciated by

- (A) Blackman (B) Hill
(C) Ruben (D) Kalmen

Sol. (A) : Blackman propounded the law of limiting factors. He also proposed the occurrence of the dark phase in photosynthesis.

Ex.2 Emerson's enhancement effect and Red drop have been instrumental in the discovery of

- (A) Photophosphorylation and non-cyclic electron transport
(B) Two photosystems operating simultaneously
(C) Photophosphorylation and cyclic electron transport
(D) Oxidative phosphorylation

Sol. (B)

Ex.3 Isotopes popularly known to have been used in the study of photosynthesis are

Or

Which of the following isotope of carbon was used by Calvin to trace the path of carbon in photosynthesis

- (A) C^{14} and O^{18} (B) C^{11} and C^{32}
(C) C^{16} and N^{15} (D) P^{32} and C^{15}

Sol. (A) : C^{14} isotope used for knowing carbon path and O^{18} used for verified that source of Q_2 in photosynthesis is H_2O , not CO_2

Ex.4 The first event in photosynthesis is

- (A) Synthesis of ATP
(B) Photoexcitation of chlorophyll and ejection of electron
(C) Photolysis of water
(D) Release of oxygen

Sol. (B) : When photon of light energy falls on chlorophyll molecule, one of the electrons pair from ground or single state passes into higher energy level called excited single state.

Ex.5 The synthesis of ATP in photosynthesis and respiration is essentially an oxidation-reduction process involving removal of energy from

Or

Which one is always transferred in redox reaction

- (A) Oxygen (B) Phytochrome
(C) Cytochrome (D) Electrons

Sol. (D)

Ex.6 Manganese and Chlorine is required in

- (A) Nucleic acid synthesis
(B) Plant cell wall formation
(C) Photolysis of water during photosynthesis
(D) Chlorophyll synthesis

Sol. (C) : The splitting of water during photosynthesis is called photolysis. Mn and Cl plays important role in photosynthesis specially light reaction of photosynthesis in splitting of water.

Ex.7 Stroma in the chloroplasts of higher plant contains

- (A) Light-independent reaction enzymes
(B) Light-dependent reaction enzymes
(C) Ribosomes
(D) Chlorophyll

Sol. (A)

Ex.8 Consider the following statements with respect to photosynthesis

- A. The first carbon dioxide acceptor in C_4 cycle is PGA
B. In C_3 plants, the first stable product of photosynthesis during dark reaction is RuBP
C. Cyclic photophosphorylation results in the formation of ATP
D. Oxygen which is liberated during photosynthesis comes from water

Of the above statements

- (A) A and B alone are correct
(B) A and C alone are correct
(C) C and D alone are correct
(D) B and C alone are correct
(E) B and D alone are correct

Sol. (C)

Ex.9 Excitation of chlorophyll due to light is a

- (A) Photooxidation reaction
(B) Endergonic reaction
(C) Thermochemical reaction
(D) Photochemical reaction

Sol. (A)

Exercise # 1

SINGLE OBJECTIVE

NEET LEVEL

1. Oxygen which is liberated during photosynthesis comes from -
 (A) Carbon di oxide
 (B) Water
 (C) Chlorophyll
 (D) Phosphoglyceric acid
2. The process of taking in CO₂ by plants and releasing O₂ is termed as
 (A) Transpiration (B) Respiration
 (C) Photosynthesis (D) Endosmosis
3. In plants during the process of photosynthesis
 (A) CO₂ is taken in
 (B) O₂ is taken in
 (C) CO₂ is taken out
 (D) O₂ is taken in and CO₂ is given out
4. In which of the following process, the light energy is converted into chemical energy
 (A) Digestive action (B) Respiration
 (C) Photosynthesis (D) Fermentation
5. The dark reaction in photosynthesis is called so because
 (A) It can only occur in dark
 (B) It does not require light
 (C) None of these
 (D) Both (A) & (B)
6. The law of limiting factor for photosynthesis was given by :-
 (A) R. Hill (B) Krebs
 (C) Calvin (D) Blackman
7. Beside water and light which is more essential as a raw material for food formation
 (A) CO₂ (B) O₂
 (C) NADP (D) Mineral salts
8. If the CO₂ content of the atmosphere is as high as 300 parts per million -
 (A) All plants would be killed
 (B) The plants would not grow properly
 (C) Plants would grow for some time and then die.
 (D) The plants would thrive well
9. The isotope of carbon used extensively for studies in photosynthesis :-
 (A) C¹³ (B) C¹⁴
 (C) C¹⁵ (D) C¹⁶
10. Which is the evidence to show that oxygen released in photosynthesis comes from water :-
 (A) Isotopic oxygen (O¹⁸) supplied as H₂O appears in the O₂ released in photosynthesis.
 (B) Activated chloroplast in water released O₂ if supplied potassium ferrocyanide or some other reducing agent in the absence of CO₂.
 (C) Photosynthetic bacteria use H₂S and CO₂ to make carbohydrates, H₂O and sulphur.
 (D) All of the above.
11. The path of CO₂ in the dark reactions of photosynthesis was successfully traced by the use of the following :-
 (A) O₂¹⁸ (B) C¹⁴O₂
 (C) P³² (D) X -rays
12. Discovery of Emerson effect has already shown the existence of :-
 (A) Two distinct photosystems
 (B) Light and dark reactions of photosynthesis
 (C) Photophosphorylation
 (D) Photorespiration
13. During the process of photosynthesis the raw materials used are :-
 (A) Glucose (B) Chlorophyll
 (C) Starch (D) CO₂ and H₂O
14. Products of photosynthesis are :-
 (A) Carbon dioxide and food material
 (B) Carbohydrates and oxygen
 (C) Carbon dioxide and oxygen
 (D) Formaldehyde and nitrogen
15. Name the scientist, who first pointed out that plants purify foul air by bell jar experiment.
 (A) Willstatter (B) Robert Hooke
 (C) Priestley (D) Iean Senebier

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. Photosynthesis is
 (A) Oxidative, exergonic, catabolic
 (B) Redox-reaction, endergonic, anabolic
 (C) Reductive, exergonic, anabolic
 (D) Reductive, endergonic, catabolic
2. What is photosynthetic quotient?
 (A) O_2 / CO_2 (B) CO_2 / O_2
 (C) O_2 / Starch (D) $\text{Water} / \text{starch}$
3. Which of the following carries out non-oxygenic photosynthesis?
 (A) Cyanobacteria (B) Crab grass
 (C) Bacteria (D) Wheat plant
4. Wavelength of light responsible for Emerson's enhancement effect :-
 (A) only 680 nm
 (B) only 680 nm
 (C) infra red wavelength
 (D) Both 680 nm- and 680 nm
5. The "red - drop" phenomenon is due to the disruption of the photo chemical activity of
 (A) PS - I (B) PS-I & PS-II both
 (C) PS - II (D) Carotenoids
6. True for photosynthesis :-
 (A) Oxidation of CO_2 and reduction of H_2O
 (B) process which connects the biotic and abiotic world
 (C) Exergonic process
 (D) Oxidation of Glucose
7. Which of the following order is correct about the rate of photosynthesis?
 (A) Blue > yellow > orange > red
 (B) Blue > red > yellow > orange
 (C) Red > blue > yellow > orange
 (D) Yellow > orange > blue > red
8. The product of hill reaction are :-
 (A) ATP and $NADPH_2$ in chloroplast
 (B) ATP and $NADPH_2$ in mitochondria
 (C) Only oxygen
 (D) A reduced substance $NADPH_2$, ATP and O_2 in chloroplast
9. Which of the following is excited molecule during photosynthesis :-
 (A) Chlorophyll (B) Oxygen
 (C) Carbondioxide (D) Water
10. During ionisation of H_2O , H^+ is captured by
 (A) Chlorophyll (B) NADP
 (C) O_2 (D) Cytochrome
11. At the time of ionization of H_2O , which initially captures the electron
 (A) Chlorophyll (B) NADP
 (C) OH^- (D) Cytochrome
12. Fixation of 1 CO_2 requires :-
 (A) $6NADPH_2$ & 3ATP (B) $2NADP.H_2$ & 3ATP
 (C) 4 $NADP.H_2$ & 3ATP (D) 5 $NADP.H_2$ & 3ATP
13. During ATP synthesis electron pass through
 (A) Water (B) Cytochromes
 (C) O_2 (D) CO_2
14. Which pigment system ultimately donates e^- for the reduction of NADP.
 (A) PS II (B) PSI
 (C) CO_2 (D) Plastoquinone
15. Respiration and photosynthesis both require
 (A) Green cells (B) Sunlights
 (C) Cytochromes (D) Organic fuel
16. Photosynthesis is an oxidation reduction process, the materials that is oxidised is
 (A) CO_2 (B) NADP
 (C) H_2O (D) PGA
17. Element which helps in electron transport in the process of photosynthesis is
 (A) Zinc (B) Molybdenum
 (C) Boron (D) Manganese
18. Photo - oxidation of chlorophyll is called
 (A) Intensification (B) Chlorosis
 (C) Solarization (D) Defoliation

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

- Match Column-I with Column-II and select the correct option from the codes given below.

Column - I A. C ₄ plants B. Chlorophyll <i>b</i> C. PS II D. CAM (A) A-iv, B-ii, C-iii, D-i (B) A-iii, B-ii, C-iv, D-i (C) A-i, B-iii, C-ii, D-iv (D) A-i, B-ii, C-iii, D-iv	Column - II i. Succulents ii. Accessory photosynthetic pigment iii. Photo-oxidation of H ₂ O iv. Kranz anatomy
--	--
- Match Column - I with Column - II and select the correct option from the codes given below.

A (A) ii (B) i (C) iii (D) i	B iii ii ii iii	C i iii i ii
---	------------------------------------	---------------------------------
- Which of the following with respect to early experiments of photosynthesis is wrongly matched

(A) Joseph Priestley	– Showed that plants release O ₂	
(B) Jan Ingenhousz	– Showed that sunlight is essential for photosynthesis	
(C) Julius von Sachs	– Proved that plants produce glucose when they grow	
(D) T.W. Engelmann	– Showed that the green substance is located within special bodies in plant	
(E) Cornelius van Net	– Showed that hydrogen reduces CO ₂ to carbohydrates	
- Match the following and choose the correct combination from the options given

Column - I A. Visible light B. Ultraviolet C. X-Rays D. Infrared	Column - II i. 0.1 to 1 nm ii. 400 to 700 nm iii. Longer than 740nm iv. 100 to 4000 nm v. 0.1 nm
---	--

(A) A-i, B-iii, C-iv, D-v (B) A-iii, B-ii, C-i, D-v (C) A-iv, B-iii, C-ii, D-i (D) A-ii, B-iv, C-i, D-iii
 (E) A-v, B-iv, C-iii, D-ii
- Match the sites in column I with the processes in column II and choose the correct combination from the options

Column I A. Grana of chloroplast B. Stroma of chloroplast C. Cytoplasm D. Mitochondrial matrix	Column II i. Krebs's cycle ii. Light reaction iii. Dark reaction iv. Glycolysis
---	--

(A) A-iv, B-iii, C-ii, D-i (B) A-i, B-ii, C-iv, D-iii (C) A-ii, B-i, C-iii, D-iv (D) A-iii, B-iv, C-i, D-ii
 (E) A-ii, B-iii, C-iv, D-i
- Select the incorrect matched pair with regard to C₄ cycle

(A) Primary CO ₂ fixation product	– PGA
(B) Site of initial carboxylation	– Mesophyll cells
(C) Primary CO ₂ acceptor	– PEP
(D) C ₄ plant	– Maize
(E) Location of enzyme RuBisCO	– Bundle sheath cells

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. Photochemical reactions in the chloroplast are directly involved in : [CBSE AIPMT 2000]
(A) Formation of phosphoglyceric acid
(B) Fixation of carbon dioxide
(C) Synthesis of glucose and starch
(D) Photolysis of water and phosphorylation of ADP to ATP
2. Fixation of one CO₂ molecule through Calvin cycle requires [CBSE AIPMT 2000]
(A) 1 ATP and 2NADPH₂
(B) 2 ATP and 2NADPH₂
(C) 3 ATP and 2NADPH₂
(D) 2 ATP and 1NADPH₂
3. The first step of photosynthesis is [CBSE AIPMT 2000]
(A) Excitation of electron of chlorophyll by a photon of light
(B) Formation of ATP
(C) Attachment of CO₂ to 5 carbon sugar
(D) Ionisation of water
4. How many turns of Calvin cycle yield one molecule of glucose ? [CBSE AIPMT 2000]
(A) 8 (B) 2
(C) 6 (D) 4
5. Which pair is wrong : - [CBSE AIPMT 2001]
(A) C₃ - Maize
(B) C₄ - Kranz anatomy
(C) Calvin cycle - PGA
(D) Hatch and Slack cycle ? O.A.A.
6. Which pigment system is inactivated in red drop : - [CBSE AIPMT 2001]
(A) PS-I and P.S-II (B) PS - I
(C) PS - II (D) None
7. In Photosynthesis energy from light reaction to dark reaction is transferred in the form of : - [CBSE AIPMT 2002]
(A) ADP (B) ATP
(C) RUDP (D) Chlorophyll
8. Which of the following absorb light energy for photosynthesis : - [CBSE AIPMT 2002]
(A) Chlorophyll (B) Water molecule
(C) O₂ (D) RUBP
9. Which element is located at the centre of the porphyrin ring in chlorophyll : - [CBSE AIPMT 2003]
(A) Manganese (B) Calcium
(C) Magnesium (D) Potassium
10. Which one of the following is wrong in relation to photorespiration : - [CBSE AIPMT 2003]
(A) It is a characteristic of C₃ - plants
(B) It occurs in chloroplasts
(C) It occurs in daytime only
(D) It is a characteristic of C₄ -plants
11. In sugarcane plant 14CO₂ is fixed in malic acid, in which the enzyme that fixes CO₂ is :- [CBSE AIPMT 2003]
(A) Fructose phosphatase
(B) Ribulose biphosphate carboxylase
(C) Phosphoenol pyruvic acid carboxylase
(D) Ribulose phosphate kinase
12. Which fractions of the visible spectrum of solar radiations are primarily absorbed by carotenoids of the higher plants : - [CBSE AIPMT 2003]
(A) Violet and blue (B) Blue and green
(C) Green and red (D) Red and violet
13. Chlorophyll in chloroplasts is located in :- [CBSE AIPMT 2004]
(A) Outer membrane (B) Inner membrane
(C) Thylakoids (D) Stroma
14. Plants adapted to low light intensity have :- [CBSE AIPMT 2004]
(A) Larger photosynthetic unit size than the sun plants
(B) Higher rate of CO₂ fixation than the sun plants
(C) More extended root system
(D) Leaves modified to spines
15. In C₃-plants, the first stable product of photosynthesis during the dark reaction is :- [CBSE AIPMT 2004]
(A) Malic acid
(B) Oxaloacetic acid
(C) 3-phosphoglyceric acid
(D) Phosphoglyceraldehyde

MOCK TEST

- A plant is provided with ideal conditions for photosynthesis and supplied with isotope $^{14}\text{CO}_2$. When the products of the process are analysed carefully, what would be the nature of products?

(A) Both glucose and oxygen are normal. (B) Both glucose and oxygen are labelled.
 (C) Only glucose is labelled and oxygen is normal (D) Only oxygen is labelled but glucose is normal.
- Chromatophores take part in

(A) movement (B) respiration (C) photosynthesis (D) growth
- Carbon dioxide is necessary for photosynthesis. The chemical used to remove this gas most effectively from entering a control apparatus is

(A) calcium oxide (B) distilled water
 (C) potassium hydroxide solution (D) sodium carbonate.
- Anoxygenic photosynthesis is characteristic of

(A) *Rhodospirillum* (B) *Spirogyra* (C) *Chlamydomonas* (D) *Ulva*
- Which of the following statements is correct?

(A) The core of cilium or flagellum is the basal body
 (B) Elaioplasts store starch whereas aleuroplasts store proteins.
 (C) Membranous extensions into the cytoplasm in cyanobacteria which contain pigments are called chromatophores.
 (D) Acrocentric chromosomes have only one arm.
- Which of the following with respect to early experiments of photosynthesis is wrongly matched?

(A) Joseph Priestley – Showed that plants release O_2
 (B) Jan Ingenhousz – Showed that sunlight is essential for photosynthesis
 (C) Julius von Sachs – Proved that plants produce glucose when they grow.
 (D) T.W. Engelmann – Showed that the green substance is located within special bodies in plants
 (E) Cornelius van Niel – Showed that hydrogen reduces CO_2 to carbohydrates
- In photosynthesis, the light-independent reactions take place at

(A) photosystem II (B) stromal matrix (C) thylakoid lumen (D) photosystem I
- Chlorophyll molecules are located in the

(A) thylakoid membrane (B) thylakoid lumen
 (C) stroma (D) inner chloroplast membrane
- Emerson's enhancement effect and Red drop have been instrumental in the discovery of

(A) photophosphorylation and cyclic electron transport
 (B) oxidative phosphorylation
 (C) photophosphorylation and non-cyclic electron transport
 (D) two photosystems operating simultaneously
- Match the following.

A. Chlorophyll <i>a</i>	(i) yellow
B. Chlorophyll <i>b</i>	(ii) bright or blue green
C. Xanthophyll	(iii) yellow - yellow orange
D. Carotenoids	(iv) yellow green

(A) A-(ii), B-(iv), C-(i), D-(iii) (B) A-(iii), B-(iv), C-(ii), D-(i)
 (C) A-(iv), B-(iii), C-(ii), D-(i) (D) A-(iv), B-(ii), C-(i), D-(iii)
 (E) A-(iv), B-(i), C-(iii), D-(ii)

www.blog.neetnearme.com

MINERAL NUTRITION

I have repeatedly had cause to refer to certain resemblances between the phenomena of irritability in the vegetable kingdom and those of the animal body, thus touching a province of investigation which has hitherto been far too little cultivated”.

“JULIUS VON SACHS (1832-1897)”

INTRODUCTION

The basic needs for all living organisms are essentially the same. The chemical substance present in food which act as a raw material for body building and maintaining its functions are termed as nutrients. Nutrients can be inorganic or can be organic in nature. They can be carbohydrates, proteins, fats and water or minerals for growth and development. The study of source, mode of absorption, distribution and metabolism of various inorganic minerals by the plants is called **Mineral nutrition**.

In this chapter you will study the role of the essential elements, their major deficiency symptoms and the mechanism of absorption of these elements. Also, the mechanism and significance of biological nitrogen fixation.

MINERALS & NUTRITION

Generally all living organism have same basic needs. They require macromolecules, such as carbohydrates, proteins and fats, and water and minerals for their growth and development.

This chapter emphasizes particularly on inorganic plant nutrition, wherein you will study the criteria for establishing the essentially and the methods to identify elements essential to growth and development of plants. In this chapter, you will study the role of the essential elements, the mechanism of absorption of these essential elements and their major deficiency symptoms The chapter also introduces you briefly to the significance and the mechanism of biological nitrogen fixation.

METHODS TO STUDY THE MINERAL, REQUIREMENTS OF PLANTS

In 1860, **Julius von Sachs**, a prominent **German botanist**, demonstrated for the first time, that plants could be grown to maturity in a defined nutrient solution in complete absence of soil. Since then, a number of improvised methods have been employed to try and determine the mineral nutrients essential for plants. This technique of growing plants in a nutrient solution is known as **Hydroponics**. The essence of all these methods involves the culture of plants in a soil-free, defined mineral solution. These methods require purified water and mineral nutrient salts.

After a series of experiments in which the roots of the plants were immersed in nutrient solutions and wherein an element was added/removed or given in varied concentration, a mineral solution suitable for the plant growth was obtained. By this method, essential elements were indentified and their deficiency symptoms discovered.

Hydroponics has been successfully employed as a technique for the commercial production of vegetables such as tomato, seedless cucumber and lettuce. It must be emphasised that the nutrient solutions must be adequately aerated to obtain the optimum growth. Diagrammatic views of the hydroponic technique is given in Figure.

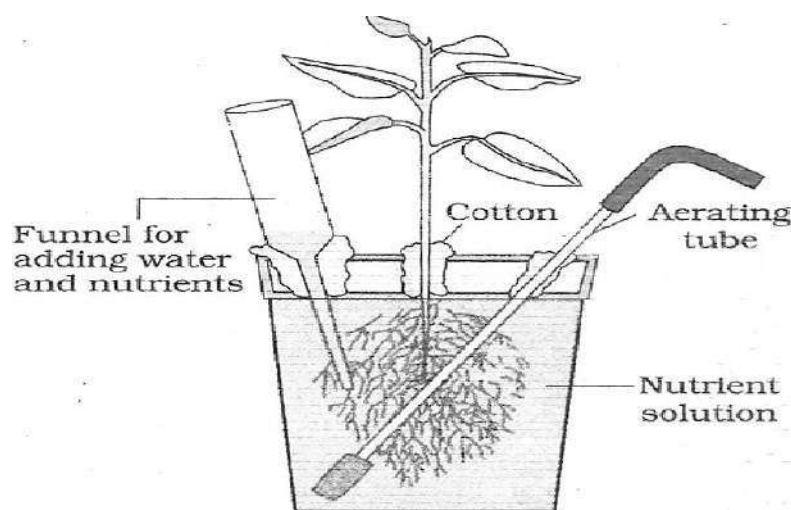


Diagram of a typical set-up for nutrient solution culture

- **Curtis** considered that transpiration is a necessary evil.
- Succulent stomata are scotoactive because they open at night and closes during the day hour e.g. Bryophyllum, Opunita etc.
- **Zelich** told that glycolic acid is responsible for opening & closing of Stomata.
- Old aged stem and fruit respire by lenticles.
- Fresh weight is maximum in morning & minimum at noon.
- If a plant is taken at higher altitude it will die because of higher transpiration.
- Guttation term was given by **Bergerstein**.
- **Transpiration ratio** : The amount of water loss per unit of dry produced during the growing of plant.
- CO_2 PMA = Phenyl mercuric acetate & ABA (Abscisic acid) act like antitranspirant.
- Blue light promotes stomates opening.
- In colocasea antiquarum guttation is a normal process. If 50% stomata are closed there will be no effect on transpiration.
- **Transpiration flux** : The quantity of water transpired by a unit area of leaf surface in a unit time is known as transpiration flux.
- The rate of transpiration is doubled with every rise of 10°C .
- In electrophoresis flow of solvent takes place between the charged particles. In electrophores in charge solute flow through the solvent.
- The main reason of osmotic pressure of the opened stomata is the potassium chloride or potassium mallate.
- The photophosphorylation process in the guard cells is a energy metabolic process, not CO_2 metabolic process.
- Accumulation of Na^+ ions is found in the epidermal cells which is present near the guard cells in some of the plants. This is found in such plants which are growing in salty land.

SOLVED EXAMPLE

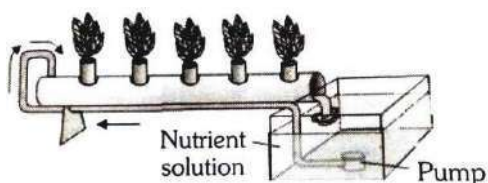
Ex.1 Which one of the following is not an essential mineral element for plants while the remaining three are

- (A) Cadmium (B) Phosphorus
(C) Iron (D) Manganese

Sol. (A)

Ex.2 The given figure shows hydroponic/soil less plant production. Plants are grown in a tube or through placed on a slight incline. The arrows indicate the direction of flow of nutrient solution.

Nutrient solution is sent to the elevated end of the tube from the reservoir by _____ and it flows back into reservoir due to _____.



- (A) Pump, Gravity (B) Gravity, Pump
(C) Gravity, Gravity (D) Pump, Pump

Sol. (A)

Ex.3 Which of the following ions of heavy metals participate in process of photosynthesis in higher plants

- (A) Pb, Fe, Ni, Co (B) Mg, Zn, Cu, Hg
(C) Mg, Mn, Co, Fe (D) Mg, Cu, Mn, Fe

Sol. (D)

Ex.4 The number of essential elements required for normal growth of plant is

- (A) 10 (B) 16
(C) 20 (D) 25

Sol. (B)

Ex.5 Which of the following is associated with electron transport in photosynthesis

- (A) Sodium (B) Potassium
(C) Iron (D) Cobalt

Sol. (C)

Ex.6 Deficiency symptoms of nitrogen and potassium are visible first in

- (A) Roots (B) buds
(C) Senescent leaves (D) Young leaves

Sol. (C) : N and K are mobile elements.

Ex.7 Plants requiring two metallic compounds (minerals) for chlorophyll synthesis, are

Or

One mineral activates the enzyme catalase and the other is a constituent of the ring structure of chlorophyll. These minerals are respectively

- (A) Fe and Ca (B) Fe and Mg
(C) Cu and Ca (D) Ca and K

Sol. (B) : Mg is an important constituent of chlorophyll molecule where it occupies a central position and essential for photosynthesis and Fe plays an important role in ETS, photosynthesis and respiration because iron is the part of cytochromes. It is also essential for chlorophyll synthesis

Ex.8 Which of the following element is very essential for uptake and utilization of Ca^{2+} and membrane function

- (A) Phosphorus (B) Molybdenum
(C) Manganese (D) Copper
(E) Boron

Sol. (E) : Boron is responsible for maintaining the solubility of calcium in cells.

Ex.9 About 98 percent of the mass of every living organism is composed of just six elements including carbon, hydrogen, nitrogen, oxygen and

- (A) Phosphorus and sulphur
(B) Sulphur and magnesium
(C) Magnesium and sodium
(D) Calcium and phosphorus

Sol. (D)

Ex.10 Micro-nutrients are

- (A) Less important in nutrition than macro-nutrients
(B) As important in nutrition as macro-nutrients
(C) May be omitted from culture media without detrimental effect on the plants
(D) Called micro because they play only minor role in nutrition

Sol. (B) : Micro-nutrients are present in less amount in plants but they are as important as macro-nutrients.

Ex.11 Find out the correctly matched pair

- (A) Zinc
– Helps to maintain the ribosome structure
(B) Magnesium
– Needed during the formation of mitotic spindle
(C) Calcium
– Plays a role in the opening and closing of stomata
(D) Manganese
– Needed in the splitting of water to liberate oxygen during photosynthesis
(E) Potassium – Needed in the synthesis of auxin

Sol. (D)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. "Reclamation" and "Little leaf" disease, caused by deficiency of -
(A) Zn and Mo (B) Cu and Zn
(C) Cu and B (D) Mn and Cu
2. Which element is required in comparatively least quantity for the growth of plant ?
(A) Zn (B) N
(C) P (D) Ca
3. Which of the following essential element is not properly placed in the given category ?
(A) Cu (B) Zn
(C) Mg (D) Mn
4. Criteria for essentiality in mineral nutrition were shown firstly by : -
(A) Arnon (B) Liebig
(C) Steward (D) Levitt
5. Which mineral nutrients are called critical element for crops ?
(A) N, P, K (B) C, H, O
(C) N, S, Mg (D) K, Ca, Fe
6. The mineral nutrient mainly concerning with apical meristematic activity is : -
(A) K (B) Ca
(C) N (D) S
7. Little leaf disease is caused by -
(A) Zn - deficiency (B) Cu - deficiency
(C) Mo - deficiency (D) Mn - deficiency
8. Which of the following does NPK denote ?
(A) Nitrogen, Potassium, Kinetin
(B) Nitrogen, Protein, Kinetin
(C) Nitrogen, Protein, Potassium
(D) Nitrogen, Phosphorus, Potassium
9. Plants absorb mineral salts from the soil solution through : -
(A) A semipermeable membrane into the cytoplasm
(B) Perforations at the apex of root hair cells
(C) The cell wall which is semipermeable
(D) None of these
10. Mineral salts which are absorbed by the roots from the soil are in the form of : -
(A) Very dilute solution
(B) Dilute solution
(C) Concentrated solution
(D) Very concentrated solution
11. By which method ions are absorbed by the plants ?
(A) Diffusion (B) DPD gradient
(C) Carriers proteins (D) Water potential
12. Hydrophytes absorb salt and water by : -
(A) Root and root hairs (B) Leaves and root
(C) Roots and stem (D) General epidermis
13. Active and passive absorption terms were coined by : -
(A) Kramer (B) Deutrochet
(C) Priestley (D) Renner
14. Which is free ion present in a cell ?
(A) P (B) K
(C) Fe (D) B
15. Who give the Cytochrome pump theory ?
(A) Sachs (B) Lundeградh
(C) Bose & Renner (D) Bennet - Clark
16. Who proposed the protein lecithin theory ?
(A) Sachs (B) Lundeградh
(C) Bose & Renner (D) Bennet & Clark
17. Carrier protein helped in : -
(A) Active absorption of ions
(B) Passive ions absorption
(C) Water absorption
(D) Vaporization
18. Active uptake of minerals depends upon :-
(A) Active water absorption
(B) Transpiration
(C) Photorespiration
(D) Dephosphorylation

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. Which of the group of elements is not essential for a normal plant ?
 (A) K, Ca, Mg (B) Fe, Zn, Mn, B
 (C) Pb, I, Na (D) Mg, Fe, Mo
2. Hydroponics is a technique in which plants are grown in ?
 (A) Green house
 (B) Water saturated sand
 (C) Balanced nutrient solution
 (D) Purified distilled water
3. For chlorophyll formation a plant needs :-
 (A) Fe, Ca & light (B) Fe, Mg & Light
 (C) Ca, K & light (D) Mn & Cu
4. Brown heart rot of beets is due to deficiency of-
 (A) B (B) P
 (C) Mg (D) Mo
5. Die back disease in citrus is due to deficiency of :-
 (A) Mo (B) B
 (C) Cu (D) Zn
6. The disease related with deficiency of molybdenum is :-
 (A) Whiptail disease of cauliflower
 (B) Little leaf disease
 (C) Reclamation disease of cereals
 (D) Brown heart disease
7. Protoplasmic elements are :-
 (A) C, H, O, P, N, S (B) C, H, O, Fe, N
 (C) N, S, Fe, P, K (D) Fe, Mg, Ca, N, P
8. Which element is not considered as macronutrient ?
 (A) Mg (B) Ca
 (C) Mn (D) P
9. The element which can not be placed along with micronutrients :-
 (A) Mn (B) Mo
 (C) Cu (D) Ca
10. The amino acid having S in its composition is -
 (A) Cystine (B) Cysteine
 (C) Methionine (D) All
11. Which elements are considered as balancing elements ?
 (A) Ca & K (B) C & H
 (C) N & S (D) Mg and Fe
12. The group of mineral nutrients known as frame work elements :-
 (A) N, S, P (B) C, H, O
 (C) Mg, Fe, Zn (D) Zn, Mn, Cu
13. Which element essential for stability of chromosome structure ?
 (A) Zn (B) Ca
 (C) Mo (D) Fe
14. Hydroponics or soilless culture helps in knowing
 (A) essentiality of an element
 (B) deficiency of an element
 (C) toxicity caused by an element
 (D) all of these
15. The technique of hydroponics is being employed for the commercial production of vegetables like
 (A) tomato (B) cucumber
 (C) lettuce (D) all of these
16. Select the correct statement (s) regarding the solution culture techniques.
 (A) Successful hydroponic culture requires a large volume of nutrient solution or frequent adjustment of the nutrient solution to prevent roots from producing radical changes in nutrient concentrations and pH of the medium.
 (B) In nutrient film growth system, plant root lie on the surface of a trough, and nutrient solutions flow in thin layer along the trough over the roots.
 (C) In aeroponics technique, plants are grown with their roots suspended in air while being sprayed continuously with a nutrient solution
 (D) All of these .

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

(Activator element)

A. Mgⁱⁱ⁺

B. Znⁱⁱ⁺

C. Mo

(A) A-ii, B-iii, (C) - i

(B) A-iii, B-ii, (C)-i

Column II

(Enzyme)

i. Nitrate reductase

ii. RuBisCO, PEPCK

iii. Alcohol dehydrogenase

(C) A-i, B-iii, (C)-ii

(D) A-ii, B-i, (C)-iii

2. Select the correctly matched pair.

(A) Zinc

– Helps to maintain the ribosome structure

(B) Magnesium

– Needed during the formation of mitotic spindle

(C) Calcium

– Plays a role in the opening and closing of stomata

(D) Manganese

– Needed in the splitting of water to liberate oxygen during photosynthesis

3. Match the element with its associated functions/roles and choose the correct option among given below.

A. Boron

i. splitting of H₂O to liberate O₂ during photosynthesis

B. Manganese

ii. needed for synthesis of auxins

C. Molybdenum

iii. component of nitrogenase

D. Zinc

iv. pollen germination

E. Iron

v. component of ferredoxin

(A) A-i, B-ii, C-iii, D-iv, E-v

(B) A-iv, B-i, C-iii, D-ii, E-v

(C) A-iii, B-ii, C-iv, D-v, E-i

(D) A-ii, B-iii, C-v, D-i, E-iv

4. Match the following with correct combination

Column I

A. Cuscuta

Column II

i. Saprophyte

B. Eichornia

ii. Pneumatophore

C. Monotropa

iii. Insectivorous plant

D. Rhizophora

iv. Parasite

E. Utricularia

v. Root pocket

(A) A-iv, B-iii, C-i, D-v, E-ii

(B) A-iv, B-v, C-i, D-ii, E-iii

(C) A-ii, B-iii, C-i, D-v, E-iv

(E) A-ii, B-v, C-iv, D-iii, E-i

(D) A-iii, B-i, C-v, D-iv, E-ii

5. Match the following and choose the correct combination from the options given

Column I

A. Potassium

Column II

i. Constituent of ferredoxin

B. Sulphur

ii. Involved in stomatal movement

C. Molybdenum

iii. Needed in the synthesis of auxin

D. Zinc

iv. Component of nitrogenase

(A) A-ii, B-i, C-iv, D-iii

(B) A-i, B-ii, C-iii, D-iv

(C) A-iv, B-iii, C-ii, D-i

(E) A-iii, B-iv, C-i, D-ii

(D) A-i, B-iii, C-iv, D-ii

6. Match the following mineral element with their deficiency symptom and choose the correct option

Column I

A. Calcium

Column II

i. Chlorotic veins

B. Potassium

ii. Delayed germination of seeds

C. Zinc

iii. Necrosis of young leaves

D. Iron

iv. Scorched leaf tips

E. Phosphorous

v. Malformed leaves

(A) A-iii, B-i, C-v, D-ii, E-iv

(B) A-i, B-iv, C-v, D-iii, E-ii

(C) A-iii, B-iv, C-v, D-i, E-ii

(E) A-iv, B-ii, C-i, D-iii, E-v

(D) A-ii, B-iii, C-iv, D-i, E-v

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. The plants grown in magnesium deficiency but urea sprayed soil would show [CBSE AIPMT 2000]
 - (A) Deep green foliage
 - (B) Early flowering
 - (C) Yellowing of leaves
 - (D) loss of pigments in petals
2. Zinc as a nutrient is used by the plants in the form of [CBSE AIPMT 2000]
 - (A) Zn
 - (B) Zn²⁺
 - (C) ZnO
 - (D) ZnSO₄
3. Which aquatic fern performs nitrogen fixation : - [CBSE AIPMT 2001]
 - (A) Azolla
 - (B) Nostoc
 - (C) Salvia
 - (D) Salvinia
4. In plants inulin and pectin are [CBSE AIPMT 2001]
 - (A) Reserved material
 - (B) Wastes
 - (C) Excretory material
 - (D) Insect attracting material
5. Enzyme involved in nitrogen assimilation : - [CBSE AIPMT 2001]
 - (A) Nitrogenase
 - (B) Nitrate reductase
 - (C) Transferase
 - (D) Transaminase
6. Passive absorption of minerals depend on [CBSE AIPMT 2001]
 - (A) Temperature
 - (B) Temperature and metabolic inhibitor
 - (C) Metabolic inhibitor
 - (D) Humidity
7. Choose the correct match Bladderwort, sundew, venus fly trap [CBSE AIPMT 2002]
 - (A) Nepenthes, Dionea, Drosera
 - (B) Nepenthes, Utricularia, Vanda
 - (C) Utricularia, Drosera, Dionea
 - (D) Dionea, Trapa, Vanda
8. The major portion of the dry weight of plants comprises of : - [CBSE AIPMT 2003]
 - (A) Carbon, hydrogen and oxygen
 - (B) Nitrogen, phosphorus and potassium
 - (C) Calcium, magnesium and sulphur
 - (D) Carbon, nitrogen and hydrogen
9. Gray spots of oat are caused by deficiency of : - [CBSE AIPMT 2003]
 - (A) Fe
 - (B) Cu
 - (C) Zn
 - (D) Mn
10. Boron in green plants assists in : - [CBSE AIPMT 2003]
 - (A) Sugar transport
 - (B) Activation of enzymes
 - (C) Acting of enzyme cofactor
 - (D) Photosynthesis
11. The major role of minor elements inside living organisms is to act as : - [CBSE AIPMT 2003]
 - (A) Binder of cell structure
 - (B) co-factors of enzymes
 - (C) Building blocks of important amino acids
 - (D) Constituent of hormones
12. A free living nitrogen-fixing cyanobacterium which can also form symbiotic association with the water fern *Azolla* is :- [CBSE AIPMT 2004]
 - (A) Tolypothrix
 - (B) Chlorella
 - (C) Nostoc
 - (D) Anabaena
13. The deficiencies of micronutrients, not only affects growth of plants but also vital functions such as photosynthetic and mitochondrial electron flow. Among the list given below, which group of three elements shall affect most, both photosynthetic and mitochondrial electron transport - [CBSE AIPMT 2005]
 - (A) Co, Ni, Mo
 - (B) Ca, K, Na
 - (C) Mn, Co, Ca
 - (D) Cu, Mn, Fe
14. A plant requires magnesium for : [CBSE AIPMT 2007]
 - (A) Holding cells together
 - (B) Protein synthesis
 - (C) Chlorophyll synthesis
 - (D) Cell wall development
15. Which one of the following elements is not an essential micronutrient for plant growth? [CBSE AIPMT 2007]
 - (A) Mn
 - (B) Zn
 - (C) Cu
 - (D) Ca

MOCK TEST

- Plants could be grown to maturity in a defined nutrient solution was demonstrated for the first time by
 (A) Priestley (B) Von Sacchs (C) Ingenhausz (D) VanNiel
- Which is essential for the growth of root tip?
 (A) Zn (B) Fe (C) Ca (D) Mn
- In which of the following all three are macronutrients?
 (A) Molybdenum, magnesium, manganese (B) Nitrogen, nicke, phosphorus
 (C) Boron, zinc, manganese (D) Iron, copper, molybdenum
- Which of the following is not a crole played by potassium in plant growth ?
 (A) Translocation of carbohydrates (B) Maintaining anion-cation balance
 (C) Opening and closing of stomata (D) Synthesis of protein
 (E) Maintaining turgidity of cells
- Assertion :** Soil particles, particularly clay and organic matter in soil, contain negative charges that attract positively-charged ions such as Ca^{++} , K^{+} and Mg^{++} .
Reason : Essential elements derived from soil are termed as mineral elements while those derived from air or water are known as non-mineralelements.
 (A) If both assertion and reason are ture and reason is the correct explanation of assertion.
 (B) If both assertion and reason are true but reason is not the correct explanation of assertion.
 (C) If assertion is true but reason is false.
 (D) If both assertion and reason are false
- Match the Column I with that of column II and choose the correct combination from the options given

Column I	Column II
Essential elements	Deficiency causes
A. N, K, Mg, S, Fe, Mn,	(i) Inhibit cell division Zn and Mo
B. N, K, Sand Mo	(ii) Necrosis
C. Ca, Mg, Cu and K	(iii) Delay in flowering
D. N, S and Mo	(iv) Chlorosis
(A) A-(iv), B-(iii), C-(ii), D-(i)	(B) A-(i), B-(ii), C-(iii), D-(iv)
(C) A-(iv), B-(i), C-(ii), D-(iii)	(D) A-(ii), B-(iii), C-(iv), D-(i)
(E) A-(iii), B-(iv), C-(ii), D-(i)	
- Which of the following groups of minerals are micronutrients?
 (A) Magnesium, Manganese, Copper, Boron and Phosphorus
 (B) Manganese, Copper, Magnesium, Zinc and Boron
 (C) Nitrogen, Potassium, Manganese, Copper and Iron
 (D) Iron, Manganese, Copper, Molybdenum and Zinc
 (E) Carbon, Potassium, Phosphorus, Nitrogen and Oxygen
- Match the mineral in column I with the enzyme activated by it in column II and choose the correct option.

Column I	Column II
A. Magnesium	i. Alcohol dehydrogenase
B. Molybdenum	ii. Phosphoenol pyruvate carboxylase
C. Zinc	iii. Nitrogenase
(A) A-ii, B-iii, C-i	(C) A-ii, B-i, C-iii
(B) A-i, B-ii, C-iii	(D) A-iii, B-ii, C-i
(E) A-iii, B-i, C-ii	

www.blog.neetnearme.com

PRINCIPLE OF INHERITANCE AND VARIATION

“If A denotes one of the two constant traits, for example, the dominating one, a the recessive, and the Aa the hybrid form in which both are united, then the expression: gives the series for the progeny of plants hybrid in a pair of differing traits.”

“GREGOR JOHANN MENDEL(1822-1884)”

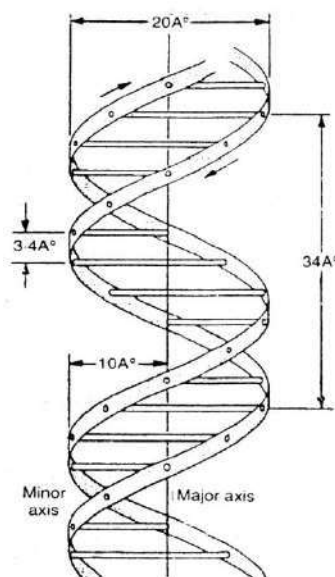
INTRODUCTION

As we have seen in earlier section, one of the most fundamental attributes of all living beings is reproduction. generally, Progeny receives the characters from parents in the form of egg and sperm. Because of this feature, progeny resembles its parents. This has been best summed up in the phrase ‘like begets like’. The transfer of characters from parents to offspring is known as **inheritance**. For example, a tiger always gives birth only to a baby cub (tiger) and not some other animal. Similarly a mango seed forms a mango plant and not any other plant.

Progeny produces resembles the parents closely but is not identical in all respects. The reason behind is **variation**. **Variation**, in biology, any difference between cells, individual organisms, or groups of organisms of any species caused either by genetic differences (genotypic variation) or by the effect of environmental factors on the expression of the genetic potentials (phenotypic variation). **Genetics** is the study of genes, genetic variation, and heredity in living organisms. It is generally considered a field of biology, but intersects frequently with many other life sciences and is strongly linked with the study of information systems.

PRINCIPLES OF INHERITANCE AND VARIATION

- Gregor Johann Mendel - Father of Genetics.
- Bateson - Genetics term, gene, Genotype, Phenotype.
- Morgan - Father of Experimental genetics.
- Galton Eugenics - Father of Eugenics.
- Hugo De Varies, Carls correns Erik Von Tschermack - Re discovered Medle's work.
- Muller - Father of Actino Biology.
- Dr. Hurgovind Khurana - Synthesized First Artificial Gene



- (1) Father of modern genetics – **Bateson**. Genetics term was given by Bateson
Homozygous– Individual that have similar allele (factor) on Homologous chromosomes.
Heterozygous– Individual that have dissimilar factors called heterozygous.
Allele– (Belongs to each other) two alternate form of a gene is called Allele.
Allele– Factors that have opposite effect & present at same locus of homologous chromosome called Allele.
- (2) Father of experimental genetics– **Morgan** experiments on Fruit fly (*Drosophila melanogaster*).
- (3) **Muller**– Father of actinobiology. (Actinobiology– Study of effect of radiation on living organism).
- (4) Father of human Genetics **Garrod**. Book written by Garrod is “In Born error of metabolism”.
First genetic disorder in human being “Alkaptonuria” discovered by Garrod.
- (5) Father of Eugenics– **Galton. Eugenics**– Improvement of man kind by applying laws of inheritance.
Euthenics – Improvement of man kind by improving the environment.
Euthenics – Medical engineering Include the treatment of genetic disorder.
- (6) **Johanssen** – Give the term Gene, Genotype and phenotype.
- (7) **Genetics** = Collective study of heredity & Variations.
- (8) **Heredity** = Transmission of genetic characters from parent to offsprings.
- (9) **Variation** = individuals of same species have some differences, these are called variation.
History of researches in genetics.

BIOLOGY FOR NEET & AIIMS

- Genetics deals with the inheritance, as well as the variation of characters from parents to offsprings.
- Inheritance is the process by which characters are passed on from parent to progeny.
- Variation is the degree by which progeny differs from their parents.

1. GENETICALTERMS:

- **Genes (Factors)** : They are the units of inheritance, which contain the information that is required to express a particular character, in an organism.
- **Alleles** : Genes which code for a pair of contrasting traits and present on a same locus on the homologous chromosome, are known as alleles. i.e. They are the slightly different forms of the same gene.
- **Homozygous (Pure)** : Identical pair of alleles (TT or tt)
- **Heterozygous (Hybrid)** : Dissimilar pair of alleles (Tt)
- **Phenotype** : External & morphological appearance of character.
- **Genotype** : Genetic make up of an organism.
- **Punnett square** : It is a graphical representation to calculate the probability of all possible genotypes of offspring in a genetic cross.

2. MENDELISM:

- Gregor Johann Mendel, conducted hybridization experiments on garden pea (*Pisum sativum*).
- He studied seven pairs of contrasting characters.

S. No.	Characters	Dominant/Recessive	Chromosome No.
1.	Seed/Cotyledon colour	Yellow / Green	1st
2.	Flower colour	Violet / White	1st
3.	Pod Shape	Inflated / Constricted	4th
4.	Flower position	Axial/ Terminal	4th
5.	Stem length / Height	Tall/ Dwarf	4th
6.	Pod colour	Green/ Yellow	5th
7.	Seed shape	Round / Wrinkled	7th

- Mendel uses Emasculation, Bagging & Tagging technique for hybridization.
- Inheritance of one gene (Monohybrid Cross)
- Study of inheritance of one character at a time in an organism is called as monohybrid cross.
- Phenotypic / Mendelian Ratio = 3 : 1
- Genotypic / Real Ratio = 1 : 2 : 1

Conclusions of monohybrid cross :

(i) Postulate of Dominance:

- Characters are controlled by discrete units called factors .
- Factors occur in pairs .
- In a dissimilar pair of factors one member of the pair dominates the other .
- A dominant allele is wild type or unmodified allele, which produces normal enzyme/protein, that forms a character.
- A modified allele is a mutant allele, which could be responsible for the production of less-efficient enzyme or non-functional enzyme or no enzyme at all. Thus it will be a recessive allele.

(ii) Law of segregation (Law of purity of gametes) :

- This law is based on the fact that the alleles do not show any blending and that both the characters are recovered as such in the F₂ generation.

SOLVED EXAMPLE

Ex.1 The first great "geneticist" was

Or

Who is considered as father of genetics

- (A) Engler (B) Mendel
(C) Schwann (D) Miller

Sol. (B) : Gregor Johann Mendel (1822-1884 Austria) is known as father of genetics, because he was the first to demonstrate the mechanism of transmission of character from one generation to the other.

Ex.2 How many types of gametes may be produced by genotype D/d : E/e : F/f

Or

How many types of gametes will be produced by individuals having genotype AaBbCc

- (A) 27 (B) 8
(C) 9 (D) 6

Sol. (B) : Kinds of gametes may be calculated by following formula:

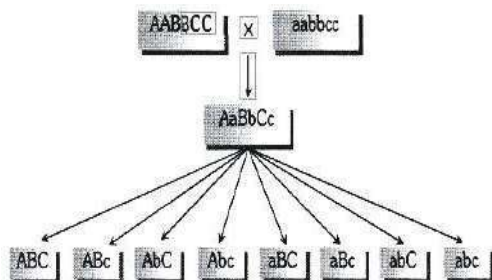
Number of gametes = $(2)^n$

n is number of alleles

Example : D/d : E/e : F/f have trihybrid cross i.e.,

n = 3 than

Kind of gametes = $(2)^3 = 2 \times 2 \times 2 = 8$



Ex.3 How many different kinds of gametes will be produced by a plant having the genotype MBbCC

- (A) Nine (B) Two
(C) Three (D) Four

Sol. (B)

Ex.4 An organism with two identical alleles for a given trait is

- (A) Homozygous (B) Segregating
(C) Dominant (D) A hermaphrodite

Sol. (A) : The homozygote is pure for the character and breeds true, that is, it gives rise to offspring having the same character on self breeding. e.g., TT or tt.

Ex.5 An exception to Mendel's law is

- (A) Law of independent assortment
(B) Law of segregation
(C) Law of dominance
(D) Law of linkage

Sol. (D) : Linkage is the tendency of two or more genes to inherit together. Mendel's law are true only in absence of linkage and gene interaction.

Ex.6 Some of the dominant traits studied by Mendel were

- (A) Round seed shape, constricted pod shape and axial flower position
(B) Green pod colour, inflated pod shape and axial flower position
(C) Yellow seed colour, violet flower colour and yellow pod colour
(D) Axial flower position, green pod colour and green seed colour

Sol. (B)

Ex.7 The colour based contrasting traits in seven contrasting pairs, studied by Mendel in pea plant were

- (A) 1 (B) 2 (C) 3 (D) 4

Sol. (C)

Ex.8 F_2 generation in a Mendelian cross showed that both genotypic and phenotypic ratios are same as 1 : 2 : 1. It represents a case of

- (A) Co-dominance
(B) Dihybrid cross
(C) Monohybrid cross with complete dominance
(D) Monohybrid cross with incomplete dominance

Sol. (D)

Ex.9 From a cross Aa BB × aa BB, following genotypic ratio will be obtained in F_1 generation

- (A) 1 Aa BB: 1 aa BB (B) 1 Aa BB: 3 aa BB
(C) 3 Aa BB: 1 aa BB (D) All Aa BB: No aa BB

Sol. (A) : AaBB x aaBB
Gametes for F_1 = AB, aB and aB, aB
After crossing = AaBB, aaBB
Ratio = 1: 1

Ex.10 In Antirrhinum two plants with pink flowers were hybridized. The F_1 plants produced red, pink and white flowers in the proportion of 1 red, 2 pink and 1 white. What could be the genotype of the two plants used for hybridization. Red flower colour is determined by RR, and white by rr genes

- (A) rrrr (B) RR
(C) Rr (D) rr

Exercise # 1

SINGLE OBJECTIVE

NEET LEVEL

1. Mendelism is related with
 (A) Heredity in living beings
 (B) Meiosis during sexual reproduction
 (C) Mutation in living organisms
 (D) None of the above
2. Mendel chose pea plants because
 (A) They were cheap
 (B) They were having seven pairs of contrasting characters
 (C) They were easily available
 (D) Of great economic importance
3. How many pairs of contrasting characters in pea pod were chosen by Mendel
 (A) 2 (B) 3
 (C) 4 (D) 7
4. When a gene exists in more than one form, the different forms are called
 (A) Heterozygous
 (B) Complementary genes
 (C) Genotypes
 (D) Alleles
5. The first law of Mendel
 (A) Law of inheritance
 (B) Law of variation
 (C) Law of independent assortment
 (D) Law of segregation
6. If in a garden pea plant, a cross is made between red flowered and white flowered plants. What will be the phenotypic ratio in F_2 generation
 (A) 1 : 2 : 1 (B) 9 : 3 : 3 : 1
 (C) 3 : 1 (D) 1 : 3
7. Mendel crossed a pure white-flowered recessive pea plant with a dominant pure red-flowered plant. The first generation of hybrids from the cross should show
 (A) 50% white-flowered and 50% red-flowered plants
 (B) All red-flowered plants
 (C) 75% red-flowered and 25% white-flowered plants
 (D) All white-flowered plants
8. In a plant, red fruit (R) is dominant over yellow fruit (r) and tallness (T) is dominant over shortness (t). If a plant with $RRtT$ genotype is crossed with a plant that is $rrtt$.
 (A) 75% will be tall with red fruit
 (B) All the offspring will be tall with red fruit
 (C) 25% will be tall with red fruit
 (D) 50% will be tall with red fruit
9. Which is the functional unit of inheritance
 (A) Cistron (B) Gene
 (C) Chromosome (D) Intron
10. A double heterozygous tall plant with yellow colour (colour of cotyledon) is selfed the ratio of dwarf plants with green cotyledon is
 (A) $\frac{1}{16}$ (B) $\frac{1}{4}$
 (C) $\frac{1}{6}$ (D) $\frac{2}{16}$
11. In F_2 generation of monohybrid cross the cause of 1 : 2 : 1 phenotypic ratio is
 (A) Epistatics
 (B) Inhibition
 (C) Quantitative inheritance
 (D) Incomplete dominance
12. When an albino female plant of maize is crossed with normal green male plant, all plants in the progeny are albino because
 (A) Plastids are inherited through maternal plants
 (B) Albinism is dominant over green character
 (C) The crossing results in structural changes in green plastids
 (D) Green plastids of male parents become mutated
13. In *Mirabilis jalapa*, when homozygous red-flowered and white-flowered plants are crossed, all F_1 plants have pink-coloured flowers. In F_2 produced by selfing of F_1 individuals, red, pink and white flowered plants appear respectively in the ratio of or What will be the ratio in F_2 generation if red-flowered variety of *Mirabilis jalapa* is crossed with white-flowered variety
 (A) 1 : 1 : 1 : 1 (B) 1 : 2 : 1
 (C) 2 : 1 (D) 3 : 1

PRINCIPLES OF INHERITANCE AND VARIATION

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

- In genetics, the use of checker board was done by
(A) Mendel (B) Correns
(C) Punnet (D) Darwin
- Who has put forth Mendel's conclusions in the form of laws
(A) Bateson (B) Correns
(C) Punnet (D) Johanssen
- In 1900 A.D. three biologists independently discovered Mendel's principles. They are
(A) De Vries, Correns and Tschermak
(B) Sutton, Morgan and Bridges
(C) Avery, McLeod and McCarthy
(D) Bateson, Punnet and Bridges
- Preformation theory concerning transmission of characters was given by
(A) Swamerdom (B) Aristotle
(C) Wolf (D) Pythagorous
- Which of the following has been used for genetic researches
(A) *Pisum* (B) *Neurospora*
(C) *E. coli* (D) All the above
- Who out of the following was of the strong opinion that acquired characteristics are inherited
(A) Lamarck (B) Lysenko
(C) Mendel (D) Huxley
- Who gave first experimental evidence of the polygenic concept of inheritance
(A) Galton (1883) (B) Malthus (1828)
(C) Nilsson Ehle (D) None of the above
- Self sterility in "Nicotiana" was reported by
(A) Morgan (B) East
(C) Crick (D) Goldberg
- A complete set of chromosomes inherited as a unit from one parent, is known as
(A) Karyotype (B) Gene pool
(C) Genome (D) Genotype
- Dominant character in tomato is
(A) Red fruit (B) Rounded fruit
(C) Violet stem (D) All the above
- Organism of pure line is that which produce individuals of
(A) Dominant characters (B) Recessive characters
(C) Its own characters (D) Intermediate type
- For obtaining hybrid ratio which characters of the plant are taken into account
(A) Dominant characters (B) R e c e s s i v e characters
(C) New characters (D) All the above
- Which of the following is regarded as *Drosophila* of the fungal world
(A) *Neurospora* (B) *Aspergillus*
(C) *Mucor* (D) *Penicillium*
- What is the practical utility of genetics
(A) Improvement in qualities of pet animals
(B) Improvement in crop quality
(C) Improvement in qualities of man
(D) All the above
- If an offspring shows any one of the characters of either of parents, the
(A) Character is said to be hereditary
(B) Offspring is hereditary
(C) The character is related with cytoplasm
(D) None of the above
- Mendel is famous for his work on
(A) *Pisum* (B) *Drosophila*
(C) *Neurospora* (D) *Oenothera*
- The F_2 dihybrid ratio 9 : 3 : 4 is explained on the basis of
(A) Epistatic gene
(B) Supplementary gene
(C) Allelic interaction
(D) Complementary gene interaction
- The phenomenon of incomplete dominance was observed by
(A) De Vries (B) Correns
(C) Tschermak (D) None of the above
- What is the other name for "incomplete dominance"
(A) Blending inheritance (B) Co-dominance
(C) Pseudo-dominance (D) All the above
- In poultry, new comb colour appears by collaboration of two dominant gene is
(A) Walnut (B) Single
(C) Rose (D) Pea

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match the genetic phenomena with their respective ratios
- | | |
|---------------------------------------|---------------------------------------|
| Column - I | Column - II |
| A. Inhibitory gene ratio | 1. 9 : 3 : 4 |
| B. Complementary gene ratio | 2. 1 : 1 : 1 : 1 |
| C. Recessive epistasis ratio | 3. 12 : 3 : 1 |
| D. Dihybrid test cross ratio | 4. 13 : 3 |
| E. Dominant epistasis ratio | 5. 9 : 7 |
| (A) A - 5; B - 4; C - 3; D - 2, E - 1 | (B) A - 4; B - 5; C - 1; D - 2, E - 3 |
| (C) A - 1; B - 2; C - 4; D - 3, E - 5 | (D) A - 2; B - 1; C - 4; D - 5, E - 3 |
| (E) A - 5; B - 4; C - 1; D - 2, E - 3 | |
2. Match column I with column II and select the correct option
- | | |
|--------------------------------|--------------------------------|
| Column - I | Column - II |
| A. Ophioglossum | 1. 23 |
| B. Rice | 2. 24 |
| C. Potato | 3. 12 |
| D. Man | 4. 630 |
| (A) A - 1, B - 2, C - 3, D - 4 | (B) A - 2, B - 3, C - 4, D - 1 |
| (C) A - 3, B - 4, C - 2, D - 1 | (D) A - 4, B - 3, C - 2, D - 1 |
| (E) A - 4, B - 3, C - 2, D - 1 | |
3. Match the numbers of genes given in Column - I with names of organisms in Column - II and choose the correct alternatives
- | | |
|---------------------------------------|---------------------------------------|
| Column - I | Column - II |
| A. 450 to 700 genes | 1. Escherichia coli |
| B. 4000 genes | 2. Drosophila melanogaster |
| C. 13,000 genes | 3. Mycoplasma |
| D. 32, 000 to 50, 000 genes | 4. Homo sapiens |
| E. 35, 000 to 45, 000 | 5. Oryza sativa |
| (A) A - 2; B - 1; C - 5; D - 3; E - 4 | (B) A - 3; B - 1; C - 2; D - 5; E - 4 |
| (C) A - 3; B - 2; C - 1; D - 5; E - 4 | (D) A - 2; B - 3; C - 1; D - 5; E - 4 |
| (E) A - 1; B - 3; C - 2; D - 5; E - 4 | |
4. Match the following
- | | |
|---|------------------------|
| Column - I | Column - II |
| A. XX - OX, method of sex determination | (i) Heterogametic |
| B. 1.5 X/A ratio | (ii) Turner's syndrome |
| C. Karyotype 45 | (iii) Hemiptera |
| D. ZW - ZZ method of sex determination | (iv) Metafemale |
| A | B |
| (A) (i) | (iv) |
| (B) (iii) | (iv) |
| (C) (iv) | (i) |
| (D) (i) | (iv) |
| C | D |
| (iii) | (ii) |
| (ii) | (i) |
| (ii) | (iii) |
| (ii) | (iii) |

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. Which one of the following characters studied by Mendel in garden pea was found to be dominant ?
[CBSE AIPMT 2000]
(A) Green seed colour
(B) Terminal flower Position
(C) Green Pod colour
(D) Wrinkled seed
2. Mutation generally Produces [CBSE AIPMT 2000]
(A) recessive genes (B) lethal genes
(C) polygenes (D) dominant genes
3. Drosophila flies with XXY genotype femals, but human beings with such genotype are abnormal males. It shows that [CBSE AIPMT 2000]
(A) Y-chromosome is essential for sex determination in Drosophila
(B) Y-chromosome is female determining in Drosophila
(C) Y-chromosome is male determining in human beings
(D) Y-chromosome has no role in sex determination either in Drosophila or in human beings
4. During the organ differentiation in Drosophila, an organ is modified to another organ (such as wings may be replaced by legs). Genes responsible for such metamorphosis are called [CBSE AIPMT 2000]
(A) double dominant genes
(B) plastid genes
(C) complementary genes
(D) homeotic genes
5. Ratio of complementary genes is [CBSE AIPMT 2001]
(A) 9 : 3 : 4 (B) 12 : 3 : 1
(C) 9 : 3 : 3 : 4 (D) 9 : 7
6. A and B genes are linked. What shall be the genotype of progeny in a cross between AB/ab and ab/ab ? [CBSE AIPMT 2001]
(A) AAbb and aabb (B) AaBb and aabb
(C) AABB and aabb (D) None of these
7. Two non-allelic genes produce the new phenotype when present together but fail to do so independently, it is called [CBSE AIPMT 2001]
(A) epistasis
(B) polygene
(C) non-complementary gene
(D) complementary gene
8. Male XX and female XY sometime occur due to [CBSE AIPMT 2001]
(A) deletion
(B) transfer of segments in X and y-chromosomes
(C) aneuploidy
(D) hormonal imbalance
9. Number of Barr bodies in XXXX female [CBSE AIPMT 2001]
(A) 1 (B) 2
(C) 3 (D) 4
10. Extranuclear inheritance occurs in [CBSE AIPMT 2001]
(A) Killer Paramecium (B) Killer Amoeba
(C) Euglena (D) Hydra
11. Which of these do not follow independent assortment ? [CBSE AIPMT 2001]
(A) Genes on non-homologous chromosomes and absence of linkage
(B) Genes on homologous chromosomes
(C) Linked genes on same chromosome
(D) Unlinked genes on same chromosome
12. In his experiment, Mendel obtained wrinkled pea. The wrinkling was due to deposition of sugar instead of starch. This happened due to the enzyme [CBSE AIPMT 2001]
(A) amylase
(B) invertase
(C) diastase
(D) absence of starch-branching enzyme
13. A plant of F₁-generation has genotype 'AABbCC'. On selfing of this plant, the phenotypic ratio in F₂-generation will be [CBSE AIPMT 2002]
(A) 3 : 1
(B) 1 : 1
(C) 9 : 3 : 3 : 1
(D) 27 : 9 : 9 : 9 : 3 : 3 : 3 : 1
14. Change in the sequence of nucleotide in DNA is called as [CBSE AIPMT 2002]
(A) mutagen (B) mutation
(C) recombination (D) translation
15. Pleiotropic gene is [CBSE AIPMT 2002]
(A) haemophilia (B) thalassemia
(C) sickle-cell anaemia (D) colour blindness

MOCK TEST

- Among the seven pairs of contrasting traits in pea plant as studied by Mendel, the number of traits related to flower, pod and seed respectively were
(A) 2,2,2 (B) 2,2,1 (C) 1,2,2 (D) 1,1,2
- In Mendel's seven contrasting traits of pea total number of colours tested by him was
(A) 2 (B) 3 (C) 4 (D) 5
- Mendel conducted hybridisation experiments on garden peas for
(A) 7 years (B) 6 years (C) 5 years (D) 4 years
- Mendel selected *Pisum sativum* for his experimental investigations among various plants available in the Monastery garden, Which of the following can be a reason for this?
(A) It has a short life cycle.
(B) It has distinctive, contrasting traits like tall and dwarf plant.
(C) It easily undergoes self pollination
(D) All of these
- The experimental material in Mendel's experiment was
(A) *Pisum sativum* (B) *Oryza sativa*
(C) *Mirabilis jalapa* (D) None of these
- In his classic experiments on pea plants. Mendel did not use
(A) seed shape (B) flower position
(C) seed colour (D) pod length.
- A tall true breeding garden pea plant is crossed with a dwarf true breeding garden pea plant. When the F_1 plants were selfed the resulting genotypes were in the ratio of
(A) 3 : 1 :: Tall : Dwarf (B) 3 : 1 :: Dwarf : Tall
(C) 1 : 2 : 1 :: Tall homozygous : Tall heterozygous (D) 1 : 2 : 1 :: Tall heterozygous : Tall homozygous : Dwarf
- If 'A' represents the dominant gene and 'a' represents its recessive allele, which of the following would be the most likely result in the first generation offspring when Aa crossed with aa?
(A) All will exhibit dominant phenotype.
(B) All will exhibit recessive phenotype.
(C) Dominant and recessive phenotypes will be 50% each.
(D) Dominant phenotype will be 75%
- In rabbits, the gene for grey fur (G) is dominant over that for black fur (g). In a litter, If 50% rabbits are grey, then the possible parental cross combination is
(A) GG × Gg (B) GG × GG (C) gg × gg (D) Gg × gg
- Two pink flowered snapdragon plants (Rr) are self-pollinated. The probability of the offsprings to have white flowers are
(A) 25% (B) 50% (C) 75% (D) 2.5%

www.blog.neetnearme.com

SEXUAL REPRODUCTION IN FLOWERING PLANTS

“A great teacher is not simply one who imparts knowledge to his students, but one who awakens their interest in it and makes them eager to pursue it for themselves. He is a spark plug, not a fuel pipe. The reason colleges exist is to bring students into contact with contagious personalities, for otherwise they might as well be correspondance schools.”

“EDMUND WARE SINNOTT (1942-1968)”

INTRODUCTION

The myriads of flowers that we enjoy gazing at, the scents and the perfumes that we swoon over, the rich colours that attract us, are all there as an aid to sexual reproduction. reproduction is a vital process without which species cannot survive for long.

An individual increases its number by asexual or sexual means. Sexual mode of reproduction enables creation of new variants so that survival advantage is enhanced. Flowers do not exist only for us to be used for our own selfishness. all flowering plants show sexual reproduction. If we look at the diversity of structures of the inflorescences, flowers and a floral parts, it shows an amazing range of adaptations to ensure formation of the end products of sexual reproduction, the seeds as well as fruits.

This chapter will help us to deal and understand the morphology, processes and structure of sexual reproduction in flowering plants (angiosperms).

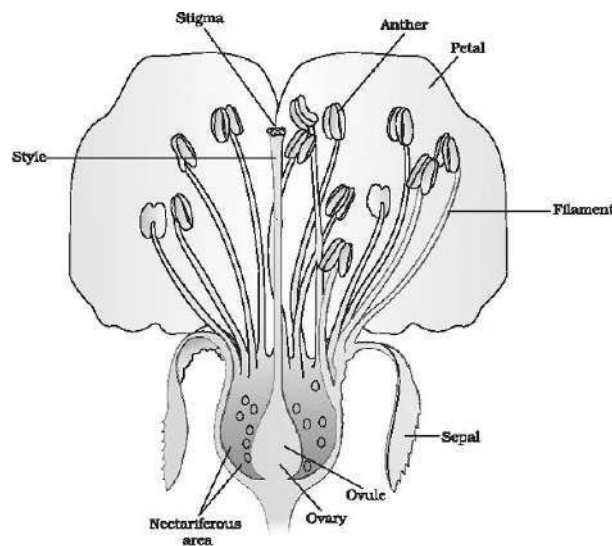
SEXUAL REPRODUCTION IN FLOWERING PLANTS

INTRODUCTION

- **Angiosperm** originated in **Mesozoic era**.
- Angiosperm originated either in the beginning of **Cretaceous** period or in ending of **Jurassic period** of **Mesozoic era**. It means they are originated between **Cretaceous** and **Jurassic** period on the earth.
- **Angiosperm** dominated over the earth in **Coenozoic era**. So this era is known as “**Golden Period of Angiosperms**”.
- First of all **N. Grew** realized the fact, that Stamens are **male sex organ** of flower (**Anatomy of plants**)
- **Sexuality** in plant first of all reported by **Jacob Camerarius**.
- He reported **Anthers are the male sex organ** and **Ovary with style and stigma** are **female sex organ** and for the formation of seed, interaction is essential in between both the sex organs.
- **Significance of pollination** and **role of insects in pollination** was recognized by **Josheph Kolreuter**.
- **C.F. Wolf** – **Father of plant Embryology**.
- **Prof. P. Maheshwari** – **Father of Indian plant Embryology**. He wrote a book – ‘**An Introduction to Embryology of Angiosperms**’.

CLASSIFICATION

- Class - Dicotyledonae
- Subclass - Polypetalae
- Series - Thalamiflorae
- Order - Parietals
- Family - Cruciferae or Brassicaceae
- Genus - **Capsella**
- Species - **Bursa pastoris** [Common name “**Shepherd’s purse**”]



STRUCTURE OF FLOWER

SEXUAL REPRODUCTION IN FLOWERING PLANTS

- Difference between Monocotyledonous and Dicotyledonous seed :

S.No.	Monocotyledonous Seeds	Dicotyledonous Seeds
(i)	Only single cotyledon is present with embryo	Two cotyledon are present with embryo
(ii)	Generally cotyledon is thin or papery	Cotyledons are thick
(iii)	Generally seeds are endospermic	Generally seeds are non endospermic, some times may be endospermic
(iv)	Cotyledon is also called scutellum	Not called by this name
(v)	In seed plumule is covered by coleoptile and radicle is covered by coleorhiza.	Coleoptile and coleorhiza are not formed
(vi)	Plumule is in lateral position and cotyledon are in terminal position	Plumule is in terminal position and cotyledons are present in lateral position
(vii)	Radicle degenerates after sometime and adventitious roots are formed at that place.	Radicle is responsible to form primary root.
(viii)	In some of the seeds, seed coats and cotyledon fused together e.g. Wheat etc.	Such types of seeds are not found.



ED OS KEY POINTS

- **Self incompatibility** –
- It is recognized in 66 families of angiosperms.
- Morphologically self incompatibility is of two types :
 - (A) Heteromorphic self incompatibility
 - (B) Homomorphic self incompatibility
- (A) **Heteromorphic self incompatibility** – Occurrence of two (distyly) or three (tristyly) morphologically distinct mating type within a species, which can be easily recognized without a breeding test.
- The difference in the mating type is generally in the relative length of stamen and style
- **Ex.** Primula, Lathyrum
- (B) **Homomorphic self incompatibility** – In this type all the mating type within a species are morphologically similar and requires proper breeding test, for their recognition.
- Depending upon the origin of factors determining the mating type on pollen side it is of two types
 - (i) Gametophytic self incompatibility (GSI)
 - (ii) Sporophytic self incompatibility (SSI)
- When two pollen tubes enter in an ovule and release their contents, it is possible that the egg may be fertilized by one male gamete from one tube and triple fusion may involve participation of male gamete from another tube.
- This phenomenon is called **Heterofertilization** eg. Zea mays.
- When the entry of male gamete is not accompanied by fusion. This phenomenon is called **semigamy**.
- The percentage of pollen germination and tube growth is better in large populations. This is called as '**population effect**' or '**crowding effect**'
- **B-Ca-inositol of Sugar complex** acts as **chemotropic agent for pollen tube growth**.
- Highest amount of **fat** is found in endosperm of **Coconut**.
- Embryonic development of **Capsella** is **endoscopic** because it is developed towards chalazal region of the zygote.

1. Flower :

- Flowers are objects of aesthetic senses, ornamental, social, religious and cultural values."Flowers are morphological embryological marvels and site of sexual reproduction in Angiosperms."In the opinion of biologist as two of the four parts, Androecium and gynoecium are the important or sexual part of the plants."A flower is a modified shoot for reproduction."Flowers bears reproductive organs where gametes are produced. Androecium represents the male reproductive organ and it consist of two parts (1) Anther (2) Filament"
- A typical anther is bilobed, dithecous and tetrasporangiate. Two microsporangia are present in each lobe of anther."After maturation two microsporangia of each lobe fused together, hence mature anther has two microsporangia.

2. Microsporangia :

- Microsporangia surrounded by four layers:-
- (i) Epidermis- outer single celled thick layer.
 - (ii) Endothecium - It helps in dehiscence of anther.
 - (iii) Middle layer - it stores food.
 - (iv) Tapetum - nutritive. It is diploid/polyploid.

3. Microsporogenesis :

- During the sporogenesis, every cells of sporogenous tissues (microspore mother cell) can give rise to tetrad of microspores through meiosis. Normally tetrad of microspores are tetrahedral in shape. Each microspore mature intopollen grain.

4. Pollen grain :

- Pollen grains are bilayered in structure. Its outer layer is exine. It is made up of sporopollenin which is highly biological resistant material."Inner layer is made up of pectocellulose. Germ pores are present on exine. The viability of pollen grains depends on temperature and humidity.

5. Microgametogenesis :

- After germination, mature pollen grain contain two cells :-
- (A) Bigger is vegetative cell with large nucleus
 - (B) Smaller cell is generative cell with small nucleus.
- Some times it is three celled stage. Generally pollen grains shed at two celled stage.
- Pollen grain can be stored for many years in liquid nitrogen (-196°) in pollen banks.

6. Carpel/Pistil :

- Carpel is unit of gynoecium and consist of three part :-
- (i) Stigma
 - (ii) Style
 - (iii) Ovary - one/many ovules attached with placenta inside the ovary

SOLVED EXAMPLE

Ex.1 Which one of the following is resistant to enzyme action

- (A) Pollen exine (B) Leaf cuticle
(C) Cork (D) Wood fibre

Sol. (A)

Ex.2 Pollengrain develops from _____ of anther

- (A) Epidermis
(B) Endothecium
(C) Tapetum
(D) Sporogenous tissue

Sol. (D)

Ex.3 Male gametes in angiosperms are formed by the division of

- (A) Microspore
(B) Generative cell
(C) Vegetative cell
(D) Microspore mother cell

Sol. (B) : Generative cell divides into two male gametes, if it has not divided already.

Ex.4 Exine of pollen grains is composed of

- (A) Pectocellulose (B) Lignocellulose
(C) Sporopollenin (D) Pollenkitt

Sol. (C) : Exine is made up of sporopollenin (derived from carotenoid).

Ex.5 The pollen grain is

- (A) An immature male gametophyte
(B) A mature male gametophyte
(C) Partially developed a male gametophyte
(D) Last stage of male gametophyte

Sol. (C) : Pollen grain is partially developed male gametophyte because the rest of the development is completed on stigma when pollen grains start to germinate and produces pollen tube having two male nuclei.

Ex.6 If there are 1280 microspores in a tetralocular anther, how many microspore mother cells will be there in its each pollen chamber

- (A) 80 (B) 160
(C) 240 (D) 1280

Sol. (A)

Ex.7 If you want to develop hybrid seeds within a bisexual flower which of the following parts need to be removed from the same flower

- (A) Stigma (B) Ovary
(C) Anther (D) Oviduct

Sol. (C)

Ex.8 If the number of chromosomes in root cells is 14, what will be the number of chromosomes in synergids cells of an ovule of that parent

- (A) 7
(B) 14
(C) 21
(D) Incomplete information

Sol. (A) : 7; the number of chromosomes in root cells is $2n$ while it is n in synergids because it develops by reductional division.

Ex.9 Which one of the most common embryo sac in flowering plant

- (A) Monosporic 8 nucleated and 7 celled
(B) Monosporic' 7 celled and 7 nucleated
(C) Bisporic, 8 nucleated and 7 celled
(D) Bisporic, 7 nucleated and 8 celled

Sol. (A)

Ex.10 Synergids of the polygonum type embryo sac are

- (A) Haploid (B) Diploid
(C) Triploid (D) Polyploid

Sol. (A) : AH cells in the ovule (integument, nucellus, funicle, hilum) are diploid ($2x$) but embryo sac (synergids, antipodal cells, egg cell) is haploid.

Ex.11 Presence of many embryos (Polyembryony) is a characteristic feature of

- (A) Citrus (B) Mango
(C) Banana (D) None of these

Sol. (A) : In angiosperms, citrus have two or more than two embryos in one seed. It is called polyembryony.

Ex.12 A dicotyledonous plant bears flowers but never produces fruits and seeds. The most probable cause for the above situation is

- (A) Plant is dioecious and bears only pistillate flowers
(B) Plant is dioecious and bears both pistillate and staminate flowers
(C) Plant is monoecious
(D) Plant is dioecious and bears only staminate flowers

Sol. (D)

Exercise # 1

SINGLE OBJECTIVE

NEET LEVEL

1. Intine of pollen grains is composed of
(A) Lipid and protein (B) Cellulose and pectin
(C) Lignin and cutin (D) Pectin and lignin
2. Anther is generally composed of
(A) One sporangium (B) Two sporangium
(C) Three sporangium (D) Four sporangium
3. A microspore mother cell forms
(A) An ovule (B) An embryo sac
(C) A pollen sac (D) Pollen grains
4. At the time of pollination, how many cells are formed in the pollen grains
(A) One (B) Two
(C) Three (D) Four
5. Generally in the wall of the anther lobes how many middle layers are formed
(A) Seven (B) Three
(C) Six (D) Nine
6. Branched type of pollen tube is formed in
(A) *Cucurbita* (B) *Salvia*
(C) China rose (D) *Solanum*
7. Endothecium layer of anther lobes is present
(A) Outside the epidermis
(B) Just inside the epidermis
(C) In the innermost layer
(D) In the middle region
8. If the leaf cell has 8 chromosomes, it is most likely that
(A) Zygote will have 4 chromosomes
(B) Gametes will have 8 chromosomes
(C) Gametes will have 4 chromosomes
(D) Zygote will have 16 chromosomes
9. During meiosis in pollen mother cell the daughter cells are interconnected by passages. The whole structure is called
(A) Symplast (B) Plasmodesmata
(C) Sycytium (D) Coenocyte
10. Before dehiscence of anther
(A) Middle layers enlarge
(B) Endothecium develops fibrous thickenings
(C) Tapetum develops fibrous thickenings
(D) Epidermis degenerates
11. Pollinia are sac like structures
(A) Which secrete yellow substance called pollen kit
(B) Which are found in megasporangia
(C) In which anther lobes are present
(D) In which pollen grains are present in mass
12. Tectum, baculum, foot layer are the different parts of
(A) Microspore wall
(B) Microspore mother cell wall
(C) Megaspore wall
(D) Megaspore mother cell wall
13. A schematic illustration of the pollen grain is called
(A) Pollenogram (B) Palenogram
(C) Histogram (D) Parallelogram
14. If the developing microspore mother cells draw nourishment by contacting the tapetal cells, the type of tapetum is called
(A) Plasmodial tapetum (B) Secretory tapetum
(C) Amoeboid tapetum (D) Endothelium
15. The function of endothecium is
(A) Nutritional (B) Mechanical support
(C) Dehiscence (D) Protection
16. One pollen mother cell may produce four germinating pollen grains, each with two male nuclei and one tube nucleus. How many meiotic divisions are necessary to bring this about
(A) Two (B) One
(C) Three (D) Four
17. The germ pores on the pollen grains are found on the
(A) Exine only (B) Intine only
(C) Both exine and intine (D) Vegetative cell
18. Generally how many megaspores take part in the development of female gametophyte
(A) One (B) Two
(C) Three (D) Four
19. The cells in embryo sac which act as haustoria are
(A) Antipodal cells
(B) Synergids
(C) Egg and synergids
(D) Antipodals and synergids

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. In a pollen grain, larger nucleus is
(A) Generative nucleus (B) Tube nucleus
(C) Vegetative nucleus (D) None of these
2. Development and formation of pollen grains in anther of the stamen is known as
(A) Pollination (B) Fertilization
(C) Microsporogenesis (D) Megasporesogenesis
3. Which of the following is correct statement
(A) Gametes are diploid
(B) Spores are invariably haploid
(C) Spores and gametes are invariably haploid
(D) Gametes are invariably haploid
4. In anther culture, the androgenic haploid plants are obtained from
(A) Young pollen grain (B) Connective tissue
(C) Anther tapetum (D) Anther wall
5. In monocots, male gametophyte is
(A) Microspore (B) Megaspore
(C) Tetrad (D) Nucellus
6. The odd one is
(A) Micropyle (B) Embryosac
(C) Nucellus (D) Pollen grain
7. In plants meiosis occurs in
(A) Anther (B) Root tip
(C) Cambium (D) Pollen grain
8. Microsporogenesis is a synonym for
(A) Spermatogenesis
(B) Development of pollen
(C) Development of male gametophyte
(D) Development of female gametophyte
9. In anther culture, some diploid plants were reported with haploids. They have evolved from
(A) Prothallial cell of pollen grain
(B) Generative cell of pollen grain
(C) Cell of anther wall
(D) Exine of pollen grain
10. The anther wall consists of four wall layers where
(A) Endothecium lies inner to middle layers
(B) Tapetum lies just inner to endothecium
(C) Tapetum lies next to epidermis
(D) Middle layers lie between endothecium and tapetum
11. A typical anther wall has
(A) Endothecium and endothecium
(B) Endothecium and tapetum
(C) Exothecium, endothecium and tapetum
(D) Exothecium and tapetum
12. In flowering plants, a mature 'male gametophyte' is derived from a 'pollen mother cell' by
(A) Three mitotic divisions
(B) One meiotic and two mitotic divisions
(C) Two meiotic divisions
(D) A single meiotic division
13. Palynology deals with the study of
(A) Pollen grains (B) Chromosomes
(C) DNA (D) Genes
14. Which of the following is not functionally analogous with others in the group
(A) Archegonium (B) Oogonium
(C) Antheridium (D) Ovule
15. The microscopic structure in flower that contains polar nuclei is
(A) Only gametophyte (B) Pollen tube
(C) Embryo sac (D) None of the above
16. Collar like outgrowth arising from the base of ovule and forming a sort of third integument is known as
(A) Coma (B) Caruncle
(C) Aril (D) Operculum
17. Filiform apparatus is found in which part of angiosperms
(A) Sperm (B) Antipodal
(C) Egg (D) Synergid
18. An orthotropous ovule is one in which micropyle and chalaza are
(A) In straight line of funiculus
(B) Parallel to funiculus
(C) At right angles to funiculus
(D) Oblique to funiculus
19. The ovule in pea are
(A) Anatroous (B) Hemianatroous
(C) Campylotropous (D) Amphitropous
20. Mature embryo sac contains or A normal angiosperm embryo sac at the final stage of development has
(A) 4 cells (B) 3 cells
(C) 7 cells (D) 8 cells

Exercise # 3**PART - 1****MATRIX MATCH COLUMN**

1. Match the items in column -I with those in column - II and choose the correct answer

Column - I

- A. Funicle
- B. Integuments
- C. Chalaza
- D. Hilum
- E. Micropyle

- (A) A -ii; B - iii; C - v; D - iv; E - i
- (C) A -ii; B - iii; C - i; D - iv; E - v
- (E) A -iii; B - iv; C - v; D - i; E - ii

Column - II

- i. Small opening of ovule
- ii. Stalk of ovule
- iii. Protective envelopes of ovules
- iv. Junction part of ovule
- v. Basal part of the ovule

- (B) A -i; B -iii; C - ii; D - iv; E - v
- (D) A -ii; B - iv; C - v; D - i; E - iii

2. Match the entries in Column - I with those of Column- II and choose the correct answer

Column - I

- A. Cleistogamy
- B. Geitonogamy
- C. Entomophily
- D. Xenogamy

- (A) A - iii; B - i; C - v; D - ii
- (C) A - ii; B - iii; C - i; D - v

Column - II

- i. Insect pollination
- ii. Bud pollination
- iii. Pollination between flowers in the same plant
- iv. Wind pollination
- v. Cross pollination

- (B) A - i; B - v; C - ii; D - iii
- (D) A - v; B - iv; C - iii; D - ii

3. Match the following

Column - I

- A. Zoophily
- B. Ornithophily
- C. Entomophily
- D. Chiropterophily

- (A) A - iii; B - ii; C - i; D - iv
- (C) A - iv; B - i; C - ii; D - iii
- (E) A - iv; B - ii; C - iii; D - i

Column - II

- i. Pollination by birds
- ii. Pollination by insect
- iii. Pollination by bats
- iv. Pollination by animals

- (B) A - i; B - ii; C - iii; D - iv
- (D) A - iv; B - i; C - ii; D - iii

4. Match Column -I with Column - II and select the correct option from the codes given below.

Column - I

- A. Tallest flower
- B. Pronuba moth
- C. Anemophily
- D. Entomophily

- (A) A - ii; B - iv; C - i; D - iii
- (C) A - iii; B - ii; C - i; D - iv

Column - II

- i. Maize
- ii. Amorphophallus
- iii. Salvia
- iv. Yucca

- (B) A - ii; B - iv; C - iii; D - i
- (D) A - iv; B - iii; C - ii; D - i

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. Double fertilisation leading to initiation of endosperm in angiosperms require [CBSE AIPMT 2000]
(A) Fusion of one polar nucleus and the second male gamete only
(B) Fusion of two polar nuclei and the second male gamete
(C) Fusion of four or more polar nuclei and the second male gamete only
(D) All of the above kinds of fusion in different angiosperms
2. Eight nucleate embryo sacs are [CBSE AIPMT 2000]
(A) always tetrasporic
(B) always monosporic
(C) always bisporic
(D) Sometimes monosporic, sometimes bisporic and sometimes tetrasporic
3. Anemophily type of pollination is found in [CBSE AIPMT 2001]
(A) Salvia (B) Bottle brush
(C) Vallisneria (D) Coconut
4. Adventive embryony in Citrus is due to [CBSE AIPMT 2001]
(A) nucellus (B) integuments
(C) zygotic embryo (D) fertilised egg
5. In angiosperms all the four microspores of tetrad are covered by a layer which is formed by [CBSE AIPMT 2002]
(A) pectocellulose (B) callose
(C) cellulose (D) sporopollenin
6. What is the direction of micropyle in anatropous ovule ? [CBSE AIPMT 2002]
(A) Upward (B) Downward
(C) Right (D) Left
7. In angiosperms pollen tubes liberate their male gametes into the [CBSE AIPMT 2002]
(A) central cell (B) antipodal cell
(C) egg cell (D) synergid
8. Which tupe of association is found in between entomophilious flower and pollinating agent ? [CBSE AIPMT 2002]
(A) Mutualism (B) Commensalism
(C) Cooperation (D) Co-evolution
9. In a flowering plant, archesporium gives rise to [CBSE AIPMT 2003]
(A) only tapetum and sporogenous cells
(B) only the wall of the sporangium
(C) both wall and the sporogenous cells
(D) wall and the tapetum
10. An ovule which becomes curved so that the nucellus and embryo sac lie at right angles to the funicle is [CBSE AIPMT 2003]
(A) hemitropous (B) campylotropous
(C) anatropous (D) orthotropous
11. Through which cell of the embryo sac, does the pollen tube enter the embryo sac [CBSE AIPMT 2005]
(A) egg cell (B) persistant synergid
(C) degenerated synergid (D) central cell
12. In a type of apomixis known as adventive embryony, embryos develop directly from the [CBSE AIPMT 2005]
(A) nucellus or integuments
(B) zygote
(C) synergids or antipodals in an embryo sac
(D) accessory embryo sac in the ovule
13. Which one of the following represents an ovule, where the embryo sac becomes horse shoe-shaped and the funiculus and micropyle are close to each other ? [CBSE AIPMT 2005]
(A) Amphitropous (B) Circinotropous
(C) Atropous (D) Anatropous
14. What would be the number of chromosomes in the cells of the aleuron layer in a plant species with 8 chromosomes in its synergids ? [CBSE AIPMT 2006]
(A) 24 (B) 32
(C) 8 (D) 16
15. The arrangement of the nuclei in a normal embryo sac in the dicot plants is [CBSE AIPMT 2006]
(A) 3 + 2 + 3 (B) 2 + 3 + 3
(C) 3 + 3 + 2 (D) 2 + 4 + 2
16. Which one of the following is surrounded by a callose wall ? [CBSE AIPMT 2007]
(A) Microspore mother cell (B) Male gamete
(C) Egg (D) Pollen grain

SEXUAL REPRODUCTION IN FLOWERING PLANTS

MOCK TEST

- In a dithecos anther, each pollen sac contain 1000 MMC. What is the total number of pollen grains produced by the anther ?
(A) 16,000 (B) 4,000 (C) 32,000 (D) 8,000
- Which of these is not a part of the anther wall ?
(A) Epidermis (B) Middle layers (C) Endothecium (D) Nucellus
(E) Tapetum
- The fibrous bands develop from cells of the anther wall layer known as
(A) Epidermis (B) Endothecium (C) Middle layers (D) Tapetum
- Which one of the following statements is not true ?
(A) Pollen grains of many species cause severe allergies.
(B) Stored pollen in liquid nitrogen can be used in the crop breeding programmes.
(C) Tapetum helps in the dehiscence of anther.
(D) Exine of pollen grains is made up of sporopollenin.
- In majority of angiosperms
(A) Egg has a filiform apparatus
(B) There are numerous antipodal cells
(C) Reduction division occurs in the megaspore mother cells
(D) A small central cell is present in that embryo sac.
- Match the items in column I with those in column II and choose the correct answer.

Column I	Column II
1. Funicle	A. Small opening of ovule
2. Integuments	B. Stalk of ovule
3. Chalaza	C. Protective envelopes of ovule
4. Hilum	D. Junction part of ovule and stalk
5. Micropyle	E. Basal part of the ovule

(A) 1-B ; 2-C ; 3-E ; 4-D ; 5-A
(B) 1-A ; 2-C ; 3-B ; 4-D ; 5-E
(C) 1-B ; 2-C ; 3-A ; 4-D ; 5-E
(D) 1-B ; 2-D ; 3-E ; 4-A ; 5-C
(E) 1-C ; 2-D ; 3-E ; 4-A ; 5-B
- In angiosperms, microsporogenesis and mega-sporogenesis
(A) Involve meiosis (B) Occur in ovule
(C) Occur in anther (D) Form gametes without further divisions
- Consider the following statements and choose the correct option.
A. The ovule is attached to the placenta by means of a stalk called filament.
B. the ovule fuses with the stalk in the region called hilum.
C. The two protective envelopes of ovule are called integuments.
D. The small opening in the tip of ovule are called germ pore.
Of the above statements
(A) A and D are correct (B) A and C are correct (C) B and D are correct (D) B and C are correct
(E) C and D are correct

www.blog.neetnearme.com

TRANSPORT IN PLANTS

“For each of us who appear to have had a successful experiment there are many to whom their own experiments seem barren and negative.”

“ MELVIN CALVIN (1911-1997)”

INTRODUCTION

It is a matter of wonderment that how water reaches the top of tall trees. How and why substances move from one cell to the other or whether all substances move in a similar way? To understand some of the transport processes that take place in plants, one needs to know that plants need to move molecules over very long distances, much more than animals do; they also do not have a circulatory system in place. Water taken up by the roots reaches each and every part of the plant up to the tip of growing. When we talk of the movement of substances we need to first define what kind of movement we are talking about, also what substances we are looking at. In the flowering plants the substances that would need to be transported are water, mineral nutrients, organic nutrients and plant growth regulators. Over small distances substances move by diffusion and by cytoplasmic streaming supplemented by active transport while their longer distance transport occurs through the vascular system, i.e., xylem, phloem and is called **Translocation**.

Transport in Plants

Introduction –

- The study of metabolism and various vital activities of plants is known as **plant physiology**.
- **Stephan Hales** is known as father of plant physiology.
- **J.C. Bose** is known as **father of Indian plant physiology**.
- Plants grow in soil
- It absorb water and minerals, which are available in soil.
- Water has great importance for plant. Water forms 80-90% of fresh weight of plant body. The method or technique, plant cells obtain water, comes under the heading of **water relations**.

INTRODUCTION (TRANSPORT IN PLANTS)

Did you ever noticed that how water reaches the top of big or tall trees and for that how and why substance travel from one cell to the other. Also, how substance are moving in similar way in the same direction.

In flowering plants, substances that would require to be transported are water, organic and mineral nutrients & plant growth hormone / regulators. Transport over longer distances proceeds through the vascular system (xylem and phloem) and is called as **Translocation**. The small distance transport means transport within the cell or across the membrane or from cell to cell in a tissue which occurs by diffusion, facilitated diffusion (Passive transport) and by active transport.

In rooted plants, transport in xylem (of water and minerals) is essentially unidirectional, from roots to the stems. Organic and mineral nutrients however, undergo multidirectional transport. Transport in phloem, means transport of organic compounds synthesized in the photosynthetic leaves which is bidirectional (from leaves to storage organs and later from storage organs to other growing parts).

Means of transport:- Transport in plants is of two types-

- a. Short distance transport
- b. Long distance transport

DIFFUSION

"The movement of molecules or atoms or ions of a material from an area of higher concentration to an area of their lower concentration is called diffusion."

- The diffusion continues till the dynamic equilibrium is not established. At this stage the net movement of molecules is equal in both directions.
- The kinetic energy, which is present in the molecules of material is distributed equally in their available space by their nature.

Diffusion rate @ **Gas > Liquid > Solid**

- Diffusion is a slow process
- Diffusion does not depend on living system.
- Diffusion rates are affected by gradient of concentration, the permeability of the membrane, temperature and pressure.
- It is very important for plants as it is only means for gaseous movement within the plant body.
- Molecules or ions which are diffused exert a pressure, on the substance or medium in which diffusion takes place, is known as diffusion pressure.

BIOLOGY FOR NEET & AIIMS

- Over small distances substances move by diffusion and cytoplasmic streaming .
- Long distance transport is called TRANSLOCATION
- Organic substances move - Multidirectional
- Inorganic substances & H₂O → Unidirectional
- Diffusion - passive, random slow and not dependent on living system .
- Gaseous exchange-is due to diffusion
- Diffusion rate depends on concentration gradient, permeability, temperature & pressure.
- Facilitated diffusion → Carried out for those substances having hydrophilic moiety
- Gradient required, carrier mediated, without energy
- Water channels made up of aquaporins
- Active transport → Uphill transport, energy & carrier proteins both required.
- Common features to Facilitated and Active transport → saturation, selectivity, Inhibition
- Hormone regulation Water potential → difference of Kinetic energy
- Solute potential → loss of free energy (Kinetic energy) due to addition of solutes
- Pressure potential → change in free energy due to external pressure (other than atmospheric pressure)
- Tonoplast and plasma membrane are two important determinants of movement of molecules in or out of the cell.
- Net direction and rate of osmosis depends on both pressure gradient and concentration gradient. $OP = \psi_s$
- During plasmolysis water lost first from cytoplasm and then from vacuole
- Imbibition depends on diffusion, water potential gradient & affinity between adsorbant and liquid
- Bulk flow - can be achieved either through positive hydrostatic pressure gradient or negative hydrostatic pressure gradient.
- Xylem - water, minerals and organic nitrogen, hormones
- Phloem - Organic substances, inorganic nutrients (mobile elements)
- Apoplastic path - Cellwall & intercellular space (Non living path)
- Symplastic path - Systems of interconnected protoplasts (Living path)
- Root-pressure - positive hydrostatic pressure, leads to guttation, modest push in overall water transport, greatest contribution - reestablishments of continuity of water column.
- Cell wall of guard cells show radial arrangement of microfibrils.
- Cohesion, adhesion and surface tension -are three physical properties of water which provide - Tensile strength and capillarity
- Evolutions of C₃ photosynthetic path is for maximising CO₂ utilisation and to minimising water loss.
- Plants obtain their most of the carbon & oxygen from CO₂
- Plants obtain most of their minerals from soil actively because
 - (1) Minerals present in soil as charged particles
 - (2) In soil mineral concentration is lower than plant cell.
- Active mineral absorption helps in creation of water's potential gradient.
- Some ions can move passively by mass flow.
- Transport proteins of endodermal cells are control points, where a plant adjust the quantity and types of solutes that reach to xylem, hence it allow transport of ions in one direction only.

SOLVED EXAMPLE

Ex.1 Best soil for healthy and vigorous growth of a plant is

- (A) Sandy soil (B) Loam
(C) Clay (D) None of these

Sol. (B) : Loam are sufficiently aerated and have good water holding capacity. Therefore, they are very good for water absorption and growth.

Ex.2 Attractive forces of cell walls for water molecules is termed as

- (A) Adhesion (B) Cohesion
(C) Osmosis (D) Plasmolysis

Sol. (A) : Walls of tracheids and vessels of xylem are made up of lignin and cellulose and have strong affinity for water (adhesion).

Ex.3 The relationship $\pi v = nRT$ is not obeyed by

- (A) Concentrated solution
(B) Dilute solution
(C) Extremely dilute solution
(D) All of these

Sol. (C)

Ex.4 Selective permeability identifies the process of transmission through semipermeable membrane is called

Or

The movement of water from higher water potential to lower water potential through a semi-permeable membrane is called

Or

Living cells placed in isotonic solution (0.9 % saline) retain their size and shape. This is based on the concept of

- (A) Diffusion (B) Osmosis
(C) Plasmolysis (D) Imbibition

Sol. (B) : Osmosis is a special type of diffusion of a liquid, when solvent moves through a semipermeable membrane.

Ex.5 In rainy season, the doors get wet due to

- (A) Imbibition (B) Absorption
(C) Diffusion (D) Endosmosis

Sol. (A) : Due to adsorption of water molecules into wooden furniture it get swelled.

Ex.6 The plant undergoes wilting when

- (A) Xylem is blocked
(B) Cambium is blocked
(C) Phloem is blocked
(D) Some roots are reduced in number

Sol. (A) : Xylem is responsible for transport of water. If xylem is blocked, plant will undergo wilting due to the lack of proper transport of water.

Ex.7 Root pressure develops due to

- (A) Low osmotic potential in soil
(B) Passive absorption
(C) Increase in transpiration
(D) Active absorption

Sol. (D)

Ex.8 In xerophytes, the osmotic concentration of cell sap is

- (A) Less than normal
(B) Normal
(C) More than normal
(D) No osmotic pressure at all

Sol. (C) : Osmotic pressure is dependent upon the concentration of solutes. It is higher in xerophytes as compared to mesophytes.

Ex.9 Which one of the following statements is wrong

- (A) Water potential is the chemical potential of the water
(B) Solute potential is always negative
(C) Pressure potential is zero in a flaccid cell
(D) Water potential equals solute potential in a fully turgid cell
(E) Pressure potential is negative in a plasmolyzed cell

Sol. (A)

Ex.10 Upwards movement of water in plants is called

- (A) Sucking (B) Ascent of sap
(C) Translocation (D) None of these

Sol. (B)

Ex.11 Which of the following would be in insignificant amount in xylem sap

- (A) Sugar (B) Nitrates
(C) Phosphates (D) Water

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. The physical process involved in the release of molecular oxygen from leaves is :-
(A) Diffusion (B) Transpiration
(C) Osmosis (D) Capillarity
2. Pieces of beet root do not lose their colour in cold water, but do so in boiling water because :-
(A) The cell wall is killed in boiling water
(B) Hot water can enter the cells readily
(C) The plasma membrane gets killed in boiling water and becomes permeable
(D) The pigment is not soluble in cold water
3. What statement can be cited for 10% sodium chloride solution and 10% sugar solution present ?
(A) Both have equal OP
(B) The concentration of sodium chloride solution will be less than concentration of sugar solution
(C) The OP of sugar solution will be higher than OP of sodium chloride solution
(D) DPD of sodium chloride solution will be higher than DPD of sugar solution
4. If a plant cell is immersed in water, the water continues to enter the cell until the :-
(A) Concentration of the salts is the same inside the cell as outside
(B) Cell bursts
(C) Concentration of water is the same inside the cell as outside
(D) Diffusion pressure deficit is the same inside the cell as outside
5. If a cell is reduced in size (shrinks) of placing in a solution of sugar, the solution is :-
(A) Hypertonic (B) Hypotonic
(C) Isotonic (D) None of the above
6. The process of osmosis involves :-
(A) Movement of solute through a semipermeable membrane
(B) Movement of solvent through a semipermeable membrane
(C) Movement of solution through semipermeable membrane
(D) None of the above
7. Grapes placed in salt solution shrink due to :-
(A) Imbibition (B) Endosmosis
(C) Exosmosis (D) Osmosis
8. Process of selective transmission of a liquid through semi permeable membrane is called :-
(A) Diffusion (B) Osmosis
(C) Plasmolysis (D) Transmission
9. When a cell is fully turgid which of the following will be zero ?
(A) Turgor pressure (B) Wall pressure
(C) Suction pressure (D) Osmotic pressure
10. Water from the soil enters in to the root hairs on account of :-
(A) Turgor pressure
(B) Suction pressure or DPD
(C) Barometric pressure
(D) Osmotic pressure
11. In a fully turgid cell the values of DPD, OP and TP should be :-
(A) DPD = 10 atm., OP = 15 atm., TP = 5 atm.
(B) DPD = 5 atm., OP = 12 atm., TP = 7 atm.
(C) DPD = 2 atm., OP = 7 atm., TP = 5 atm.
(D) DPD = 0 atm., OP = 15 atm., TP = 15 atm.
12. When the cell is placed in water, it takes water this is due to ?
(A) Osmotic pressure
(B) Suction pressure
(C) Diffusion
(D) Water potential and TP
13. What is the direction of the movement of water if two cells have the same OP but differ in TP ?
(A) No net flow
(B) From lower T.P to higher TP
(C) From higher TP to lower TP
(D) Data insufficient
14. When water enters into a cell what happens to its OP, TP and DPD ?
(A) OP & TP increase & its DPD increase
(B) OP & DPD increase & TP decrease
(C) TP & DPD decrease & OP increase
(D) OP & DPD decrease & TP increase

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Which helps in maintaining form and structure of cells & soft parts of plants ?
(A) Osmotic pressure
(B) Turgor pressure
(C) Atmospheric pressure
(D) DPD
2. Which process occurs against a concentration gradient of solute ?
(A) Diffusion (B) Osmosis
(C) Transpiration (D) Translocation
3. When beet root slices are washed and then placed in cold water, anthocyanin does not come out, because plasma membrane is ?
(A) Differentially permeable to anthocyanin
(B) Dead structure
(C) Impermeable to anthocyanin
(D) Permeable to anthocyanin
4. The osmotic pressure of distilled water will be :-
(A) Minimum
(B) Maximum
(C) Higher than any solution
(D) Variable
5. Tonoplast is :-
(A) Permeable membrane
(B) Semi permeable membrane
(C) Impermeable membrane
(D) Selectively permeable membrane
6. If in a cell suction pressure value is 30 atm. while osmotic pressure 42 atm. then calculate the turgidity developed in form of TP in the cell :-
(A) 12 atm. (B) 72 atm.
(C) -12 atm. (D) 1.4 atm.
7. Osmosis is the phenomenon expressed by :-
(A) Solutes present in the solution
(B) Solution
(C) Semi-permeable membrane
(D) O₂
8. The osmotic pressure of the cell is measured by :-
(A) Plasmolysis method
(B) Osmometer
(C) Molar concentration of the cell sap
(D) Deplasmolysis
9. Maximum osmotic pressure is found in :-
(A) Root hair
(B) Cortex cell of the root
(C) Passage cell of the root
(D) Mesophyll cell
10. The osmotic pressure is due to :-
(A) Solute
(B) Semi permeable membrane
(C) Hypertonic solution
(D) Water
11. When the solute has been added in the solution, then following observation can be made ?
(A) The DPD of the solution decreases
(B) The Ψ_w of the solution increases
(C) DPD of the solution decreases while its Ψ_w increases
(D) DPD of the solution increases while its Ψ_w decreases
12. If the given solution is of 25% concentration; then what cannot be presented for this :-
(A) OP (B) DPD
(C) Solute potential (D) TP
13. In a flaccid cell which condition does not occur-
(A) TP = 0 (B) SP = 0
(C) WP = 0 (D) SP = OP
14. Osmotic pressure of a cell is zero when :-
(A) T.P. is maximum (B) DPD is maximum
(C) T.P. is zero (D) Not possible
15. In which condition the Turgor pressure of the cell becomes equal to the osmotic pressure :-
(A) In flaccid cell (B) In plasmolysed cell
(C) In fully turgid cell (D) It never happens

Exercise # 3**PART - 1****MATRIX MATCH COLUMN**

1. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Hypotonic
B. Hypertonic
C. Isotonic
(A) A-ii, B-iii, C-i
(C) A-i, B-ii, C-iii

Column - II

- i. No net flow of water
ii. Water moves into the cell
iii. Water moves out of the cell
(B) A-iii, B-ii, C-i
(D) A-ii, B-i, C-iii

2. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Vein ending
B. Necessary evil
C. Semipermeable
D. Cohesion
E. Stomata closure
(A) A-iv, B-i, C-iii, D-ii, E-(v)
(C) A-iii, B-(v), C-i, D-ii, E-iv

Column - II

- i. Transpiration
ii. Osmosis
iii. Transpiration pull membrane
iv. Guttation
(v) ABA
(B) A-iv, B-i, C-ii, D-iii, E-(v)
(D) A-i, B-ii, C-iii, D-iv, E-(v)

3. Match Column I with Column - II and select the correct option from the codes given below.

Column - I

- A. Dixon and Jolly
B. Stomata
C. Manometer
D. Capillary water
E. Potometer
(A) A-iv, B-iii, C-(v), D-ii, E-i
(C) A-iv, B-iii, C-i, D-ii, E-(v)

Column - II

- i. Root pressure
ii. Only water available to plants
iii. Transpiration
iv. Transpiration pull
(v) Rate of transpiration
(B) A-i, B-iii, C-iv, D-ii, E-(v)
(D) A-(v), B-iv, C-iii, D-ii, E-i

4. Match the following and choose the correct option

- A. Leaves
B. Seed
C. Roots
D. Aspirin
E. Plasmolyzed cell

- i. Anti-transpirant
ii. Transpiration
iii. Negative osmotic potential
iv. Imbibition
(v) Absorption

Options :

- (A) A-ii, B-iv, C-(v), D-i, E-iii
(B) A-iii, B-ii, C-iv, D-i, E-(v)
(C) A-i, B-ii, C-iii, D-iv, E-(v)
(D) A-(v), B-iv, C-iii, D-ii, E-i

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. When enters a cell due to : [CBSE AIPMT 2001]
 - (A) O.P.
 - (B) S.P.
 - (C) T.P.
 - (D) W.P.

2. In which of the following plant sunken stomata are found : - [CBSE AIPMT 2001]
 - (A) Nerium
 - (B) Hydrilla
 - (C) Mango
 - (D) Guava

3. Glycolate induces opening of stomata in : - [CBSE AIPMT 2001]
 - (A) Presence of oxygen
 - (B) Low CO₂ conc.
 - (C) High CO₂
 - (D) CO₂ absent

4. Opening and closing of stomata is due to the : - [CBSE AIPMT 2002]
 - (A) Hormonal change in guard cells
 - (B) Change in Turgor pressure of guard cells
 - (C) Gaseous exchange
 - (D) Respiration

5. Stomata of CAM plants :- [CBSE AIPMT 2003]
 - (A) Open during the night and close during the day
 - (B) Never open
 - (C) Are always open
 - (D) Open during the day and close at night

6. Stomata of a plant open due to : - [CBSE AIPMT 2003]
 - (A) Influx of hydrogen ions
 - (B) Influx of calcium ions
 - (C) Influx of potassium ions
 - (D) Efflux of potassium ions

7. The translocation of organic solutes in sieve tube members is supported by- [CBSE AIPMT 2006]
 - (A) P-proteins
 - (B) Mass flow involving a carrier and ATP
 - (C) Cytoplasmic streaming
 - (D) Root pressure and transpiration pull

8. Two cells A and B are contiguous. Cell A has osmotic pressure 10 atm, turgor pressure - 7 atm and diffusion pressure deficit 3 atm. Cell B has osmotic pressure 8 atm, turgor pressure 3 atm and diffusion pressure deficit 5 atm. The result will be: [CBSE AIPMT 2007]
 - (A) Movement of water from Cell B - A
 - (B) No movement of water
 - (C) Equilibrium between the two
 - (D) Movement of water of Cell A - B

9. The rupture and fractionation do not usually occur in the water column in vessel/tracheids during the ascent of sap because of : [CBSE AIPMT 2008]
 - (A) lignified thick walls
 - (B) cohesion and adhesion
 - (C) weak gravitational pull
 - (D) transpiration pull

10. Guard cells help in : [CBSE AIPMT 2009]
 - (A) Protection against grazing
 - (B) Transpiration
 - (C) Guttation
 - (D) Fighting against infection

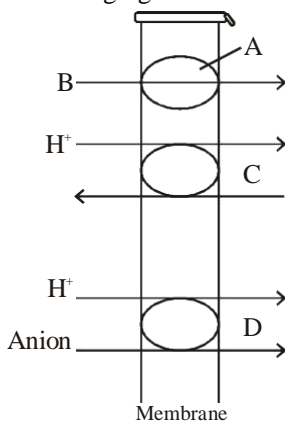
11. In land plants, the guard cells differ from other epidermal cells in having : [CBSE AIPMT 2011]
 - (A) Mitochondria
 - (B) Endoplasmic reticulum
 - (C) Chloroplasts
 - (D) Cytoskeleton

12. Which of the following criteria does not pertain to facilitated transport ? [NEET 2013]
 - (A) Requirement of special membrane proteins
 - (B) High selectivity
 - (C) Transport saturation
 - (D) Uphill transport

13. A column of water within xylem vessels of tall trees does not break under its weight because of : [CBSE AIPMT 2015]
 - (A) Dissolved sugars in water
 - (B) Tensile strength of water
 - (C) Lignification of xylem vessels
 - (D) Positive root pressure

MOCK TEST

- When a molecule moves across a membrane independent of other molecules the process is called
 (i) uniport (ii) symport (iii) antiport.
 (A) (i) only (B) (i) and (ii) only (C) (i) and (iii) only (D) (ii) and (iii) only
 (E) (iii) only
- The cellular transport method which involves use of transmembrane proteins without energy expenditure is called
 (A) diffusion (B) facilitated diffusion (C) active transport (D) exocytosis
- The type of transport taking across the biomembranes without the help of proteins is
 (A) facilitated diffusion (B) active transport (C) simple diffusion (D) diffusion *via* symport
- Which of these is/are not a property of facilitated transport?
 A. Requires special membrane proteins B. Highly selective
 C. Uphill transport D. Requires ATP energy
 (A) A and B only (B) C and D only (C) A and C only (D) B and C only
 (E) B and D only
- Consider the following statements with reference to facilitated transport.
 A. Requires ATP energy B. Transport saturates
 C. Highly selective D. Requires special membrane properties
 E. Uphill transport
 Of the above statements
 (A) A, B and C are relevant but D and E are irrelevant
 (B) B, C and E are relevant but A and D are irrelevant
 (C) C, D and E are relevant but A and B are irrelevant
 (D) A, D and E are relevant but B and C are irrelevant
 (E) B, C and D are relevant but A and E are irrelevant
- What do A, B, C and D represent in the following figure?



- A : carrier protein, B : symport, C : uniport, D : antiport
- A : carrier protein, B : uniport, C : antiport, D : symport
- A : carrier protein, B : antiport, C : symport, D : uniport
- A : carrier protein, B : uniport, C : symport, D : antiport

www.blog.neetnarme.com

STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION

“Food is the moral right of all who are born into this world.”

“NORMAN E.BORLAUG (1914-2009)”

INTRODUCTION

Human beings derive their nutrition from plants and animals. If we look at the history, humans also have hunted wild animals and collected fruits from wild plants. After so many years, they began to cultivate plant species and rear animals under their supervision. With ever-increasing population of the world, enhancement in food production is a major necessity. Biological principles as applied to animal husbandry and plant breeding have a major role in our efforts to increase food production. So many new techniques have been adopted like embryo transfer technology and tissue culture techniques are going to play a pivot role in further enhancing food productions.

Strategies For Enhancement in Food Production

With ever-increasing population of the world, enhancement of food production is a major necessity. Biological principles as applied to animal husbandry and plant breeding have a major role in our efforts to increase food production. Several new techniques like embryo transfer technology and tissue culture techniques are going to play a vital role in further enhancing food production.

Animal Husbandary

Animal husbandry is the agricultural practice of breeding and raising livestock. As such it is a vital skill for farmers and is as much science as it is art. Animal husbandry deals with the care and breeding of livestock like buffaloes, cows, pigs, horses, cattle, sheep, camels, goats, etc., that are useful to humans. Extended, it includes poultry farming and fisheries. Fisheries include rearing, catching, selling, etc., of fish, molluscs (shell-fish) and crustaceans (prawns, crabs, etc.). Since time immemorial, animals like bees, silk-worm, prawns, crabs, fishes, birds, pigs, cattle, sheep and camels have been used by humans for products like milk, eggs, meat, wool, silk, honey, etc.

It is estimated that more than 70 per cent of the world livestock population is in India and China. However, it is surprising to note that the contribution to the world farm produce is only 25 per cent, i.e., the productivity per unit is very low. Hence, in addition to conventional practices of animal breeding and care, newer technologies also have to be applied to achieve improvement in quality and productivity.

Management of Farms and Farm Animals

A professional approach to what have been traditional practices of farm management gives the much needed boost to our food production.

Dairy Farm Management

Dairying is the management of animals for milk and its products for human consumption. In dairy farm management, we deal with processes and systems that increase yield and improve quality of milk. Milk yield is primarily dependent on the quality of breeds in the farm. Selection of good breeds having high yielding potential (under the climatic conditions of the area), combined with resistance to diseases is very important. For the yield potential to be realised the cattle should be carried out in a scientific manner - with special emphasis on the quality and quantity of fodder. Besides, stringent cleanliness and hygiene (both of the cattle and the handlers) are of paramount importance like milking, storage and transport of the milk and its products. Nowadays, of course, much of these processes have become mechanised, which reduces chance of direct contact of the produce with the handler. Ensuring these stringent measures would also help to identify and rectify the problems as early as possible. It would also help to identify and rectify the problems as early as possible. Regular visits by a veterinary doctor would be mandatory.

Poultry Farm Management

Poultry is the class of domesticated fowl (birds) used for food or for their eggs. They typically include chicken and ducks, and sometimes turkey and geese. The word poultry is often used to refer to the meat on only these birds. but in a more general sense it may refer to the meat of other birds too.

As in dairy farming, selection of disease free and suitable breeds proper and safe farm conditions, proper feed and water, and hygiene and health care are important components of poultry farm management.

You may have seen TV news or read newspaper-reports about the 'bird flu virus' which created a scare in the country and drastically affected egg and chicken consumption, Find out more about it and discuss whether the panic reaction was justified. How can we prevent the spread of the flu in case some chicken are infected?

1. DOMESTICATION OF PLANTS

- Recorded evidences of plant breeding dates back to 9000 - 11,000 years ago.
- The main step of plant breeding is
 - (1) Collection of variability
 - (2) Evaluation and selection of parents
 - (3) Cross hybridisation among the selected parents
 - (4) Selection and testing of superior recombinants
 - (5) Testing, release and commercialisation of new cultivators.
- Genetic variability is the root of any breeding programme.
- The entire collection (of plants/seeds) having all the diverse allele for all genes in a given crop is called germplasm collection.
- Agriculture accounts for approximately 33% of India's GDP and employs nearly 62 percent of the population.
- P-1542 is Indian hybrid crop of pea.
- During the period 1960 to 2000, wheat production increased from 11 million tonne to 75 million tonnes while rice production went up from 35 million tonnes to 89.5 million tonnes.
- In 1963 Sonalika, Kalyan Sona, which were high yielding and disease resistant varieties of wheat, were introduced in India.
- Semi dwarf rice variety [IR-36], which were derived from IR-8 [developed at IRR, Philippines] and Taichung native-1 (from Taiwan) introduced in India in 1966.
- Jaya and Ratna which are better yielding dwarf varieties of rice, later developed in India.
- Saccharum barberi (grown in North India) had poor sugar content and yield and Saccharum officinarum (grown in South India) had thick stem and higher sugar content. By crossing of these two varieties we developed new varieties which have desirable qualities like high yield, thick stem, high sugar. [Jawahar sugarcane]
- The conventional method of breeding for disease resistance is hybridisation and selection.
- Some crop varieties developed by hybridisation and selection for disease resistance →

Breeding for disease resistance

Crop	Variety	Resistance to diseases
Wheat	Himgiri	Leaf and stripe rust, hill bunt
Brassica	Pusa swarnim (Karan Rai)	white rust
Cauliflower	Pusa shubhra, Pusa snowball K-1	Black rot and curl blight black rot
Cowpea	Pusa Komal	Bacterial blight
Chilli	Pusa sadabahar	Chilly mosaic virus, tobacco mosaic virus and leaf curl

- In mung bean, resistance to yellow mosaic virus and powdery mildew were induced by mutation.
- Resistance to yellow mosaic virus in bhindi (*Abelmoschus esculentus*) was transferred from a wild species and resulted in a new variety of *A. esculentus* called Parbhani Kranti.
- Hairy leaves in several plants are associated with resistance to insect pests, e.g. resistance to jassids in cotton and cereal leaf beetle in wheat.
- In wheat, solid stems lead to non-preference by the stem sawfly and smooth leaved and nectar-less cotton varieties do not attract bollworms.

STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION

SOLVED EXAMPLE

- Ex.1** Green revolution in India occurred during
(A) 1960's (B) 1970's
(C) 1980's (D) 1950's
- Sol.** (A)
- Ex.2** In plants breeding programme, the entire collection (of plants/seeds) having all the diverse alleles for all genes in a given crop is called
(A) Germplasm collection
(B) Selection of superior recombinants
(C) Cross hybridization among the selected parents
(D) Evaluation and selection of parents
- Sol.** (A)
- Ex.3** In maize, hybrid vigour is exploited by
(A) Harvesting seeds from the most productive plants
(B) Inducing mutations
(C) Bombarding the protoplast with DNA
(D) Crossing of two inbred parental lines
- Sol.** (D)
- Ex.4** The new varieties of plants are produced by
(A) Selection and hybridization
(B) Mutation and selection
(C) Introduction and mutation
(D) Selection and introduction
- Sol.** (A) : Selection and hybridization is method of crop improvement or new varieties production of plants.
- Ex.5** Transgenic plants are the ones
(A) Produced by a somatic embryo in artificial medium
(B) Generated by introducing foreign DNA in to a cell and regenerating a plant from that cell
(C) Produced after protoplast fusion in artificial medium
(D) Growth in artificial medium after hybridization in the field
- Sol.** (B) : Transgenic plants are those plants in which a foreign gene has been introduced and stably integrated into host DNA.
- Ex.6** Read the following four statements (A - D) about caused by prions in a.....
(A) The first transgenic buffalo, Rosie produced milk which was human alpha-lactalbumin enriched
(B) Restriction enzymes are used in isolation of DNA from other macromolecules
(C) Downstream processing in one of the steps of R-DNA technology
(D) Disarmed pathogen vectors are also used in transfer of R-DNA into the host
- Which are the two statements having mistakes
(A) Statements (A) and (C)
(B) Statements (A) and (B)
(C) Statements (B) and (C)
(D) Statements (C) and (D)
- Sol.** (B)
- Ex.7** Mule is a product of
(A) Camel
(B) Mutation
(C) Hybridisation
(D) Interspecific hybridisation
- Sol.** (D) : Mule is an interspecific hybrid of the male ass and the mare.
- Ex.8** The most commonly maintained species of bee by bee-keepers is
- Or**
- Which one of the following species of bees is used for the commercial production of honey
(A) *Apis mellifera* (B) *Apis dorsata*
(C) *Apis indica* (D) *Apis florea*
- Sol.** (A)
- Ex.9** Which among the following is the real product of the honey bee
(A) Honey (B) Beewax
(C) Propolis (D) Both (B) and (C)
- Sol.** (D) : Propolis is a component of honey secreted by honey bee itself and Bee wax is real products of honey bees.
- Ex.10** 'Cast nets' are used to catch
(A) Marine fishes (B) Estuary fishes
(C) Freshwater fishes (D) All of the above
- Sol.** (D)
- Ex.11** One of the following is a disease of poultry
(A) Abdominal gland
(B) Salivary gland
(C) Anthrax
(D) Ranikhet (new castle disease) Aspergillosis
- Sol.** (D)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. The centre of origin of wheat is
(A) South-east Asia
(B) South-west Asia
(C) Asia Minor and Afganistan
(D) None of these
2. The origin of sunflower is believed to be in
(A) Peruvian Andes
(B) Mexico and Central America
(C) Brazil
(D) USA
3. Maize evolved in
(A) USA
(B) Brazil
(C) Mexico and Central America
(D) Peruvian Andes
4. South-east Asia is thought to be the centre of origin of
(A) Rice, sugarcane, mango and banana
(B) Rice, sugarcane and mango
(C) Rice and sugarcane
(D) None of these
5. Ethiopia is the native place of
(A) Cabbage (B) Rice
(C) Coffee (D) Maize
6. Dwarf wheats were developed by
(A) Vavilov (B) Borlaug
(C) Swaminathan (D) None of these
7. Majority of the high yielding varieties of 'Indian rice' have been developed by cross between
(A) *O. sativa japonica* times *O. sativa indica*
(B) *O. sativa indica* times *O. nivara*
(C) *O. nivara* times *O. sativa japonica*
(D) *O. nivara* times *O. rufipogon*
8. The product of hybridization is known as
(A) Clone (B) Homozygous
(C) Hybrid (D) Heterozygous
9. Which of the following is not used for crop improvement
(A) Inbreeding (B) Introduction
(C) Hybridization (D) Mutations
10. The indica varieties of rice are crossed with japonic varieties as these are
(A) High yielding
(B) Resistant to diseases
(C) Cheaper
(D) Short life-cycled annual
11. The enzyme DNA polymerase was discovered by
(A) Kornberg (B) Okazaki
(C) Watson and Crick (D) Jacob and Monod
12. Bombay green banana cultivation is the result of
(A) Mass selection (B) Pureline selection
(C) Clonal selection (D) Natural selection
13. The alkaloid from *Colchicum autumnale* of Liliaceae induces
(A) Sterility (B) Dormancy
(C) Cell division (D) Polyploidy
14. Heterosis means
(A) Hybrid vigour
(B) Hybrids are weak
(C) Hybrids are weak as well as vigorous
(D) Hybrids are neither weak nor vigorous
15. Which one of the following chemical induces polyploidy in plant cells
(A) 2, 4-dichlorophenoxy acetic acid
(B) Rifampicin
(C) Cytokinin
(D) Colchicine
16. Which of the following condition is hybrid breakdown
(A) Failure of hybrid adult to produce functional gametes
(B) Failure of the fusion of ova and sperm plant breed of two species
(C) Failure of hybrid zygote to develop into an offspring
(D) None of these
17. The latest trend in plant disease control is
(A) Chemical control
(B) Biological control
(C) Use of fertilizers
(D) Use of disease resistant varieties

STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

- Norin-10 gene is
 - Dwarf gene of wheat
 - Dwarf gene of rice
 - Dwarf gene of tomato
 - Smut resistant gene of wheat
- Total number of centres of origin of crop plants given by Vavilov is
 - 2
 - 4
 - 8
 - 11
- Green revolution means
 - Increase in production of food plants
 - Increase in growth of green plants of maintaining ecosystem balance
 - Growth of green plants in order to check soil erosion
 - None of the above
- The dwarf varieties of wheat brought from Mexico into India were
 - Sonara-64 and Sonalika
 - Sonara-64 and Lerma Roja-64
 - Sharbati sonara and Pusa Lerma
 - Sonalika
- The native place of *Hevea* rubber is
 - South-east Asia
 - Brazil
 - Peruvian Andes
 - Malaysia
- Pure line breed refers to
 - Heterozygosity only
 - Homozygosity only
 - Heterozygosity and linkage
 - Homozygosity and self-assortment
- The improved variety Indore 2 obtained by mutation breeding belongs to which of the following crop varieties
 - Bajra
 - Cotton
 - Sugar cane
 - Potato
- Production of plant without fertilization is done by
 - Vegetative propagation
 - Transplantation
 - Grafting
 - None of these
- Desired improved varieties of economically useful crops are raised by
 - Migration
 - Biofertilizer
 - Hybridization
 - Natural selection
- Heterosis requires
 - Selection
 - Crossing
 - Transformation
 - Mutation
- The reason for vegetatively reproducing crop plants to suit for maintaining hybrid vigour is that
 - They can be easily propagated
 - They have a longer life span
 - They are more resistant to diseases
 - Once a desired hybrid produced, no changes of losing it
- The new varieties of plants are produced by
 - Selection and hybridization
 - Mutation and selection
 - Introduction and mutation
 - Selection and introduction
- Mutations are caused due to
 - Radioactive mutagens
 - Chemical mutagens
 - Radiation mutagens
 - Change in base sequence
- Triticale* is the hybrid between wheat and
 - Maize
 - Barley
 - Rye
 - Bean
- Piece of sterile plant tissue to be used for tissue culture under aseptic condition is
 - Inoculant
 - Explant
 - Clone
 - Somaclone
- The genetically engineered crop which has been recently introduced in India is
 - Herbicide tolerant maize
 - Bt cotton
 - Slow ripening tomato
 - Golden rice
- Somaclonal variations are produced
 - By mutagens
 - In tissue culture during differentiation
 - By gamma rays
 - By sexual reproduction
- Introduction of foreign genes for improving genotype is
 - Biotechnology
 - Tissue culture
 - Vernalization
 - Genetic engineering

1. Match the names given under Column - I with their relations given under column - II, choose the answer which gives the correct combination of the alphabets of the two columns

Column - I

(Name)

- (A) Bombyx mori
(B) Morus alba
(C) Grainage
(D) Powdery

- (A) A - q, B - r, C - s, D - t
(C) A - r, B - q, C - t, D - s

Column - II

(Relations)

- (p) Disease of mulberry
(q) Centre where silkworm egg are produced and supplied
(r) Silkworm
(s) Mulberry plant
(t) Freshly hatched silkworm

- (B) A - r, B - s, C - q, D - p
(D) A - s, B - r, C - q, D - t

2. Match the following and select the correct answer

Column - I

- (A) Bears
(B) Snail
(C) Zooplanktons
(D) Seeds

- (A) A - 3, B - 4, C - 1, D - 2
(C) A - 4, B - 1, C - 2, D - 3
(E) A - 2, B - 4, C - 1, D - 3

Column - II

- (1) Diapause
(2) Hibernation
(3) Dormancy
(4) Aestivation
(B) A - 1, B - 2, C - 4, D - 3
(D) A - 1, B - 4, C - 2, D - 3

3. Find the correct match

Column - A

- (I) Mackerel
(II) Honey bee
(III) Mirgala
(IV) Silkworm

(A) II and IV

Column - B

- Rastrelliger
Apis
Tacchardia
Bombyx

(B) I and II

Column - C

- Freshwater fish
Wax
Marine waterfish
Mulberry silk

(C) IV only

(D) I and III

4. Match the terms given in Column - I with their descriptions given in Column - II and select the correct option from the codes given below.

Column - I

- (A) Out-crossing
(B) Interspecific hybridisation
(C) Cross-breeding
(D) Inbreeding

- (A) A - (ii), B - (iii), C - (iv), D - (i)
(C) A - (iv), B - (ii), C - (iii), D - (i)

Column - II

- (i) Mating of closely related individuals within the same breed
(ii) Mating of animals of same breed but having no common ancestors on either side of their pedigree for 4 -6 generations.
(iii) Mating of animals of two different species
(iv) Mating of animals belonging to different breeds.

- (B) A - (iii), B - (ii), C - (iv), D - (i)
(D) A - (ii), B - (iv), C - (iii), D - (i)

1. One of the most important reason why wild plants should thrive is that these are good sources of
 - (A) Unsaturated edible oils
 - (B) Highly nutritive animals feed
 - (C) Genes for resistance to diseases and pests
 - (D) Rare and highly sought after fruits of medical importance
2. Which statement is correct about centre of origin of plants?
 - (A) More diversity in varieties
 - (B) Frequency of dominant gene is more
 - (C) Climatic conditions more favourable
 - (D) None of the above
3. Before the European invaders which vegetable was/were absent in India?
 - (A) Potato and tomato
 - (B) Simla mirch and brinjal
 - (C) Maize and chichinda
 - (D) Bitter gourd
4. What is the best pH of the soil for cultivation of plants?
 - (A) 3.4- 5.4
 - (B) 6.5 - 7.5
 - (C) 4.5- 8.5
 - (D) 5.5 - 6.5
5. Which of the following crops have been brought to India from New world?
 - (A) Cashewnut, potato, rubber
 - (B) Mango, tea
 - (C) Tea, rubber, mango
 - (D) Coffee
6. India's wheat yield revolution in the 1960s was possible primarily due to
 - (A) Hybrid seeds
 - (B) increased chlorophyll content
 - (C) Mutations resulting in plant height reduction
 - (D) quantitative trait mutations
7. The world's highly prized wool yielding 'Pashmina' breed is
 - (A) goat
 - (B) sheep
 - (C) goat-sheep cross
 - (D) Kashmir sheep-Afghan sheep cross
8. Which of the following is generally used for induced mutagenesis in crop plants?
 - (A) X-rays
 - (B) UV(260 nm)
 - (C) Gamma rays (from cobalt 60)
 - (D) Alpha particles
9. Why is vivipary an undesirable character for annual crop plants?
 - (A) It reduces the vigour of plant
 - (B) The seeds cannot be stored under normal conditions for the next season
 - (C) The seeds exhibit long dormancy
 - (D) It adversely affects the fertility of the plant
10. The name of Norman Borlaug is associated with
 - (A) Green revolution
 - (B) Yellow revolution
 - (C) White revolution
 - (D) Blue revolution
11. Three crops that contribute maximum to global food grain production are
 - (A) wheat, rice and maize
 - (B) wheat, maize and sorghum
 - (C) rice, maize and sorghum
 - (D) wheat, rice and barley
12. Triticale, the first man-made cereal crop, has been obtained by crossing wheat with
 - (A) Rye
 - (B) Pearl millet
 - (C) Sugarcane
 - (D) Barley
13. Crop plants grown in monoculture are
 - (A) Low in yield
 - (B) Free from intraspecific competition
 - (C) Characterised by poor root system
 - (D) Highly prone to pests
14. Golden rice is a transgenic crop of the future with the following improved trait
 - (A) High lysine (essential amino acid) content
 - (B) insect resistance
 - (C) high protein content
 - (D) high vitamin-A content
15. In order to obtain virus-free plants through tissue culture the best method is
 - (A) Meristem culture
 - (B) Protoplast culture
 - (C) Embryo rescue
 - (D) Anther culture
16. In maize, hybrid vigour is exploited by
 - (A) inducing mutations
 - (B) bombarding the protoplast with DNA
 - (C) crossing of two interbreed parental lines
 - (D) harvesting seeds from the most productive plants

- Among the following edible fishes, which one is a marine fish having rich source of omega-3 fatty acids ?
(A) Mystus (B) Mangur (C) Mrigala (D) Mackerel
- Interspecific hybridisation is mating of
(A) Animals within same breed without having common ancestors
(B) Two different related species
(C) Superior males and females of different breeds
(D) More closely related individuals within same breed for 4-6 generations
- Outbreeding is an important strategy of animal husbandry because it
(A) Is useful in overcoming inbreeding depression
(B) Exposes harmful recessive genes that are eliminated by selection
(C) Helps in accumulation of superior genes
(D) Is useful in producing purelines of animals
- One of the breeding techniques useful to eliminate harmful recessive genes by selection is
(A) Inbreeding (B) Artificial insemination
(C) MOET (D) Out-breeding
- Hisardale is obtained by crossing
(A) Horse with donkey (B) Merino ewes with Bikaneri rams
(C) Superior bull with superior cow (D) Bikaneri ewes with Merino rams
- Which of the statement about breeding is wrong
(A) By inbreeding purelines cannot be evolved.
(B) Continued inbreeding, especially close inbreeding reduces fertility and productivity
(C) Cross-breeding allows desirable qualities of two different breeds to be combined
(D) Inbreeding exposes harmful recessive genes that are eliminated by selection
(E) A single outcross often helps to overcome inbreeding depression
- Apiculture is associated with which of the following groups of plants ?
(A) Grapes, maize, potato (B) Sugarcane, paddy, banana
(C) Guava, sunflower, strawberry (D) Pineapple, sugarcane, strawberry
- Cattle fed with spoiled hay of sweet clover which contains dicumarol
(A) Are healthier due to a good diet
(B) Catch infections easily
(C) May suffer vitamin K deficiency and prolonged bleeding
(D) May suffer from beri beri due to deficiency of B vitamins
- The scientific name of the moth which produce tasar is
(A) Bombyx mori (B) Antheraea mylitta
(C) Antheraea assamensis (D) Philosamia ricini
- Which is correctly matched
(A) Sericulture – fish
(B) Aquaculture – mosquito
(C) Apiculture – honey bee
(D) Pisciculture – silk moth

www.blog.neetnearnme.com

MICROBES IN HUMAN WELFARE

“Man's survival, from the time of Adam and Eve until the invention of agriculture, must have been precarious because of his inability to ensure his food supply.”

“NORMAN ERNEST BORLAUG (1914)”

INTRODUCTION

Besides macroscopic plants and animals, microbes are the major component of biological systems on this earth. Microbes are present everywhere in water, soil, inside our bodies and that of other animals and plants. They even exist where there is no other life-form could possibly exist such as deep inside the geysers (thermal vents) where the temperature may be as high as 100°C deep in the soil, under the layers of snow several meters thick and in highly acidic environments.

Microbes are diverse—protozoa, bacteria, fungi and microscopic plants, viruses, viroids and also prions that are usually proteinaceous infectious agents. Microbes like fungi and bacteria can be grown on nutritive and various media to form colonies. Such cultures are useful in studies on micro-organisms (Microbiology).

Microbes in Human Welfare

introduction

Definition –

"**Biotechnology** may be defined as use of micro-organism, animals, or plant cells or their products to generate different products at industrial scale and services useful to human beings."

A powerful industry based on microbes has been developed in recent time. A careful selection of microbial strains, improved method of extraction and purification of the product, have resulted in enormous yields.

The use of living organisms in systems or process for the manufacturer of useful products, It may involve algae, bacteria, fungi, yeast, cells of Higher plants & animals or subsystems of any of these or Isolated components from living matter.

Old biotechnology are based on the natural capabilities of micro organisms.

e.g. formation of Citric acid, production of penicillin by *Penicillium notatum*

New biotechnology is based on Recombinant DNA technology.

e.g. Human gene producing Insulin has been transferred and expressed in bacteria like *E.coli*.

In, **modern biotechnology**, different types of valuable products are produced with help of microbiology, biochemistry, tissue culture, chemical engineering and genetic engineering, molecular biology and immunology.

microbes in household products

1. A common example of microbes activity in household is the production of curd from milk. Micro-organisms such as *Lactobacillus* and others commonly called **lactic acid bacteria (lab)** which grow in milk and convert it to curd. During growth, the LAB produce acids that coagulate and partially digest the milk proteins.
2. A small amount of curd added to the fresh milk as inoculum or starter contain millions of LAB, which at suitable temperatures multiply, thus converting milk to curd, which also improves its nutritional quality by increasing vitamin B₁₂. In our stomach too, the LAB play very beneficial role in removing disease causing microbes.
3. The dough, which is used for making foods such as dosa and idli is mainly also fermented by bacteria. The puffed-up appearance of dough is due to the production of CO₂ gas. Similarly the dough, which is used for making bread, is fermented using baker's yeast (*Saccharomyces cerevisiae*).
4. A number of traditional drinks (e.g. 'Todi' prepared from sap of palms) and foods are also made by fermentation by the microbes. Microbes are also used to ferment fish, soyabean and bamboo shoots to make foods.
5. Cheese, is one of the oldest food items in which microbes were used. Different varieties of cheese are known by their characteristic textur flavour and taste, the specificity coming from the microbes used. For example, the large holes in 'Swiss cheese' are due to production of a large amount of CO₂ by a bacterium named **Propionibacterium sharmanii**. The 'Roquefort cheese' are ripened by growing a specific fungi on them, which gives them a particular flavour.

Yeast

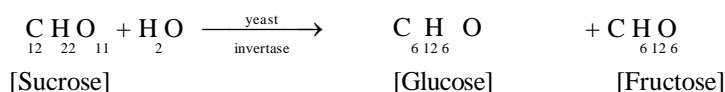
Louis Pasteur showed in the middle of nineteenth century that **beer and butter milk** are product of fermentation brought about by "yeast". It is a microscopic single celled organism – *Saccharomyces cerevisiae*. Presently however yeast product for human and animal consumption are produced on commercial scale.

"**Alcohol** was the first product of ancient biotechnology"

There are basically two types of yeasts (i) Baker's yeast (ii) Alcohol yeast or Brewer's yeast

Baker's yeast generally utilize during the preparation of food materials to increase the taste of food, flavour in food and nutrients in food. It is also utilized as "**leavening agent**".

By the incomplete degradation of complex organic compounds [sucrose] by yeast fermentation, alcohol is formed.



Microbes in Household products

1. Curd:

Milk → Curd

- (1) During growth LAB produce acids that coagulate and partially digest the milk protein.
- (2) LAB increase vitamin B₁₂ and check diseases causing microbes in stomach.

2. Dough → Bread

Puffed up appearance of Dough is due to production of CO₂ gas.

3. Cheese : Different varieties of cheese are known by their characteristic texture, flavour and taste. The Specificity coming from the microbes used.

Type of cheese :

1. Unripened cheese.
2. Ripened cheese. e.g. Roquefort cheese, Swiss cheese.

Microbes in industrial products :

1. Fermented Beverages:

1. Beer	Barley	4 - 6 %
2. Wine	Grapes	10 - 20 %
3. Brandy	Distillation of wine	55 - 60 %
4. Rum	Molasses	40 - 45 %
5. Whisky	Cereal	20 - 40 %
6. Gin	Secale cerealae	40 %

2. Antibiotics

(Anti = against, bio = life)

Penicillin:

1. First discovered antibiotics.
2. Discovered by Alexander Fleming.
3. Full potential of penicillin was established by Ernest chain and Howard Florey.

3. Chemical, Enzymes and other Bioactive molecules.

Organic acid	Microbes
1. Citric acid	Aspergillus niger
2. Acetic acid	Acetobacter aceti
3. Butyric acid	Clostridium butylicum
4. Lactic acid	Lactobacillus

Enzymes:

1. Lipases : Used in detergents for removing oily stains from the laundry.
2. Pectinases and proteases : For clearing bottled juices.
3. Streptokinase (Clot buster) : Used for a removing clots from the blood vessels (in case of myocardial infarction)

Bioactive molecules :

1. Cyclosporin A : Used as an immunosuppressive agent in organ - transplant patients (produced from fungus Trichoderma polysporum)
2. Statin : Blood cholesterol lowering agents. (From yeast = Monascus purpureus)

Microbes in production of biogas :

SOLVED EXAMPLE

- Ex.1** The puffed up appearance of dough in bakery is due to
 (A) CO₂ production during fermentation by yeast
 (B) CO₂ production during aerobic respiration by yeast
 (C) Death of yeast
 (D) Spoiling of the dough due to death of yeast and production of many gases
Sol. (A) : The dough which is used for making foods such as dosa, idli, jalebi, biscuit and bread etc. are fermented by bacteria or yeast (*Saccharomyces cerevisiae*). The puffed-up appearance of dough is due to the production of CO₂ gas. Bacteria are present in the atmosphere and the yeast has to be added to the dough.
- Ex.2** Curdling of milk takes place by
 (A) *Streptococcus lactis*
 (B) *Streptococcus thermophilus*
 (C) *Lactobacillus lactis*
 (D) All the above
Sol. (D)
- Ex.3** Streptomycin is produced by or from which micro-organism streptomycin is prepared
 (A) *Streptomyces venezuelae*
 (B) *Streptomyces griseus*
 (C) *Streptomyces scouleri*
 (D) *Streptomyces fradiae*
Sol. (B) : Streptomycin is produced from *Streptomyces griseus*. Streptomycin inhibits the bacterial protein synthesis by affecting 30S subunit of ribosome.
- Ex.4** The organism used for alcohol fermentation is
 (A) *Penicillium*
 (B) *Pseudomonas*
 (C) *Aspergillus*
 (D) *Saccharomyces*
Sol. (D) : Brewing industry produces alcoholic beverages of several types depending upon the fermenting agent and the medium. Fermenting agents are *Saccharomyces cerevisiae*, *S. sake*, *S. ellipsoideus* (wine yeast) and *S. pastorianus*, (ginger yeast).
- Ex.5** *Monascus purpureus* is a yeast used commercially in the production of
 (A) Ethanol
 (B) Streptokinase for removing clots from the blood vessels
 (C) Citric acid
 (D) Blood cholesterol lowering agents
Sol. (D) : Statins produced by the yeast *Monascus purpureus* have been commercialised as blood-cholesterol lowering agents. It acts by competitively inhibiting the enzyme responsible for synthesis of cholesterol.
- Ex.6** Which one of the following is used in the baking of the bread
 Or
 Baker's yeast is
 Or
 The dough used for making bread is fermented by
 (A) *Rhizopus stolonifer*
 (B) *Zygosaccharomyces*
 (C) *Saccharomyces cerevisiae*
 (D) *Saccharomyces ludwigii*
Sol. (C) : Invertase enzyme is obtained from *Saccharomyces cerevisiae* and is used to bread baking is also called baker's yeast.
- Ex.7** During which stage of sewage treatment microbes are used
 (A) Primary treatment
 (B) Secondary treatment
 (C) Tertiary treatment
 (D) All of these
Sol. (B) : Secondary treatment/biological treatment the primary effluent is passed into large aeration tanks where it is constantly agitated mechanically and air is pumped into it. This allows vigorous growth of useful aerobic microbes into flocs.
- Ex.8** The solids which settle after primary treatment of sewage are called
 (A) Primary sludge
 (B) Activated sludge
 (C) Flocs
 (D) Total solids
Sol. (A) : All solids that settle down forms the primary sludge the supernatant forms the effluent. The effluent from the primary settling tank is taken for sewage treatment.
- Ex.9** BOD of waste water is estimated by measuring the amount of
 (A) Total organic matter
 (B) Biodegradable organic matter
 (C) Oxygen evolution
 (D) Oxygen consumption
Sol. (D)
- Ex.10** What would happen if oxygen availability to activated sludge flocs is reduced
 (A) It will slow down the rate of degradation of organic matter
 (B) The center of flocs will become anoxic, which would cause death of bacteria and eventually breakage of flocs
 (C) Flocs would increase in size as anaerobic bacteria would grow in large numbers
 (D) Protozoa would grow in large numbers
Sol. (B)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. In olden days cheese was prepared by
(A) Aspergillus (B) Rennet enzym
(C) Clostridium bacteria (D) None of the above
2. Which micro-organism is used in the formation of cheese
(A) Streptococcus (B) Aspergillus
(C) Acetic acid bacteria (D) Lactic acid bacteria
3. Rannet is used in
(A) Fermentation
(B) Cheese making
(C) Bread making
(D) Synthesis of antibiotic
4. Butter is produced from
(A) Propanoic acid (B) Butyric acid
(C) Pentanoic acid (D) Ethanoic acid
5. Which of the following organism is useful in the organism is useful in the preparation of roquefort cheese
(A) Mucor (B) Rhizopus
(C) Aspergillus (D) Pencillium
6. Lactic acid bacteria (LAB) at suitable temperature converts milk to curd, which improves its nutritional quality enhancing vitamin
(A) A (B) B (B₁₂)
(C) C (D) D
7. Which antibiotic inhibits peptide bond formation
(A) Streptomycin (B) Tetracyclin
(C) Chloramphenicol (D) Neomycin
8. Which of the following is maintained for optimum production of vinegar
(A) Anaerobic condition
(B) Temperature of 65°C
(C) Aerobic condition
(D) Microaerophilic condition
9. A compound which is produced by an organism and inhibits growth of other organism is called
(A) Antigen (B) Antibiotic
(C) Antibody (D) Interferon
10. Lactic acid is produced by
(A) Lactobacillus bulgaricus
(B) Streptococcus lactis
(C) Rhizopus oryzae
(D) All the above
11. Who coined the term “antibiotics”
(A) Kornberg (B) Okazaki
(C) Waston and Crick (D) Jacob and Monod
Or
Streptomycin was first isolated in 1944-45 by
(A) Flemming (B) Florey
(C) Chain (D) S. Waksman
12. Vinegar is produced from sugars with the help of
Or
In the formation of ascorbic acid, the micro-organism used is
(A) Lactobacillus (B) Acetobacter
(C) Nitrosomonas (D) Salmonella
13. First antibiotic isolated was
Or
Antibiotics are produced by
(A) Terramycin (B) Neomycin
(C) Penicillin (D) Streptomycin
14. Ernest chain and Howard Florey’s contribution was
(A) Establishing the potential of penicillin as an effective antibiotic
(B) Discovery of streptokynase
(C) Production of genetically engineered insulin
(D) Discovery of DNA sequence
15. The microbe Pseudomonas denitrificans produces Vitamin
(A) K (B) D
(C) B₂ (D) B₁₂
16. Highest number of antibiotics are produced by
(A) Bacillus (B) Penicillium
(C) Streptomyces (D) Cephalosporium
17. The initial step in preparation of beer is
(A) Malting (B) Carboxylation
(C) Clarification (D) Distillation
18. Penicillin was used in
(A) I world war (B) II world war
(C) Both I and II world war
(D) None of these
19. The enzyme diastase was identified by
(A) S.A. Waksman (B) A. Fleming
(C) Christian Hasen (D) Payen and Persoz

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. Dough kept overnight in warm weather becomes soft and spongy because of
(A) Cohesion
(B) Osmosis
(C) Absorption of carbon dioxide from atmosphere
(D) Fermentation
2. Cheese are usually classified on the basis of
(A) Texture (B) Flavour
(C) Colour (D) All the above
3. The micro-organism grown on molasses and sold as a food flavouring substance is
(A) Saccharomycetes (B) Rhizopus
(C) Acetobacter (D) Lactobacillus
4. Cheese is prepared from
(A) Lactobacillus
(B) Streptococcus
(C) Myrothecium
(D) Streptococcus, Lactobacillus and Leuconstoc
5. Lactobacillus mediated conversion of milk to curd results because of
(A) Coagulation and partial digestion of milk fats
(B) Coagulation and partial digestion of milk proteins
(C) Coagulation of milk proteins and complete digestion of milk fats
(D) Coagulation of milk fats and complete digestion milk protein
6. Yeast is used in the production of
(A) Citric acid and lactic acid
(B) Lipase and pectinase
(C) Bread and beer
(D) Cheese and butter
7. Sir Alexander Flemming extracted penicillin from
(A) Penicillium citrinum
(B) Penicillium notatum
(C) Penicillium chrysogenum
(D) Bacillus brevis
8. Which of the following is not an antibiotic
(A) Griseofulvin (B) Cephalosporin
(C) Citric acid (D) Streptomycin
9. Conversion of sugar into alcohol during fermentation is due to the direct action of
(A) Temperature
(B) Micro-organism
(C) Concentration of sugar solution
(D) Zymase
10. Cheese and Yoghurt are products of the process
(A) Distillation (B) Pasteurization
(C) Fermentation (D) Dehydration
11. Streptomycin is used to cure the diseases caused by the bacteria
(A) Gram-positive
(B) Gram-negative
(C) Gram-neutral
(D) Both gram-positive and gram-negative
12. Yeast is an important source of
(A) Vitamin C (B) Vitamin B
(C) Vitamin B (D) Vitamin D
13. The antibiotic "chlorellin" is extracted from the genus
(A) Chlamydomonas (B) Chlorella
(C) Spirogyra (D) Batrachospermum
14. Stirred-tank bioreactors have been designed for
(A) Availability of oxygen throughout the process
(B) Addition of preservation to the product
(C) Purification of the product
(D) Ensuring anaerobic conditions in the culture vessel
15. Rennin used in cheese industry is
(A) Antibiotic (B) Alkaloid
(C) Enzyme (D) Inhibitor
16. Which one of the following is not used in the production of yoghurt
(A) Streptococcus lactis
(B) Streptococcus thermophilus
(C) Lactobacillus bulgaricus
(D) Acetobacter aceti
17. Antibodies in our body are complex
(A) Prostaglandins (B) Glycoproteins
(C) Lipoproteins (D) Steroids
18. Penicillin is obtained from
(A) Aspergillus fumigatus
(B) Penicillium chrysogenum
(C) Penicillium griseofulvum
(D) Streptomyces griseus
19. Saccharomyces is commonly used in the production of
(A) Ethyl alcohol (B) Curd
(C) Citric acid (D) Acetic acid

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match the following list of microbes and their importance

Column - I

- (A) Saccharomyces
- (B) Monascus
- (C) Trichoderma polysporum
- (D) Propionibacterium sharmanii

Column - II

- (i) Production of immunosuppressive
- (ii) Ripening of swiss cheese
- (iii) Commercial production of ethanol
- (iv) Production of blood cholesterol lowering agents

	A	B	C	D
(A)	(iii)	(ii)	(i)	(iv)
(B)	(iv)	(ii)	(i)	(iii)
(C)	(iii)	(i)	(iv)	(ii)
(D)	(iii)	(iv)	(i)	(ii)

2. Match the microbes in column - I with their commercial/industrial products in column II and choose the correct answer

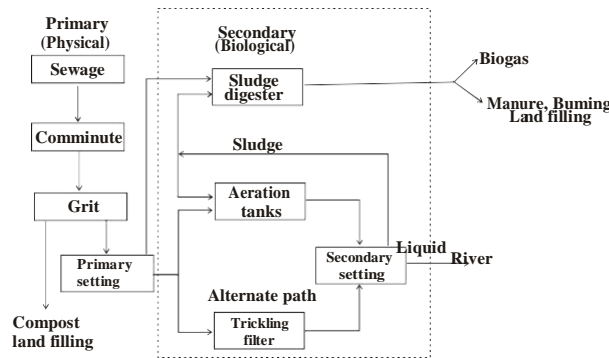
Column - I

- (A) Aspergillus niger
- (B) Clostridium butylicum
- (C) Saccharomyces
- (D) Trichoderma polysporum
- (E) Monascus purpureus
- (A) A - 4, B - 5, C - 2, D - 1, E - 3
- (C) A - 3, B - 4, C - 1, D - 2, E - 5
- (E) A - 2, B - 3, C - 4, D - 5, E - 1

Column - II

- (1) Ethanol
- (2) Stains
- (3) Citric acid
- (4) Butyric acid
- (5) Cyclosporin A
- (B) A - 5, B - 4, C - 1, D - 2, E - 3
- (D) A - 3, B - 4, C - 5, D - 1, E - 2

3. Refer the given flowchart of sewage treatment, accordingly match Column I with Column II and select the correct answer from the codes given below.



Column - I

- (A) The stage in which physical treatment of sewage is done
- (B) The stage in which biological treatment of sewage is done
- (C) Name of the sediment in primary treatment
- (D) It is carried to aeration tanks from primary settling
- (E) Name of the sediment in secondary treatment
- (F) Site of flocs growth
- (G) Function of sludge digester

Column - II

- (i) Anaerobic digestion of activated sludge and production of biogas
- (ii) Activated sludge
- (iii) Aeration tanks
- (iv) Primary effluent
- (v) Primary sludge
- (vi) Secondary treatment
- (vii) Primary treatment

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. Farmers have reported over 50% higher yields of rice by using which of the following biofertiliser?
 (A) Mycorrhiza
 (B) Azolla pinnata
 (C) Cyanobacteria
 (D) Legume -Rhizobium symbiosis
2. The aquatic fern, which is an excellent biofertiliser is
 (A) Azolla (B) Pteridium
 (C) Salvinia (D) Marselia
3. Which of the following plants are used as green manure in crop fields and in sandy soils?
 (A) Saccharum munja and Lantana camara
 (B) Dichanthium annulatum and Azolla nilotica
 (C) Crotalaria juncea and Alhagi comelorum
 (D) Calotropis procera and Phyllanthus niruri
4. During anaerobic digestion of organic waste, such as in producing biogas, which one of the following is left undegraded?
 (A) Hemicellulose (B) Cellulose
 (C) Lipids (D) Lignin
5. The most likely reason for the development of resistance against pesticides in insect damaging a crop is
 (A) random mutations
 (B) genetic recombinations
 (C) directed mutations
 (D) acquired heritable changes
6. A free-living nitrogen-fixing cyanobacterium which can also form symbiotic association with the water fern Azolla is
 (A) Tolypothrix (B) Chlorella
 (C) Nostoc (D) Anabaena
7. Which one of the following is being utilised as a source of bio-diesel in the Indian countryside?
 (A) Euphorbia (B) Beet root
 (C) Sugarcane (D) Pongamia
8. Which one of the following statements is correct?
 (A) Extensive use of chemical fertilisers may lead to eutrophication of nearby water bodies
 (B) Both Azotobacter and Rhizobium fix atmospheric nitrogen in root nodules of plants
 (C) Cyanobacteria such as Anabaena and Nostoc are important mobilisers of phosphates and potassium for plant nutrition in soil
 (D) At present it is not possible to grow maize without chemical fertilisers
9. Which one of the following proved effective for biological control of nematode diseases in plants?
 (A) Gliocladium virens
 (B) Paecilomyces lilacinus
 (C) Pisolithus tinctorius
 (D) Pseudomonas cepacia
10. Which one of the following proved effective for biological control of nematode diseases in plants?
 (A) Pisolithus tinctorius
 (B) Pseudomyces lilacinus
 (C) Gliocladium virens
 (D) Paecilomyces lilacinus
11. Main objective of production/use of herbicide resistant GM crops is to
 (A) eliminate weeds from the field without the use of manual labour
 (B) eliminate weeds from the field without the use of herbicides
 (C) encourage eco-friendly herbicides
 (D) reduce herbicide accumulation in food particles for health safety
12. Cr y-I endotoxins obtained from Bacillus thuringiensis are effective against
 (A) mosquitoes (B) flies
 (C) nematodes (D) bollworms
13. What is true about Bt toxin?
 (A) The inactive protoxin gets converted into active form in the insect gut
 (B) Bt protein exists as active toxin in the Bacillus
 (C) The activated toxin enters the ovaries of the pest to sterilise it and thus, prevent its multiplication
 (D) The concerned Bacillus has antitoxins
14. Which of the following is not used as biopesticide?
 (A) Bacillus thuringiensis
 (B) Trichoderma harzianum
 (C) Nuclear Polyhedrosis Virus (NPV)
 (D) Xanthomonas campestris
15. The bacterium Bacillus thuringiensis is widely used in contemporary biology as a/an
 (A) indicator of water pollution
 (B) insecticide
 (C) agent for production of dairy products
 (D) source of industrial enzyme

1. Ernst Chain and Howard Florey's contribution was
(A) Establishing the potential of penicillin as an effective antibiotic
(B) Discovery of streptokinase
(C) Production of genetically engineered insulin
(D) Discovery of DNA sequence
2. Identify a micro-organism that can produce biomass of protein.
(A) *Methylophilus methylotrophus* (B) *Monascus purpureus*
(C) *Trichoderma polysporum* (D) *Aspergillus niger*
3. Consider the following four statements (A-D) and select the option which includes all the correct ones only.
(A) Single cell *Spirulina* can produce large quantities of food rich in protein, minerals, vitamins, etc.
(B) Body weight-wise the microorganism *Methylophilus methylotrophus* may be able to produce several times more proteins than the cows per day.
(C) Common button mushrooms are a very rich source of vitamin C.
(D) A rice variety has been developed which is very rich in calcium.
(A) Statements (C) and (D) (B) Statements (A), (C) and (D)
(C) Statements (B), (C) and (D) (D) Statements (A) and (B)
4. Which of the following is not correctly matched for the organism and its cell degrading enzyme ?
(A) Algae – Methylase
(B) Fungi – Chitinase
(C) Bacteria – Lysozyme
(D) Plant cells – Cellulase
5. Match column I with column II and select the correct option using the codes given below :
- | Column - I | Column - II |
|--|--|
| (A) Citric acid | (i) <i>Trichoderma</i> |
| (B) Cyclosporin A | (ii) <i>Clostridium</i> |
| (C) Statins | (iii) <i>Aspergillus</i> |
| (D) Butyric acid | (iv) <i>Monascus</i> |
| (A) A- (iii), B- (i), C- (ii), D- (iv) | (B) A- (iii), B- (i), C- (iv), D- (ii) |
| (C) A- (i), B- (iv), C- (ii), D- (iii) | (D) A- (iii), B- (iv), C- (i), D- (ii) |
6. Match the following:
- | List - I | List - II |
|---|---|
| (i) Statins | A. <i>Propionibacterium shermani</i> |
| (ii) Swiss cheese | B. <i>Streptococcus</i> |
| (iii) Cyclosporin A | C. <i>Aspergillus niger</i> |
| (iv) Citric acid | D. <i>Trichoderma polysporum</i> |
| (v) Clot buster | E. <i>Monascus purpureus</i> |
| (A) (i) - E, (ii) - A, (iii) - D, (iv) - C, (v) - E | (B) (i) - B, (ii) - A, (iii) - D, (iv) - E, (v) - C |
| (C) (i) - E, (ii) - A, (iii) - B, (iv) - C, (v) - D | (D) (i) - C, (ii) - E, (iii) - B, (iv) - C, (v) - D |
| (E) (i) - E, (ii) - C, (iii) - A, (iv) - D, (v) - B | |

www.blog.neetnearme.com

BIODIVERSITY AND CONSERVATION

“Destroying rainforest for economic gain is like burning a Renaissance painting to cook a meal.”

“EDWARD WILSON (1929)”

INTRODUCTION

The rich variety of living organisms on this planet never ceases to astonish and fascinate us. Biodiversity is inherent in the occurrence of various types of environmental conditions in different parts of an area as well as earth and the presence of various forms of life adapted to these different environmental regimes.

There are about 20,000 species of ants, 3,00,000 species of beetles, 28,000 species of fishes and nearly 20,000 species of orchids. Biodiversity is not uniform. It is low at certain regions, moderate in others and tremendous in some places. Ecologists and evolutionary biologists are trying to understand and get the significance of such a tremendous diversity. This chapter will help us to know the different levels of biodiversity, patterns of biodiversity, loss of biodiversity and their result. The various ways which can help us to prevent biodiversity and so on.

Biodiversity and Conservation

Biodiversity

- Term given by **Edward Wilson**.
- Combined diversity at all the levels of biological organization. The biodiversity can be studied at three levels.
(1) **Genetic diversity** (2) **Species diversity** (3) **Community and Ecosystem diversity**

(1) Genetic diversity :

- A species show high diversity at **gene level** over its distributional range. For ex. Medicinal plant **Rauwolfia Vomitoria** growing in Himalayan range show diversity in synthesis of chemical **reserpine** in concentration and potential.
- **India has 50,000 genetically different species of rice and 1000 varieties of mangos.**
- Each species, varying from bacteria to higher plants and animals, stores an immense amount of genetic information. For example, the number of genes is about 450-700 in Mycoplasma, 4000 in Escherichia coli, 13000 in Drosophila melanogaster, 32000-50000 in Oryza sativa and 35000 to 45000 in Homo sapiens.
- Genetic diversity refers to the variation of genes within species; the differences could be in alleles (different variants of same genes), in entire genes (the traits determining particular characteristics) or in chromosomal structures.
- The genetic diversity enables a population to adapt to its environment and respond to natural selection. If a species has more genetic diversity, it can adapt better to the changed environmental conditions.
- Lower genetic diversity in a species leads to uniformity, as in the case of large monocultures of genetically similar crop plants. This has advantage when increased crop production is a consideration, but can be a problem when an insect or a fungal disease attacks the field and poses a threat to the whole crop.
- The amount of genetic variation is the basis of **speciation** (evolution of new species). It has a key role in the maintenance of diversity at species and community levels. The total genetic diversity of a community will be greater if there are many species, as compared to a situation where there are only a few species. Genetic diversity within a species often increases with environmental variability.

(2) Species diversity :

- Diversity at species level.
Ex.: Western Ghat have greater species diversity of amphibians than Eastern Ghat.
- Species are distinct units of diversity, each playing a specific role in an ecosystem. Therefore, loss of species has consequences for the ecosystem as a whole.
- Species diversity refer to the variety of species within a region. Simplest measure of species diversity is **species richness**, i.e., the number of species per unit area. The number of species increases per unit area of the site.
- Generally, greater the species richness, greater is the species diversity. However, number of individuals among the species may also vary, resulting into differences in **evenness** or **equitability** and **consequently** in diversity.
- Suppose, we are having three sample areas. In the sample area-I, there are three species of birds. Two species are represented by one individual each, while the third species has four individuals. In the sample area-2 that has the same three species, each species is represented by two individuals. This sample area show greater evenness, and there are equal chances for a species being represented in a sample. The sample area-2 will be considered more diverse than the first. In the sample area-3 the species are represented by an insect, a mammal and a birds. This sample area is most diverse as it compares taxonomically unrelated species. In this example, we find equal number of species but varying number of individuals per species. In nature, both the number and kind of species, as well as the number of individuals per species vary, leading to greater diversity.

BIOLOGY FOR NEET & AIIMS

- Biodiversity is the term popularised by the sociologist Edward Wilson to describe the combined diversity at all the levels of biological organisation. The most important of them.
 - (i) Genetic diversity
 - (ii) Species diversity
 - (iii) Ecological diversity
- According to the IUCN (2004), the total number of plant and animal species described so far is slightly more than 1.5 million.
- Robert May places the global species diversity at about 7 million.
- More than 70 percent of all the species recorded are animals, while plants (including algae, fungi, bryophytes, gymnosperms and angiosperms) comprise no more than 22 percent of the total. Out of every 10 animals on this planet, 7 are insects.
- Although India has only 2.4 percent of the world's land area, its share of the global species diversity is an impressive 8.1 percent.
- India, in the tropical latitudes, has more than 1,200 species of birds.
- The largely torpical Amazonian rain forest in South America has the greatest biodiversity on earth.
- Tropics that might account for their greater biological diversity ?
- Tropical latitudes have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification, (b) Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity and (c) → There is more solar energy available in the tropics, which contributes to higher productivity.
- A stable community should not show too much variation in productivity from year to year, it must be either resistant or resilient to occasional disturbances (natural or man-made) and it must also be resistant to invasions by alien species.
- Tilman found that plots with more species showed less year-to-year variation in total biomass. Increased diversity contributed to higher productivity.
- The IUCN Red List (2004) documents the extinction of 784 species (including 338 vertebrates, 359 invertebrates and 87 plants) in the last 500 years. Some examples of recent extinctions include the dodo (Mauritius), quagga (Africa), thylacine (Australia). Steller's Sea Cow (Russia) and three subspecies (Bali, Javan, Caspian) of tiger.
- Presently, 12 percent of all bird species, 23 percent of all mammal species, 32 percent of all amphibian species and 31 percent of all gymnosperm species in the world face the threat of extinction.

Causes of biodiversity losses

- (i) Habitat loss and fragmentation
- (ii) Over-exploitation : Steller's sea cow, passenger pigeon, were extinct due to overexploitation by humans.
- Environmental damage was caused and threat was posed on our native species by invasive weed species like carrot grass (Parthenium), Lantana and water hyacinth (Eicchomia). The recent illegal introduction of the
- African catfish *Clarias gariepinus* for aquaculture purposes is posing a threat to the indigenous catfishes in rivers.
- Amazon forest is estimated to produce, through photosynthesis, 20 percent of the total oxygen in the earth's atmosphere.

SOLVED EXAMPLE

Ex.1 One of the following plant species is in endangered list

- (A) Eucalyptus (B) Nepenthes
(C) Ceratophyllum (D) Delonix

Sol. (B)

Ex.2 Biodiversity Act of India was passed by the parliament in the year

- (A) 1992 (B) 1996
(C) 2000 (D) 2002

Sol. (D) : Biodiversity act of India – In september 2002, India has 581 protected areas of National parks, Sanctuaries covering 4.7 % land surface against 10 % internationally through this act.

Ex.3 Which of the following regions of our country are known for their rich biodiversity

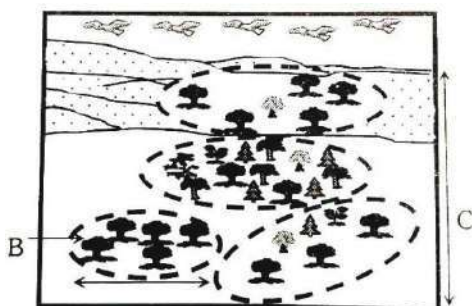
Or

Which of the following are considered hot-spot of biodiversity in India

- (A) Western ghats and eastern himalayas
(B) Western ghats and deccan plateau
(C) Eastern himalayas and gangetic plane
(D) Trans himalayas and deccan peninsula

Sol. (A) : Largest region is Deccan, Peninsula and most biodiversity rich region is Western ghats (4 %) with a very large number of endemic amphibian species.

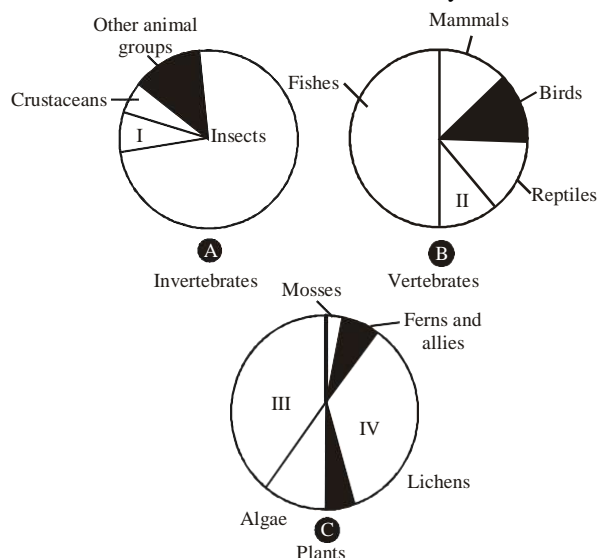
Ex.4 The following diagram shows different types diversity. Identify them



- (A) A - Beta - diversity, B - Alpha - diversity, C - Gamma - diversity
(B) A - Gamma - diversity, B - Beta - diversity, C - Alpha - diversity
(C) A - Gamma - diversity, B - Alpha - diversity, C - Beta - diversity
(D) A - Gamma - diversity, B - Beta - diversity, C - Alpha - diversity

Sol. (A)

Ex.5 The following are pie diagrams A, B and C related to proportionate number of species of major taxa of invertebrates, vertebrates and plants respectively. Study and select the right option in which all the blanks I, II, III and IV are correctly identified.



- (A) I - Turtles, II - Amphibians, III - Fungi, IV - Angiosperms
(B) I - Hexapoda, II - Amphibians, III - Fungi, IV - Angiosperms
(C) I - Molluscs, II - Amphibians, III - Angiosperms, IV - Fungi
(D) I - Molluscs, II - Amphibians, III - Fungi, IV - Angiosperms

Sol. (D)

Ex.6 Total number of identified biodiversity hot spots in the world is

- (A) 25 (B) 24
(C) 40 (D) 34

Sol. (D)

Ex.7 In India the horned rhinoceros is the most important protected species in

Or

The single horned rhinoceros is protected at

- (A) Dachigam National Park (J & K)
(B) Kaziranga National Park (Assam)
(C) Sunderbans National Park (West Bengal)
(D) Dudhwa National National Park (U. P)

Sol. (B)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Endemic plants are those which are
(A) Cosmopolitan in distribution
(B) Restricted to certain area
(C) Found in arctic region
(D) Gregarious in habit
2. Earth Summit at Rio-de-Janero was related to
(A) Soil fertility
(B) Survey of natural resources
(C) Conservation of environment
(D) Prevention of afforestation
3. Each couple should produce only two children which will help in
(A) Checking pollution
(B) Stabilizing the ecosystem
(C) Fertility of soil
(D) Improving food web
4. One of the following is an endangered plant
(A) Lycopersicum (B) Dalbergia
(C) Cedrus (D) Rauwolfia
5. Red data book provides data on
(A) Red flowered plants
(B) Red coloured fishes
(C) Endangered plants and animals
(D) Red eyed birds
6. World Wild Life Week is
(A) First week of September
(B) First week of October
(C) Third week of October
(D) Last week of October
7. Black buck in India is protected by
(A) Bhils (B) Bishnois
(C) Phasis (D) All tribals
8. Which of the following is most dangerous to wild life
(A) Over exploitation
(B) Man made forest
(C) Habitat destruction
(D) Introduction of foreign species
9. Which is preserved in National Park
(A) Flora (B) Fauna
(C) Both (A) and (B) (D) None of these
10. One of the following plant species is in endangered list
(A) Eucalyptus (B) Nepenthes
(C) Ceratophyllum (D) Delonix
11. Plant genes of endangered species are stored
(A) Gene library (B) Gene bank
(C) Herbarium (D) None above
12. Red data book is maintained by
(A) IUCNNR
(B) The Bombay Natural History Society
(C) WPSI
(D) IUCN
13. Kew, London is famous for
(A) Being the largest biological reserve
(B) Herbarium
(C) Being the largest botanical garden
(D) Diverse flora and fauna
14. Which of the following species are restricted to a given area
(A) Sympatric species (B) Allopatric species
(C) Sibling species (D) Endemic species
15. New approach to conservation is the establishment of
(A) Sancturies (B) Reserve forests
(C) National parks (D) Biosphere reserves
16. The presence of diversity at the junction of territories of two different habitats is known as
(A) Bottle neck effect (B) Edge effect
(C) Junction effect (D) Pasteur effect
17. Biodiversity Act of India was passed by the parliament in the year
(A) 1992 (B) 1996
(C) 2000 (D) 2002
18. The most biodiversity rich zone in India
(A) Gangetic planes (B) Transhimalayas
(C) Western Ghats (D) Central India
19. The Environment Protection Act was passed in
(A) 1968 (B) 1974
(C) 1981 (D) 1986

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Which bird is symbol of 'Bombay Natural History Society'
(A) Horn bill (B) Egret
(C) Spoon bill (D) Sun bird
2. 'Central Public Health Engineering Research Institute' is situated at
(A) Delhi (B) Bombay
(C) Nagpur (D) Bihar
3. 'Central Ganga Water Pollution Board' was established in
(A) 1982 (B) 1985
(C) 1987 (D) 1989
4. At a time, a lioness usually gives birth to
(A) One cub (B) Two cubs
(C) Three cubs (D) Four cubs
5. National bird of India is
(A) Hornbill
(B) Black swan
(C) Peacock (*Pavo cristatus*)
(D) House sparrow
6. The bird 'Dodo' became extinct because of
(A) Its beautiful feathers
(B) Its fearlessness
(C) Its curved beak
(D) Its melodious songs
7. The lion tailed monkeys 'Malaca Malaca Silenus' are found only in these regions
(A) Khaziranga and other parts of Assam
(B) Eastern ghats and Madras
(C) Western ghats including Travancore-Mysore
(D) Himalayan mountains
8. What is the generic name of Indian peacock
(A) *Pavo cristatus* (B) *Milvus migrans*
(C) *Paradis flycatcher* (D) *Parser domesticus*
9. The largest Indian poisonous snake is
(A) Python (B) Krait
(C) Cobra (D) Sea snake
10. Which of the following animal has become almost extinct in India
(A) Wolf (B) Rhinoceros
(C) Hippopotamus (D) Cheetah
11. Which of the following types of animals does man chiefly protect
(A) Harmless animals (B) Economically useful
(C) Those likely to perish (D) Feeble animals
12. Animals species should be preserved mainly because
(A) They are lovely creatures
(B) They are useful to mankind
(C) Man cannot recreate a species of animals if it be destroyed
(D) Zoologists want to study them
13. Hippopotamus is found in
(A) America (B) Africa
(C) Asia (D) Australia
14. Elephant has very few hairs while bear has a thick fur because the bear
(A) Has much more natural enemies
(B) Has not been domesticated
(C) Lives in cold climate
(D) Has to regulate body temperature more accurately
15. In nature, which of the following animals has the power of killing the snakes
(A) Falcon (B) Peacock
(C) Squirrel (D) Pangolin
16. In India, commonly available Rhesus monkey is
(A) *Macaca mulatta* (B) *Alouatta*
(C) *Ateles paniscus* (D) *Ateles geoffroyi*
17. Indian elephant is
(A) *Elephas maximus* (B) *Elephas africana*
(C) *Loxodonta africana* (D) *Loxodonta indicus*
18. Now-a-days rhino is present in
(A) Asia (B) Africa
(C) America (D) Africa and Asia
19. The leopard or 'tendwa' is zoologically named as
(A) *Panthera tigris* (B) *Panthera leo*
(C) *Panthera uncia* (D) *Panthera pardus*
20. In elephants the tusks are

Exercise # 3**PART - 1****MATRIX MATCH COLUMN**

1. Match the animals given in Column - I with their location in column - II

Column - I

- (A) Dodo
(B) Quagga
(C) Thylacine
(D) Stellar's sea cow
(A) A- (i), B - (iii), C - (ii), D - (iv)
(C) A- (iii), B - (i), C - (ii), D - (iv)

Column - II

- (i) Africa
(ii) Russia
(iii) Mauritius
(iv) Australia
(B) A- (iv), B - (iii), C - (i), D - (ii)
(D) A- (iii), B - (i), C - (iv), D - (ii)

2. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- (A) Lungs of the planet
(B) Reserpine
(C) Anti-cancer drug
(D) Exotic species
(A) A- (ii), B - (iv), C - (iii), D - (i)
(C) A- (iv), B - (iii), C - (i), D - (ii)

Column - II

- (i) Lantana camara
(ii) Amazon rain forests
(iii) Yew tree
(iv) Rauwolfia
(B) A- (ii), B - (iii), C - (iv), D - (i)
(D) A- (ii), B - (iv), C - (i), D - (iii)

3. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- (A) Rivet Popper hypothesis
(B) Long-term ecosystem experiments using outdoor plots
(C) Species-area relationships
(A) A- (iii), B - (i), C - (ii)
(C) A- (i), B - (iii), C - (ii)

Column - II

- (i) Paul Ehrlich
(ii) David Tilman
(iii) Alexander von Humboldt
(B) A- (i), B - (ii), C - (iii)
(D) A- (ii), B - (iii), C - (i)

4. Match the countries in Column - I with their respective symbols based on animals in Column -II and select the correct option from the codes given below.

Column - I

- (A) New Zealand
(B) India
(C) Australia
(D) U.S.A
(E) China
(A) A- (ii), B - (i), C - (iii), D - (v), E - (iv)
(C) A- (iii), B - (i), C - (ii), D - (iv), E - (v)

Column - II

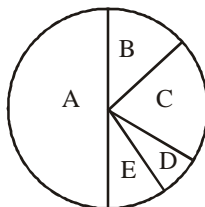
- (i) Tiger
(ii) Kangaroo
(iii) Kiwi
(iv) Giant Panda
(v) Bald eagle
(B) A- (iii), B - (i), C - (ii), D - (v), E - (iv)
(D) A- (iv), B - (i), C - (ii), D - (iii), E - (v)

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. The endangered largest living lemur *Idri idri* is inhabitant of
(A) Madagascar (B) Mauritius
(C) Sri Lanka (D) India
2. Which group of vertebrates comprises the highest number of endangered species?
(A) Reptiles (B) Birds
(C) Mammals (D) Fishes
3. Which endangered animal is the source of the world's finest, lightest, warmest and most expensive wool - the shahtoosh?
(A) Kashmiri goat (B) Chiru
(C) Nilgai (D) Cheetal
4. In your opinion which is the most effective way to conserve the plant diversity of an area?
(A) By tissue culture method
(B) By creating biosphere reserve
(C) By creating botanical gardens
(D) By developing seed banks
5. Biodiversity act of India was passed by the Parliament in the year
(A) 1996 (B) 1992
(C) 2002 (D) 2000
6. One of the most important function of botanical garden is that
(A) One can observe tropical plants there
(B) They allow ex situ conservation of germplasm
(C) They provide the natural habitat for wild Life
(D) They provide a beautiful area for recreation
7. According to IUCN Red List, what is the status of red panda (*Ailurus fulgens*) ?
(A) Vulnerable species
(B) Critically endangered species
(C) Extinct species
(D) Endangered species
8. Which of the following is considered a hotspot of biodiversity in India?
(A) Western ghats
(B) Indo-Gangetic plain
(C) Eastern ghats (D) Aravalli hills
9. Which of the following pairs of an animal and a plant represents endangered organisms in India?
(A) *Bentinckia nicobarica* and red panda
(B) Tamarind and rhesus monkey
(C) Cinchona and leopard
(D) Banyan and black buck
10. Which one of the following is not included under in situ conservation?
(A) Sanctuary (B) Botanical gardens
(C) Biosphere reserve (D) National park
11. Identify the odd combination of the habitat and the particular animal concerned.
(A) Dachigam National Park - Snow leopard
(B) Sunderbans - Bengal tiger
(C) Periyar - Elephant
(D) Rann of Kutch - Wild ass
12. One of endangered species of Indian medicinal plants is that of
(A) Podophyllum (B) *Ocimum*
(C) Garlic (D) *Nepenthes*
13. Which one of the following pairs of organisms are exotic species introduced in India?
(A) *Ficus religiosa*, *Lantana camara*
(B) *Lantana camara*, water hyacinth
(C) Water hyacinth, *Prosopis cineraria*
(D) Nile perch, *Ficus religiosa*
14. ICBN stands for
(A) Indian Congress of Biological Names
(B) International Code of Botanical Nomenclature
(C) International Congress of Biological Names
(D) Indian Code of Botanical Nomenclature
15. World Summit on Sustainable Development (2002) was held in
(A) Brazil (B) Sweden
(C) Argentina (D) South Africa
16. Which one of the following is not observed in biodiversity hot spots?
(A) Endemism
(B) Accelerated species loss
(C) Lesser interspecific competition
(D) Species richness

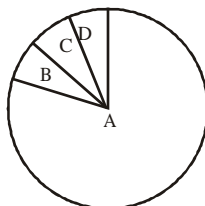
MOCK TEST

- Which is the National Aquatic Animal of India ?
 (A) Blue whale (B) Sea-horse (C) Gangetic shark (D) River diolphin
- The species confined to a particular region and not found elsewhere is termed as
 (A) endemic (B) rare (C) keystone (D) alien
- Given below is the representation of the extent of global diversity of vertebrates. What groups does the portions represent ?



- | | A | B | C | D | E |
|-----|---------|------------|---------|------------|------------|
| (A) | Birds | Reptiles | Fishes | Mammals | Amphibians |
| (B) | Mammals | Birds | Fishes | Amphibians | Reptiles |
| (C) | Fishes | Amphibians | Mammals | Birds | Reptiles |
| (D) | Fishes | Mammals | Birds | Reptiles | Amphibians |

- Given here is a pie chart representation of the exityent of global diversity of invertebrates. What groups the four portions (A-D) represent respectively ?



- | | A | B | C | D |
|-----|-------------|---------------------|---------------------|---------------------|
| (A) | Insects | Crustaceans | Other animal groups | Molluscs |
| (B) | Crustaceans | Insects | Molluscs | Other animal groups |
| (C) | Molluscs | Other animal groups | Crustaceans | Insects |
| (D) | Insects | Molluscs | Crustaceans | Other animal group |

- Choose the right one which denotes gentic diversity.
 (A) Chromosomes → Nucleotides → Genes → Individuals → Populations
 (B) Populations → Individuals → Chromosomes → Nucleotides → Genes
 (C) Genes → Nucleotides → Chromosomes → Individuals → Populations
 (D) Nucleotides → Genes → Chromosomes → Individuals → Populations
- Biodiversity of a geographical region represents
 (A) endangered species found in the region
 (B) the diversity in the organisms living in the region
 (C) genetic diversity in the dominant species of the region
 (D) species endemic to the region

www.blog.neetnearme.com

MOLECULAR BASIS OF INHERITANCE

“One of the deepest functions of a living organisms is to look ahead... to produce future”.

“FRANCOIS JACOB (1920-2013)”

INTRODUCTION

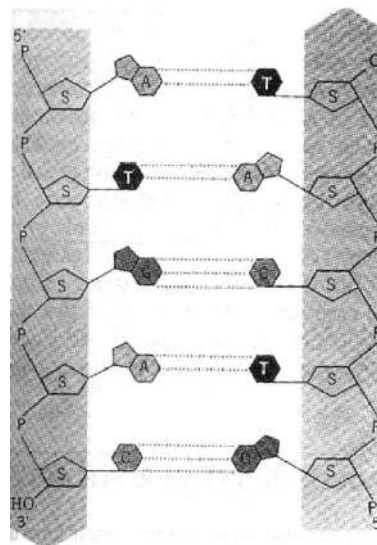
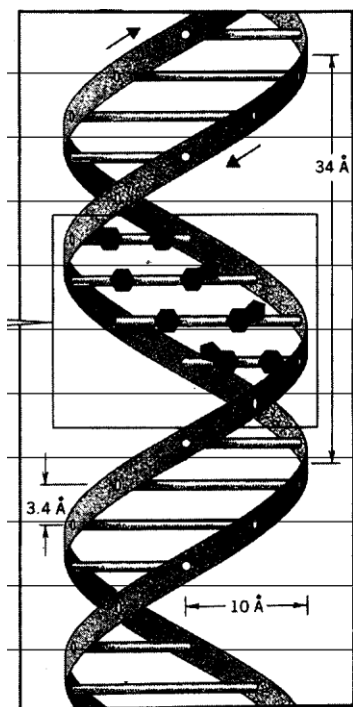
In previous chapter, you have learnt the inheritance patterns and genetic basis of such patterns. Factors/Genes were first detected and analyzed by Mendel and subsequently many other scientists, by following their patterns of transmission from generation to generation. Over the next hundred years, the nature of the putative genetic material was investigated culminating in the realisation that DNA-deoxyribonucleic acid-is the genetic material at least for the majority of various organisms. This is the substance which controls the inheritance of traits from one generation to the next and it is also able to express its effect through the formation and functioning of traits.

Nucleic acid is of two types in all living system i.e., deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). DNA is a genetic material in all organism except some viruses. RNA is a genetic material in riboviruses. In others, RNA also functions as messenger which carry genetic information, an adapter for picking up amino acids, structural and catalytic molecule in some cases

Molecular Basis of Inheritance

DNA

- Discovered by - **Meischer**. DNA was first identified by Friedrich Mrischer in 1869. He named it as Nuclein. Altmann found these substances to be acidic in nature and hence named it as nucleic acid.
- In DNA pentose sugar is deoxyribose sugar and four types of nitrogen bases A,T,G,C
- **Wilkins and Franklin** studied DNA molecule with the help of X-Ray crystallography.



- With the help of this study, **Watson and Crick** (1953) proposed a double helix model for DNA. For this model Watson, Crick and Wilkins were awarded by Noble Prize in 1962.
- According to this model, DNA is composed of two polynucleotide chains.
- Both polynucleotide chains are complementary and antiparallel to each other.
- In both strand of DNA direction of phosphodiester bond is opposite. i.e. If direction of phosphodiester bond in one strand is 3'-5' then it is 5'-3' in another strand.
- Both strand of DNA held together by hydrogen bonds. These hydrogen bonds are present between nitrogen bases of both strand.
- Adenine binds to thymine by two hydrogen bonds and cytosine binds to guanine by three hydrogen bonds.
- **Chargaff's equivalency rule** - In a double stranded DNA amount of purine nucleotides is equals to amount of pyrimidine nucleotides.

$$\text{Purine} = \text{Pyrimidine}$$

$$[A] + [G] = [T] + [C]$$

$$\frac{[A] + [G]}{[T] + [C]} = 1$$

- **Base ratio** = $\frac{A + T}{G + C}$ = constant for a given species.

BIOLOGY FOR NEET & AIIMS

Types of DNA :-

On the basis of direction of twisting, there are two types of DNA.

1. Left handed DNA:-

Anticlockwise twisting e.g. Z-DNA - discovered by Rich. Phosphate and sugar backbone is zig-zag. Units of Z-DNA are dinucleotides (purine and pyrimidine in alternate order)

Helix length – 5.6 \AA

Diameter – 18.4 \AA

No. of base pairs – 12 (6 dimers)

Distance between 2 base - pairs – 3.75 \AA

2. Right Handed DNA-

Clockwise twisting e.g. The DNA for which Watson and Crick proposed model was 'B' DNA.

DNA	Helix Length	No. of base pairs	Distance between twopairs	Diameter
'A'	28 \AA	11 pairs	2.56 \AA	23 \AA
'B'	34 \AA	10 pairs	3.4 \AA	20 \AA
'C'	31 \AA	9.33 pairs	3.32 \AA	19 \AA
'D'	24.24 \AA	8 pairs	3.03 \AA	19 \AA

● Palindromic DNA – Wilson and Thomas



Sequence of nucleotides same from both ends.



ED OS KEY POINTS

- DNA molecule is Dextrorotatory while RNA molecule is Laevorotatory.
- C – value = Total amount of DNA in a haploid genome of organism

Packaging of DNA Helix -

Taken the distance between two consecutive base pairs as 0.34 nm ($0.34 \times 10^{-9} \text{ m}$), if the length of DNA double helix in a typical mammalian cell is calculated (simply by multiplying the total number of bp with distance between two consecutive bp, that is $6.6 \times 10^9 \text{ bp} \times 0.34 \times 10^{-9} \text{ m/bp}$), it comes out to be approximately 2.2 metres. A length that is far greater than the dimension of a typical nucleus (approximately 10^{-6} m). How is such a long polymer packaged in a cell?

If the length of E. coli DNA is 1.36 mm, can you calculate the number of base pairs in E.coli?

1. GENE EXPRESSION

- One gene-one enzyme hypothesis was given by Beadle & Tatum.
- According to this, each gene produces a particular type of enzyme.
- They worked on *Neurospora crassa*.
- Prototroph : It is the wild type *Neurospora* which can easily grow on minimal nutrient medium.
- Auxotroph : These are the nutritional mutants which are unable to grow on minimal nutrient medium.
- Later on one gene-one enzyme hypothesis has been modified into one gene-one polypeptide hypothesis.

2. REGULATION OF GENE EXPRESSION

- The 'ON' or 'OFF' mechanism of non-constitutive genes, as per requirement is called gene regulation.'
- In 1961, F. Jacob and J. Monod proposed Operon model for the regulation of gene action in *E. coli*.
- An operon is a part of DNA, which acts as single regulated unit having one or more structural genes, one operator gene, one promoter gene and one regulator gene.
- Operons are of two types :-
 - Inducible operon (e.g. Lac operon)
 - Repressible operon (e.g. Tryptophan operon)
- In lac operon, a polycistronic structural gene is regulated by a common promoter and regulatory genes.
- Lactose is the substrate for the enzyme β -galactosidase and it regulates switching on & off the operon. Hence it is called inducer.
- A very low level of expression of lac operon has to be present in the cell all the time, otherwise lactose cannot enter the cells.
- The repressor of the operon is synthesised (all the time constitutively) from the i-gene.
- Glucose or galactose cannot act as inducers for lac operon. The lac operon would be expressed in the presence of lactose till the level of glucose remains low in cell.
- Regulation of lac operon by repressor is referred to as negative regulation.

The Lac Operon

In eukaryotes, the regulation could be exerted at

- transcriptional level (formation of primary transcript)
- processing level (regulation of splicing)
- transport of mRNA from nucleus to the cytoplasm
- translational level

3. HUMAN GENETICS

- Study of inheritance of genetic characters and aspects like genetic improvements among humans is known as human genetics.
- In human direct genetical studies are not possible. For this different indirect methods are used. Pedigree analysis is one such important method.
- Study of the family history for the inheritance of particular trait in several generations of a family is called the pedigree analysis.

4. POPULATION GENETICS:

- Study of gene frequency in a population is called population genetics.
- Gene frequency : It is the proportion of different alleles of a gene in a population.
- Hardy-Weinberg law :
- In a large, randomly mating population, the frequency of a gene remains constant from generation to generation when factors like selection, mutation & migration are absent.
- According to this law, $p + q = 1$

SOLVED EXAMPLE

- Ex.1** Which site of a t-RNA molecule hydrogen bonds to am-RNA molecule
(A) Codon
(B) Anticodon
(C) 5' end of the t-RNA molecule
(D) 3' end of the t-RNA molecule
- Sol.** (B) : Anticodon arm is responsible for recognizing and binding codons in the m-RNA.
- Ex.2** Removal of introns and joining the exons in a defined order in a transcription unit is called
(A) Splicing (B) Tailing
(C) Transformation (D) Capping
- Sol.** (A) : Spliceosomes cut introns from hn-RNA and exons are joined by RNA ligase. It is called splicing.
- Ex.3** Semiconservative model of DNA replication was proposed by which workers in eukaryotes
(A) Taylor, Woods and Hughes, 1957
(B) Messelson and Stahl, 1957
(C) Nirenberg and Khorana, 1967
(D) Watson and Crick, 1952
- Sol.** (B)
- Ex.4** In the double helix model of DNA, how far is each base pair from the next base pair
(A) 3.4 nm (B) 0.34 nm
(C) 2.0 nm (D) 34 nm
(E) 0.034 nm
- Sol.** (B)
- Ex.5** If the DNA codons are ATG ATG ATG and a cytosine base is inserted at the beginning, which of the following will result
(A) A non-sense mutation
(B) CATGATGATG
(C) CAT GATGATG
(D) CATGATGATG
- Sol.** (C)
- Ex.6** The chemical knives of DNA are
Or
Enzyme that cleaves nucleic acids within the polynucleotide chain is known as
(A) Ligases (B) Polymerases
(C) Endonucleases (D) Transcriptase
- Sol.** (C) : Endonucleases enzymes cut DNA at specific desired place so it is called chemical knives of DNA.
- Ex.7** Nucleotides are building blocks of nucleic acids. Each nucleotide is a composite molecules formed by
(A) (Base-sugar)n (B) Base-sugar-OH
(C) Base-sugar-phosphate (D) Sugar-phosphate
- Sol.** (C) : Nucleotides are the building blocks or monomeric units. Each nucleotide contain Nitrogen bases (Purines and pyrimidines), pentose sugar (5c) and phosphoric acid.
- Ex.8** Which one of the following also acts as a catalyst in a bacterial cell
(A) 23 sr RNA (B) 5 sr RNA
(C) sn RNA (D) hn RNA
- Sol.** (A) : 23 S rRNA is catalytic RNA.
- Ex.9** Read the following four statements (A - D)
A. In transcription, adenosine pairs with uracil
B. Regulation of lac operon by repressor is referred to as positive regulation
C. The human genome has approximately 50,000 genes
D. haemophilia is a sex-linked recessive disease
How many of the above statements are right
(A) Two (B) Three
(C) Four (D) One
- Sol.** (A) : Regulation of lac operon by repressor is referred as negative regulation. Human genome has approximately 30000 genes.
- Ex.10** A triplet codon means
(A) A sequence of three nitrogen bases on mRNA
(B) A sequence of three nitrogen bases in tRNA
(C) A sequence of three bases in rRNA
(D) The presence of only three bases in mRNA
- Sol.** (A)
- Ex.11** The one aspect which is not a salient feature of genetic code, is its being
(A) Specific (B) Degenerate
(C) Ambiguous (D) Universal
- Sol.** (C)
- Ex.12** Which one-of the following is not a part of a transcription unit in DNA
(A) The inducer (B) A terminator
(C) A promoter (D) The structural gene
- Sol.** (A) : Transcription unit consists of promoter, structural gene and terminator.

Exercise # 1

SINGLE OBJECTIVE

NEET LEVEL

1. In sea urchin DNA, which is double stranded, 17% of the bases were shown to be cytosine. The percentages of the other three bases expected to be present in this DNA are
 (A) G 17%, A 16.5% , T 32.5%
 (B) G 17%, A 33% , T 33%
 (C) G 8.5%, A 50%, T 24.5%
 (D) G 34%, A 24.5%, T 24.5%
2. Which of the following RNAs picks up specific amino acid (from amino acid pool) in the cytoplasm to ribosome during protein synthesis
 or
 Which from of RNA has a structure resembling clover leaf
 (A) tRNA (B)mRNA
 (C)rRNA (D) All ofthese
3. Read the following statements and choose the correct option
 A. Nitrogenous base is linked to the pentose sugar through a N-glycosidic linkage
 B. Phosphate group is linked to 5'-OH of a nucleoside through phosphoester linkage
 C. Two nucleosides are linked through 3'-5' N-glycosidic linkage
 D. Negatively charged DNA is wrapped around positively charged histone octamer to form nucleosome
 E. The chromatin that is more densely packed and stains dark is called euchromatin
 (A) A, B and C alone are wrong
 (B) D alone is wrong
 (C) C and E alone are wrong
 (D) A alone is wrong
 (E) A, B and D alone are wrong
4. The substance that acts as connecting link between two generation is
 (A) Ribonucleic acid
 (B) Deoxyribonucleic acid
 (C) Nucleoplasm
 (D) Ribonucleic acid + Deoxyribonucleic acid
5. Which one of the following peak absorption of ultraviolet light by heterocyclic bases (Nitrogen bases)
 (A) 1500nm (B) 26 nm
 (C) 75 nm (D) 260nm
6. The enzyme that breaks H₂ bonds in DNA is
 (A) Helicase (B) Topoisomerase
 (C) Ligase (D) Polymerase
7. Exon part of m-RNAs has code for
 (A) Protein (B) Lipid
 (C) Phospholipid (D) Carbohydrate
8. It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for genetic material. This is written by
 (A) Meselson and Stahl (B) Archibold Garrod
 (C) Severo Ochoa (D) Waston and Crick
9. DNA elements, which can switch their position, are called
 (A) Exons
 (B) Introns
 (C) Cistrons
 (D) Transposons/Jumping genes
10. The specific DNA sequence where EcoRI cuts is
 or
 Which of the following plaindromic sequence is recognized by EcoRI
 (A) ATTCGA (B) GAATTC
 CGAATT CAAGTT
 (C) GCTTAA (D) GTTCAA
 TAAGCT CTTAAG
11. The enzyme DNA polymerase was discovered by
 (A) Kornberg (B) Okazaki
 (C) Waston and Crick (D) Jacob and Monod
12. What is false about t RNA
 (A) It binds with an amino acid at it 5' end
 (B) It has five double stranded regions
 (C) It has a codon at one end which recognizes the anticodon on messenger RNA
 (D) It looks like clover leaf in the three dimensional structure
13. c-DNA can be formed by
 (A) Transaminase
 (B) DNA ligase
 (C) RNA dependent DNA polymerase (Reverse Transcriptase)
 (D) DNA dependent DNA polymerase

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. In prokaryotes, the process of replication is catalysed by the following enzymes. Identify which of the enzymes is best coordinate with the role
 - (A) Helicase– Joins the ends of DNA segments
 - (B) DNA polymerase I – Synthesis DNA
 - (C) DNA polymerase II – Erases primer and fills gaps
 - (D) Primase – Synthesis RNA primers
2. The eukaryotic differs from the prokaryotic genome because
 - (A) Repetitive sequences are present in eukaryotes.
 - (B) Genes in the former case are organized into operons
 - (C) The DNA is complexed with with histones in prokaryotes
 - (D) The DNA is circular and single stranded in prokaryotes
3. The double helix model of Waston and Crick is known as
 - (A) C-DNA
 - (B) B-DNA
 - (C) Z-DNA
 - (D) D-DNA
4. Find out the wrong statement
 - (A) Mobile genetic elements, transposons were visualized by Barbara McClintock
 - (B) Udder cell, a somatic cell is used to produce the cloned sheep nuclear transplantation method
 - (C) In pedigree analysis, a person immediately affected by an action is called propositus
 - (D) Dr. Ian Wilmut produced a cloned sheep called Dolly
 - (E) DNA ligase are used to cleave a DNA molecule
5. Who among the following did not provide experimental proof for the semiconservative model of DNA replication
 - (A) Meselson & Stahl
 - (B) Cairns
 - (C) Waston & Crick
 - (D) Taylor
6. mRNA carries the genetic information from DNA to the

or

 Which of the following is the site of translation of the mRNA
 - (A) Chloroplasts
 - (B) Ribosomes
 - (C) Mitochondria
 - (D) Lysosomes
7. During DNA replication in prokaryotes DNA is anchored
 - (A) Chromosome
 - (B) Mesosome
 - (C) Nucleolus
 - (D) Ribosome
8. DNA is acidic due to
 - (A) Sugar
 - (B) Phosphoric acid
 - (C) Purine
 - (D) Pyrimidine
9. RNA is not found in
 - (A) Chromosome
 - (B) Plasmmalemma
 - (C) Nucleous
 - (D) Ribosome
10. The length of DNA molecule greatly exceeds the dimensions of the nucleus in eukaryotic cells. How is this DNA accommodated
 - (A) Deletion of non-essential genes
 - (B) Super-coiling in nucleosomes
 - (C) DNAase digestion
 - (D) Through elimination of repetitive DNA
11. The two polynucleotide chains in DNA are
 - (A) Parallel
 - (B) Discontinuous
 - (C) Antiparallel
 - (D) Semiconservative
12. In DNA of certain organisms, guanine constitutes 20% of the bases. What percentage of the bases would be adenine
 - (A) 0%
 - (B) 10%
 - (C) 20%
 - (D) 30%
 - (E) 40%
13. Base composition in RNA is
 - (A) A + T = G + C
 - (B) A + G = T + C
 - (C) A + U = G + C
 - (D) A + G = U + C
14. Left handed DNA among following is
 - (A) DNA
 - (B) A DNA
 - (C) C DNA
 - (D) B DNA
15. Which of the following be named for DNA produced from RNA
 - (A) A–DNA
 - (B) B–DNA
 - (C) C–DNA
 - (D) Z–DNA
16. hn-RNA undergoes two additional processing. Out of which, in one of them an unusual nucleotide (methyl guanosine triphosphate) is added to the 5'-end of hnRNA. This is known as
 - (A) Capping
 - (B) Tailing
 - (C) Splicing
 - (D) Termination
17. If a segment of an mRNA molecule has the sequence 5' GUACCGAUCG 3', which of the following could have been the template DNA molecule
 - (A) 5' GCUAGCCUAG 3'
 - (B) 5' GUACCGAUCG 3'
 - (C) 5' CATGGCTAGC 3'
 - (D) 5' CGATCGGTAC 3'

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match the following

Column - I

- A. tRNA
- B. mRNA
- C. rRNA
- D. Peptidyl transferase

A	B
(A) 4	2
(B) 1	4
(C) 1	2
(D) 1	3

Column - II

- 1. Linking of amino acids
- 2. Transfer of genetic information
- 3. Nucleolar organising region
- 4. Transfer of amino acid from cytoplasm of ribosome

C	D
3	1
3	2
3	4
2	4

2. Identify the correct match between the codons and coding functions

Column - I

- A. AUG
- B. UAA
- C. UUU
- D. UGG

- (A) A - 1, B - 4, C - 2, D - 3
- (C) A - 4, B - 3, C - 2, D - 1
- (E) A - 2, B - 3, C - 4, D - 1

Column - II

- 1. Phenylalanine
- 2. Methionine
- 3. Tryptophan
- 4. Termination

- (B) A - 2, B - 4, C - 1, D - 3
- (D) A - 4, B - 1, C - 3, D - 2

3. Match the following.

Column - I

- A. VNTR
- B. Introns and Exons
- C. Dystrophin
- D. Satellite

- (A) A - R; B - S; C - P; D - Q
- (C) A - Q; B - P; C - S; D - R

Column - II

- P. Largest gene
- Q. DNA fingerprinting
- R. Bulk DNA
- S. Splicing

- (B) A - Q; B - S; C - P; D - R
- (D) A - S; B - P; C - Q; D - R

4. Match the following in column - I with column - II and choose the correct combination

Column - I

- A. Termination
- B. Translation
- C. Transcription
- D. DNA replication

- (A) A - 1; B - 3; C - 1; D - 4
- (C) A - 3; B - 1; C - 4; D - 2
- (E) A - 2; B - 4; C - 1; D - 3

Column - II

- 1. Aminoacyl synthetase
- 2. Okazaki fragments
- 3. GTP dependent release factor
- 4. RNA polymerase

- (B) A - 1; B - 4; C - 2; D - 3
- (D) A - 4; B - 2; C - 1; D - 3

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. During replication of DNA, its two strands separate. Each of these serves as a template for the formation of new strand. Such type of replication is called [CBSE AIPMT 2000]
(A) non-conservative (B) semi-conservative
(C) flexible (D) conservative
2. 'Signal hypothesis' for the biosynthesis of secretory type of proteins was proposed by [CBSE AIPMT 2000]
(A) Camillo Golgi (B) Blobel and Sabatini
(C) Baltimore (D) Sheeler and Bianchi
3. Due to discovery of which of the following is 1980's the evolution was termed as RNA world ? [CBSE AIPMT 2001]
(A) mRNA, tRNA, rRNA synthesis proteins
(B) In some viruses, RNA is genetic material
(C) Some RNAs have enzymatic property
(D) RNA is not found in all cells
4. E.coli about to replicate was placed in a medium containing radioactive thymidine for five minutes. Then it was made to replicate in a normal medium. Which of the following observation shall be correct ? [CBSE AIPMT 2001]
(A) Both the strands of DNA will be radioactive
(B) One strand radioactive
(C) Each strand half radioactive
(D) None is radioactive
5. Gene and cistron words are sometimes used synonymously because [CBSE AIPMT 2001]
(A) one cistron contains many genes
(B) one gene contains many cistrons
(C) one gene contains one cistron
(D) one gene contains no cistron
6. In which direction mRNA is synthesised on DNA template ? [CBSE AIPMT 2001]
(A) 5' → 3' (B) 3' → 5'
(C) both (A) and (B) (D) any of above
7. In negative operon [CBSE AIPMT 2001]
(A) co-repressor binds with repressor
(B) co-repressor does not bind with repressor
(C) co-repressor binds with inducer
(D) cAMP has negative effect on lac operon
8. Sequence of which of the following is used to know the phylogeny ? [CBSE AIPMT 2001]
(A) mRNA (B) rRNA
(C) tRNA (D) DNA
9. In E. coli, during lactose metabolism repressor binds to [CBSE AIPMT 2002]
(A) regulator gene (B) operator gene
(C) structural gene (D) promoter gene
10. Jacob and Monod studied lactose metabolism in E. coli and proposed Operon concept. Operon concept applicable for [CBSE AIPMT 2002]
(A) all prokaryotes
(B) all prokaryotes and some eukaryotes
(C) all prokaryotes and all eukaryotes
(D) all prokaryotes and some protozoans
11. In a DNA percentage of thymine is 20. What is the percentage of guanine ? [CBSE AIPMT 2002]
(A) 20% (B) 40%
(C) 30% (D) 60%
12. Which statements is correct bacterial transduction ? [CBSE AIPMT 2002]
(A) Transfer of some genes from one bacteria to another bacteria through virus
(B) Transfer of genes from one bacteria to another bacteria by conjugation
(C) Bacteria obtained its DNA directly
(D) Bacteria obtained DNA from other external source
13. Nucleus of a donor embryonal cell/somatic cell is transferred to an enucleated egg cell. Then after the formation of organism what, shall be true ? [CBSE AIPMT 2002]
(A) Organism will have extra-nuclear genes of the donor cell
(B) Organism will have extra-nuclear genes of recipient cell
(C) Organism will have extra-nuclear genes of both donor and recipient cell
(D) Organism will have nuclear genes of recipient cell

MOCK TEST

- Beads on string like structures of A are seen in B, which further condense to form chromosomes in C stage of cell division

A	B	C
(A) Chromonema	Chromatin	Metaphase
(B) Chromatin	Chromatid	Metaphase
(C) Chromonema	Chromosome	Anaphase
(D) Chromonema	Chromatid	Anaphase
- Microsatellites are

(A) Repetitive DNA sequences	(B) ESTs
(C) YAC	(D) BAC
(E) UTR	
- In the DNA molecule

(A) The proportion of adenine in relation to thymine varies with the organism

(B) There are two strands which run antiparallel-one in 5' → 3' direction and other in 3' → 5'

(C) The total amount of purine nucleotides and pyrimidine nucleotides is not always equal

(D) There are two strands which run parallel in the 5' → 3' direction
- The diagram shows an important concept in the genetic implication of DNS. Fill in the blanks A to C.

(A) A-Transcription, B - Translation, C-Francis Crick (B) A-Translation, B - Extension, C-Rosalind Frankline

(C) A-Transcription, B- Replication, C-James Watson (D) A-Translation, B- Transcription, C-Ervin Chargaff
- If the total of adenine and thymine in a double stranded DNA is 55 %, the amount of guanine in this DNA will be

(A) 45 %	(B) 27.5%	(C) 25%	(D) 22.5%
(E) 40%			
- Read the following statements and choose the correct option

A. Nitrogenous base is linked to the pentose sugar through a N-glycosidic linkage.

B. Phosphate group is linked to 5' -OH of a nucleoside through phosphoester linkage

C. Two nucleoside are linked through 3' -5' N-glycosidic linkage

D. Negatively charged DNA is wrapped around positively charged histone octamer to form nucleosome.

E. The chromatin that is more densely packed and stains dark is called euchromatin.

(A) A,B and C alone are wrong	(B) D alone is wrong
(C) C and E alone are wrong	(D) A lone is wrong
(E) A,B and D alone are wrong.	
- The result of which of the following reaction experiments carried out by Avery et. on Streptococcus pneumoniae has proved conclusively that DNA is the genetic material ?

(A) Live 'R' strain + DNA from 'S' strain + RNA ase

(B) Live 'R' strain + DNA from 'S' strain +DNA ase

(C) Live 'R' strain + Denatured DNA of 'S' strain + protease

(D) Heat killed 'R' strain +DNA from 'S' strain + DNA ase

www.blog.neetnearme.com

BREATHING AND EXCHANGE OF GASES

“To be a Christian without prayer is no more possible than to be alive without breathing.”

“ MARTIN LUTHER (1712-1778)”

INTRODUCTION

All animals to perform function like breathing require energy which is derived from the breakdown of nutrients molecules like glucose. Carbon dioxide which is harmful is also released during the catabolic reactions, also energy is released in the form of ATP. Now, this ATP is utilised by various animals to carry out their body functions readily.

Therefore it is an evident that O_2 Has to be continuously provided to the cells, CO_2 released by the cells. This process of exchange of O_2 from the atmosphere with CO_2 produced by the cells is known as **Breathing**, which is commonly called as **Respiration**.

Breathing includes expiration and inhalation. **Inspiration** means to inhale prior to breathe in and **Expiration** means to exhale or to breathe out.

RESPIRATORY SYSTEM

INTRODUCTION

Definition

Respiration is the physiological catabolic process in which gaseous exchange occurs to oxidise food. The energy generated is utilized and by products, CO_2 and H_2O are given out.

So, respiration is a physio-chemical process. The surface at which exchange of gases occurs is called respiratory surface, and the compounds oxidised in respiration are called respiratory substrate.

TYPES OF RESPIRATION

Following are the types of respiration.

Direct and Indirect respiration

Aerobic and Anaerobic respiration

Direct and Indirect respiration

Direct respiration

- (i) In this type of respiration, there is direct exchange of gases in between body cells and respiratory medium.
- (ii) Exchange of gases occurs on the principle of diffusion, through moist body surface.
- (iii) Direct respiration is found in unicellular organisms like, aerobic bacteria, amoeba, sponges, hydra, flatworm, roundworm etc.

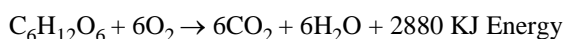
Indirect respiration

- (i) In this type of respiration, there is no direct contact in between the body cells and respiratory medium.
- (ii) Indirect respiration is found in complex and higher form of organism.
- (iii) Higher organism have some specialized, structure for gaseous exchange which are called **respiratory organs**.
e.g.
 - (a) Skin - Skin is respiratory organ in annelida and amphibians.
 - (b) Gills - Most of crustaceans, mollusca, all fishes and some amphibians the exchange of gases in gills is called branchial respiration.
 - (c) Lungs - Lungs is respiratory organ in snails, some amphibians, all reptiles, birds and mammals.
 - (d) Trachea - Trachea is respiratory organ in insects.

AEROBIC AND ANAEROBIC RESPIRATION

Aerobic respiration

- (i) Respiration which occurs in presence of oxygen is called aerobic respiration.
- (ii) The oxygen completely oxidises the food to CO_2 and H_2O releasing large amount of energy. This process can be shown by following way.



- (iii) Such type of respiration (aerobic respiration) found in most animals and plants.

Phases of aerobic respiration

There are two phases of aerobic respiration.

A- External respiration

B- Internal respiration

→ The process of exchange of O_2 from the atmosphere with CO_2 produced by the cells is called breathing, commonly known as respiration.

S.No.	Respiratory organs	Examples
1.	General body surface	Sponges, Coelenterates, Flat worms
2.	Moist skin	Earthworms, Frogs
3.	Tracheal tubes	Insects
4.	Gills	Aquatic arthropods, Molluscs, Fishes
5.	Lungs	Reptiles, Birds, Mammals

→ Pharynx is the common passage for food and air.

→ In human, path of air is :

External → Nasal → Nasopharynx → Larynx → Trachea → Primary
nostrils chamber Bronchi
Alveoli ← Bronchioles ← Tertiary ← Secondary ↙
network bronchi Bronchi

→ Inspiration can occur if the pressure within the lungs (intra-pulmonary pressure) is less than the atmospheric pressure. Inspiration is initiated by the contraction of diaphragm and external inter costal muscles (EICM). Expiration takes place when the intrapulmonary pressure more than the atmospheric pressure. In this diaphragm and EICM are relaxed.

→ Alveoli are the primary sites of exchange of gases. Exchange of gases also occur between blood and tissues.

→ O_2 and CO_2 are exchanged in these sites by simple diffusion mainly based on pressure/concentration gradient.

→ Partial pressures (in mm Hg) of oxygen and carbon dioxide.

Respiratory Gas	Atmospheric Air	Alveoli	Deoxygenated blood	Oxygenated blood	Tissues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

S.No.	Respiratory volumes and capacities	Value
1.	Tidal volume (TV)	500 ml
2.	Inspiratory reserve volume (IRV)	2500- 3000ml
3.	Expiratory reserve volume (ERV)	1000- 1100ml
4.	Residual volume (RV)	1100- 1200ml
5.	Inspiratory capacity (TV + IRV)	3500 ml
6.	Expiratory capacity (TV + ERV)	1600 ml
7.	Functional residual capacity (ERV+ RV)	2300 ml
8.	Vital capacity (TV + IRV + ERV)	4600 ml
9.	Total lung capacity (TV + IRV + ERV + RV)	5800 ml

→ Blood transport O_2 in the form of oxyhaemoglobin. O_2 can bind with haemoglobin in a reversible manner to form oxyhaemoglobin. Each haemoglobin molecule can carry a maximum of four molecules of O_2 . Binding of oxygen with haemoglobin is primarily related to partial pressure of O_2 .

SOLVED EXAMPLE

- Ex.1** Respiratory pigment in cockroach is
 (A) Haemozoin (B) Haemocyanin
 (C) Haemoglobin (D) Absent

Sol. (D) : Haemolymph is found in insect blood which is colourless.

- Ex.2** Carbon dioxide is transported via blood to lungs mostly
 (A) As carbaminohaemoglobin and as carbonic acid
 (B) In the form of carbonic acid only
 (C) In combination with haemoglobin only
 (D) Dissolved in blood plasma

Sol. (A)

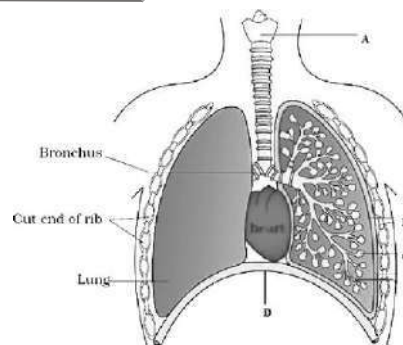
- Ex.3** The diagram represents the human larynx. Choose the correct combination of labelling from the option given :



- (A) A- Larynx, B - Parathyroid, C - Tracheal cartilage, D - Trachea
 (B) A - Naso Larynx, B - Thyroid, C - Tracheal cartilage, D - Trachea
 (C) A - Trachea, B - Thyroid, C - Bronchiole, D - Tracheal cartilage
 (D) A - Epiglottis, B - Thyroid, C - Tracheal cartilage, D - Trachea
 (E) A - Epiglottis, B - Parathyroid, C - Trachea, D - Tracheal cartilage

Sol. (D)

- Ex.4** The figure shows a diagrammatic view of human respiratory system with labels A, B, C and D. Select the option which gives correct identification and main function and/or characteristic.



- (A) D – Lower end of lungs – diaphragm pulls it down during inspiration
 (B) A – Trachea – long tube supported by complete cartilaginous rings for conducting inspired air
 (C) B – Pleural membrane – surround ribs on both sides to provide cushions against rubbing
 (D) C – Alveoli – thin walled vascular bag like structures for exchange of gases

Sol. (D)

- Ex.5** What is vital capacity of our lungs
 (A) Inspiratory reserve volume plus expiratory reserve volume
 (B) Total lung capacity minus residual volume
 (C) Inspiratory reserve volume plus tidal volume
 (D) Total lung capacity minus expiratory reserve volume

Sol. (B)

- Ex.6** The largest quantity of air that can be expired after a maximum inspiratory effort is
 (A) Residual volume (B) Tidal volume
 (C) Vital capacity of lungs (D) Lung volume

Sol. (C) : Vital capacity of lungs to expire maximum volume of air after a deep inspiration. The largest quantity of air that can be expired after a maximal inspiratory. Vital capacity is equal the sum of the tidal complementary and supplemental air (500 + 3100 + 1200 = 4800 ml).

- Ex.7** The volume of air which remains in the conducting airways and is not available for gas exchange is called
 (A) Vital capacity
 (B) Functional residual capacity
 (C) Forced expiratory volume
 (D) Anatomic dead space

Sol. (D)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. The maximum amount of air that our lung can normally hold is-
(A) Vital capacity
(B) Pulmonary capacity
(C) Tidal capacity
(D) Total lung capacity
2. The blood leaving the lungs has all its haemoglobin oxygenated and gives up oxygen to the tissue, because-
(A) The tissue can absorb O_2 from oxyhaemoglobin
(B) O_2 concentration in tissues is higher and CO_2 concentration lower than in lungs
(C) O_2 concentration in tissues is lower and CO_2 concentration higher than in lungs
(D) Oxyhaemoglobin undergoes reduction
3. Which of the following increases the oxygen affinity of Hb-
(A) High body temperature
(B) Low pCO_2
(C) High blood pH
(D) Both B and C
4. Haemoglobin has least affinity for-
(A) Carbon dioxide
(B) Carbon monoxide
(C) Oxygen
(D) Same affinity for all above
5. When a frog is completely submerged in water it can respire only through-
(A) Lungs
(B) Skin
(C) Branchial chamber
(D) Buccopharyngeal cavity
6. Respiratory mechanism is controlled by-
(A) Sympathetic nervous system
(B) Central nervous system
(C) Autonomic nervous system
(D) Parasympathetic nervous system
7. Carbon monoxide combines with haemoglobin to form-
(A) Carboxyhaemoglobin
(B) Oxyhaemoglobin
(C) Carbaminohaemoglobin
(D) None
8. The percentage of haemoglobin saturated with oxygen will increase if-
(A) The arterial pH is decreased
(B) The arterial pO_2 is increased
(C) The haemoglobin concentration is increased
(D) The temperature is increased
9. Which mammal lacks true vocal cords-
(A) Hippopotamus
(B) Man
(C) Elephant
(D) Monkey
10. Expiration involves-
(A) Contraction of diaphragm muscles
(B) Contraction of intercostal muscles
(C) Relaxation of diaphragm and intercostal muscles
(D) Contraction of diaphragm and intercostal muscles
11. During inspiration, air passes into lungs due to-
(A) Fall in pressure inside the lungs
(B) Increased volume of thoracic cavity
(C) Muscular expansion of lungs
(D) Increase in volume of thoracic cavity and fall in lung pressure
12. In human beings, CO_2 concentration in the inspired and expired air is respectively-
(A) 0.04 % and 4.0 %
(B) 0.03 % and 5.3 %
(C) 0.4 % and 5.0 %
(D) 0.04 % to 3.0 %
13. Pneumotaxic centre is associated with-
(A) Movement
(B) Closure of glottis
(C) Respiration
(D) Breathing
14. In mammals, the tracheal cartilaginous rings are-
(A) Complete rings
(B) Incomplete rings
(C) Incomplete dorsally
(D) Incomplete laterally

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Even when there is no air in it, human trachea does not collapse due to presence of -
(A) Chitinous rings (B) Bony rings
(C) Cartilaginous rings (D) Turgid pressure
2. Speciality common in the alveoli of lungs and villi of intestine in mammals is that both -
(A) Have rich supply of blood vessels and lymph ducts
(B) Are suited for diffusion of gases
(C) Have ciliated epithelium
(D) Provide a large surface area
3. The structure which does not contribute to the breathing in mammals is -
(A) Diaphragm
(B) Larynx
(C) Intercostal muscles
(D) Ribs
4. C - shaped cartilaginous rings supporting the trachea are made of -
(A) Fibrous cartilage
(B) Elastic cartilage
(C) Calcified cartilage
(D) Hyaline cartilage
5. Which of the following is the smallest structure in the lung of rabbit.
(A) Tracheae (B) Alveoli
(C) Bronchioles (D) Hilum
6. Rate of breathing in an adult human is -
(A) 25 - 30/min (B) 20-25/min
(C) 14-18/min (D) 10-12/min
7. Glottis is opening in the floor of -
(A) Trachea
(B) Diaphragm
(C) Bucco- pharyngeal cavity
(D) None of the above
8. In mammals ventilation movements of lungs are governed by -
(A) Diaphragm and intercostal muscles
(B) Diaphragm
(C) Intercostal muscles
(D) Muscular wall of lungs
9. Which type of respiration appeared first in the primitive organism and why
(A) Aerobic respiration as no harmful waste products are formed
(B) Anaerobic respiration because small organism can only do it
(C) Anaerobic respiration as there was no O₂
(D) Aerobic respiration as it releases more energy
10. Oxyhaemoglobin is an unstable compound because -
(A) One molecule of haemoglobin combines with four molecules of oxygen
(B) There is a chemical bonding between oxygen and haemoglobin
(C) There is a physical bonding between oxygen and haemoglobin
(D) Haemoglobin is a complex pigmented protein
11. Percentage of O₂ present in inhaled air in man is about -
(A) 43% (B) 78% (C) 21% (D) 1%
12. Food does not normally enter the trachea because during swallowing of food-
(A) The circular muscles at the end of trachea contract and close its opening
(B) The cartilage called arytenoids lie between the larynx and the glottis
(C) The nodule called cartilage of Santorini plug the larynx
(D) The epiglottis and tongue cover the glottis
13. If O₂ concentration in tissue was almost as high as at the respiratory surface -
(A) Oxyhaemoglobin would not dissociate to supply O₂ to the tissue
(B) CO₂ will interfere the O₂ transport
(C) Oxyhaemoglobin would dissociate to supply O₂ to the tissue
(D) Haemoglobin would combine with more O₂ at respiratory surface
14. Ratio of oxyhaemoglobin and haemoglobin in the blood is based upon-
(A) Bicarbonate tension (B) CO₂ tension
(C) Carbonate tension (D) O₂ tension

1. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I**(Animals)**

- A. Pigeon
B. Scorpion
C. *Planaria*
D. Earthworm
E. Spiders
F. King crab
G. Prawn
H. *Labeo*

Column - II**(Respiratory structures)**

- (i) Book gills
(ii) Pharyngeal wall
(iii) Lungs
(iv) Gills
(v) Book lungs
(vi) Body surface
(vii) Skin

- (A) A-(iii), B-(v), C-(vi), D-(vii), E-(v), F-(i), G-(iv), H-(iv)
(B) A-(v), B-(ii), C-(vi), D-(vii), E-(vi), F-(iv), G-(i), H-(iii)
(C) A-(vi), B-(iv), C-(vii), D-(v), E-(i), F-(ii), G-(iii), H-(vii)
(D) A-(i), B-(v), C-(vii), D-(iii), E-(vii), F-(ii), G-(iv), H-(vi)

2. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. TV+ERV
B. RV+ERV+TV+IRV
C. ERV+RV
(A) A-(i), B-(ii), C-(iii)
(C) A-(iii), B-(ii), C-(i)

Column - II

- (i) Expiratory capacity
(ii) Total lung capacity
(iii) Functional residual capacity
(B) A-(iii), B-(i), C-(ii)
(D) A-(ii), B-(iii), C-(i)

3. Match Column-I with Column-II and select the correct option from the codes given below.

Column - I

- A. Tidal volume
B. Inspiratory reserve volume
C. Expiratory reserve volume
D. Residual volume
E. Vital capacity

Column - II

- (i) 2500-3000 mL of air
(ii) 1000 mL of air
(iii) 500 mL of air
(iv) 3400-4800 mL of air
(v) 1200 mL of air

- (A) A-(iii), B-(iv), C-(ii), D-(i), E-(v)
(B) A-(iii), B-(i), C-(ii), D-(v), E-(iv)
(C) A-(iii), B-(i), C-(iv), D-(v), E-(ii)
(D) A-(v), B-(i), C-(ii), D-(iii), E-(iv)

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

- When CO₂ concentration in blood increases, breathing becomes - [CBSE AIPMT 2004]
 - Shallower and slow
 - There is no effect on breathing
 - Slow and deep
 - Faster and deeper
- Blood analysis of a patient reveals an unusually high quantity of carboxyhaemoglobin content. Which of the following conclusions is most likely to be correct ? Which of the followingh conclusions are most likely to be correct ? [CBSE AIPMT 2004]
 - The patient has been inhaling polluted air containing unusually high content of carbon disulphide.
 - The patient has been inhaling polluted air containing unusuallyhigh content of chloroform.
 - The patient has been inhaling polluted air containing unusually high content of carbon dioxide.
 - The patient has been inhaling polluted air containing unusually high content of carbon monoxide.
- People living at sea level have around 5 million RBC per cubic millimeter of their blood whereas those living at an altitude of 5400 metres have around 8 million. This is because at high altitude- [CBSE AIPMT 2006]
 - Atmospheric O₂ level is less and hence more RBCs are needed to absorb the required amount of O₂ to survive.
 - There is more UV radiation which enhances RBC production
 - People eat more nutritive food, therefore more RBCs are formed
 - People get pollution-free air to breathe and more oxygen is available
- What is vital capacity of our lungs? [CBSE AIPMT 2008]
 - Inspiratory reserve volume plus tidal volume
 - Total lung capacity minus expiratory reserve volume
 - Inspiratory reserve volume plus expiratory reserve volume
 - Total lung capacity minus residual volume
- The haemoglobin of a human foetus: [CBSE AIPMT 2008]
 - has a lower affinity for oxygen than that of an adult
 - its affinity for oxygen is the same as that of an adult
 - has only 2 protein subunits instead of 4
 - has a higher affinity for oxygen than that of an adult
- Which two of the following changes (1-4) usually tend to occur in the plain dwellers when they move to high altitudes (3,500 m or more) ? [CBSE AIPMT2010]
 - Increase in red blood cell size
 - Increase in red blood cell production
 - Increased breathing rate
 - Increase in thrombocyte count

Changes occurring are ?

 - (2) and (3)
 - (3) and (4)
 - (1) and (4)
 - (1) and (2)
- Listed below are four respiratory capacities (1-4) and four jumbled respiratory volumes of a normal human adult: [CBSE AIPMT 2010]

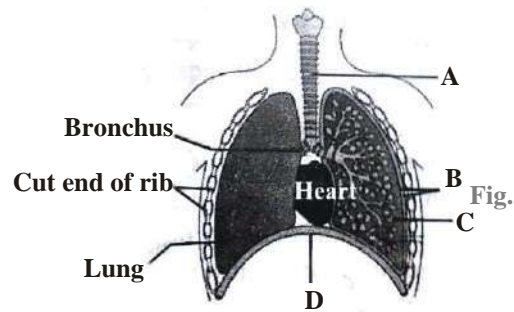
Respiratory capacities	Respiratory volumes
1. Residual volume	2500mL.
2. Vital capacity	3500mL
3. Inspiratory reserve volume	1200 mL
4. Inspiratory capacity	4500mL

Which one of the following is the correct matching of two capacities and volumes?

 - (2) 2500 mL, (3) 4500 mL
 - (3) 1200 mL, (4) 2500 mL
 - (4) 3500 mL, (1) 1200 mL
 - (1) 4500 mL, (2) 3500 mL
- The figure given below shows a small part of human lung where exchange of gases takes place. In which one of the options given below, the one part **A, B, C** or **D** is **correctly** identified along with its function? [CBSE AIPMT 2011]

 - A – Alveolar cavity – main site of exchange of respiratory gases
 - D – Capillary wall – exchange of gases takes place here
 - B– Red blood cell – transport of mainly haemoglobin
 - C– Arterial capillary – passes oxygen to tissues

- Bowman's glands are found in
(A) olfactory epithelium (B) external auditory canal
(C) cortical nephrons only (D) juxtamedullary nephrons
- The entry of food into the larynx is prevented by
(A) mitral valve (B) diaphragm (C) epiglottis (D) hyoid
(E) frenulum
- The figure shows a diagrammatic view of human respiratory system with labels A, B, C and D. Select the option which gives correct identification and main function and / or characteristic.



- (A) C-Alveoli - Thin walled vascular bag like structures for exchange of gases
(B) D- Lower end of lungs - Diaphragm pulls it down during inspiration
(C) A- Trachea - Long tube supported by complete cartilaginous rings for conducting inspired air
(D) B - Pleural membrane - Surrounds ribs on both sides to provide cushion against rubbing
- Lungs do not collapse between breaths and some air always remains in the lungs which can never be expelled because
(A) there is a negative pressure in the lungs
(B) there is a negative intrapleural pressure pulling at the lung walls.
(C) there is a positive intrapleural pressure.
(D) pressure in the lungs is higher than the atmospheric pressure.
- Hiccups can be best described as
(A) forceful sudden expiration
(B) forceful contraction of intercostal muscles during deep breathing
(C) vibration of the soft palate during breathing while sleeping
(D) jerky incomplete inspiration.
- Which one of the following is a possibility for most of us in regard to breathing, by making a conscious effort?
(A) One can breathe out air totally without oxygen.
(B) One can breathe out air through Eustachian tube by closing both nose and mouth.
(C) One can consciously breathe in and breathe out by moving the diaphragm alone, without moving the rib sat all.
(D) The lungs can be made fully empty by forcefully breathing out all air from them.

www.blog.neetnearme.com

LOCOMOTION AND ITS MOVEMENT

“I am very conscious that there is no scientific explanation for the fact that we are conscious.”

“SIRANDREW FIELDING HUXLEY(1917-2012)”

INTRODUCTION

Movement is a change in posture or position. It is the significant feature of living beings. Animals and plants both exhibit wide range of movements. Also, unicellular and multicellular organisms show movement. For example, unicellular organism such as Amoeba is a simple form of movement . Movement of cilia, flagella tentacles, limbs, jaws etc are shown by many organisms. Such voluntary movements are called **Locomotion**.

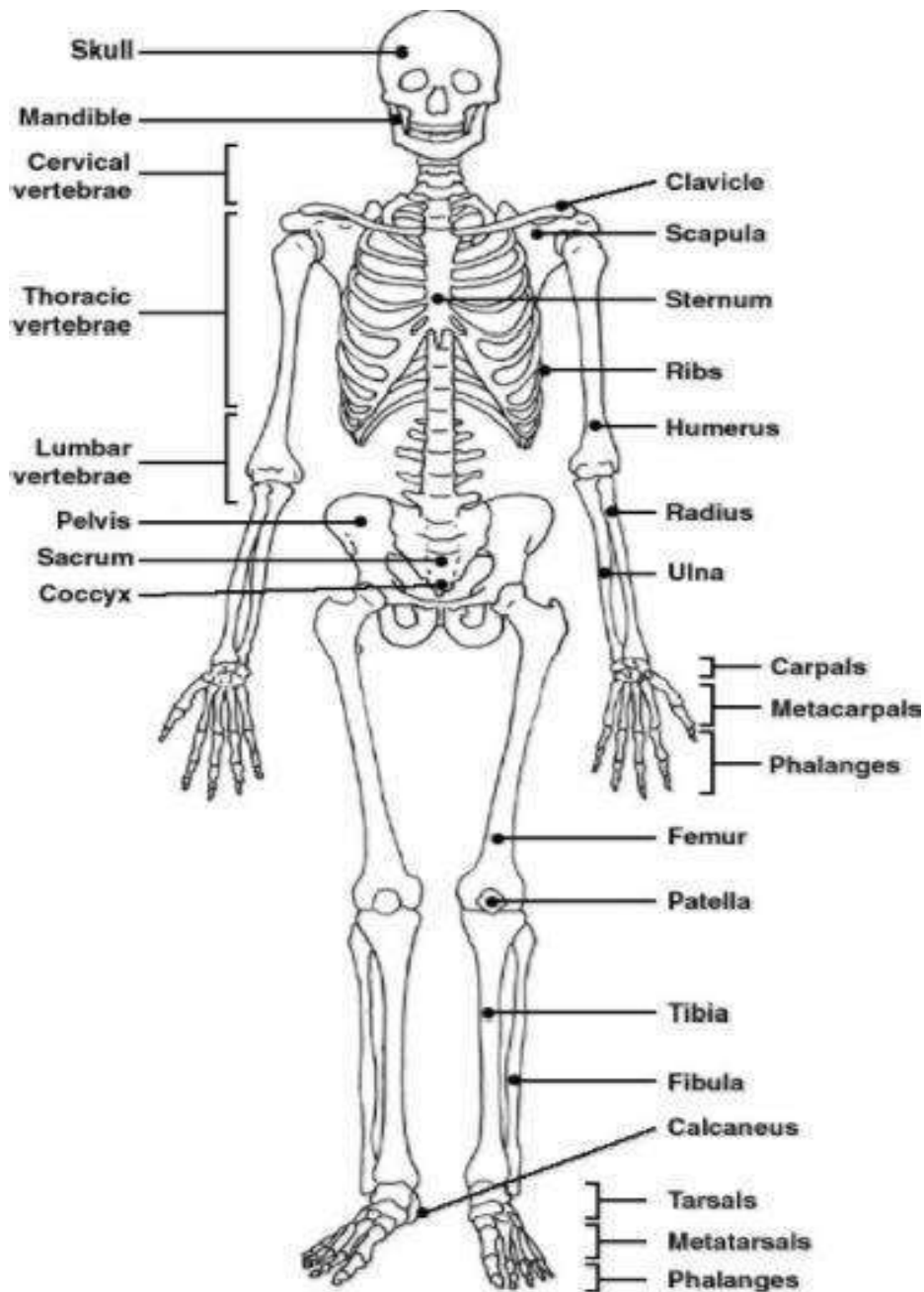
Hydra uses its tentacles for capturing its prey and also use them for locomotion. We use limbs for changes in body postures and locomotion as well.

Methods of locomotion performed by animals vary with their habitats and the demand of the situation.

LOCOMOTION AND MOVEMENT

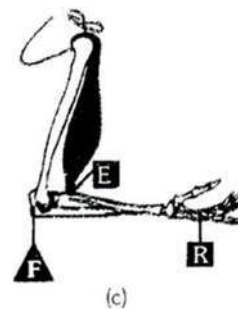
DEFINITION AND INTRODUCTION

- The hard protective or supportive part of the animal constitute skeletal system.
- Study of skeleton is called **Osteology** or **Skeletology**.
- Skeleton of different design are needed for the aquatic or terrestrial animals.



TYPES OF BONES (ON BASIS OF SHAPE AND SIZE)

- (i) Long bones
e.g. Humerus, Radius, Ulna, Tibia fibula, Femur.
- (ii) Short bones
e.g. Carpals and tarsals.
- (iii) Flat bones
e.g. Skull bone, sternum and ribs.
- (iv) Irregular bones
e.g. Ear ossicles and vertebrae.
- (v) Sesamoid bones
e.g. Patella (knee cap), pisiform



ED OS KEY POINTS

- (i) A small sesamoid bone Fabella often develops in the tendon of lateral head of gastrocnemius muscles behind the knee joint.
- (ii) In frog tibiofibula is the longest bone.
- (iii) Bones formed by ossification in cartilages is called **replacing bone** e.g. Humerus, femur. (cartilagenous bones)
- (iv) The bones of a children have large amount of organic matter, so, their bones are very flexible and less likely to break. (hence they may undergo green stick fracture)
- (v) Bones formed by ossification in the dermis and sink to get attached over the cartilages. e.g. Frontals and parietals is called **investing bone** of the skull. (Dermal bones or membranous bones)
- (vi) Skull of reptiles and birds possess one occipital condyles so the skull is called **monocondylic**, skull of amphibians and mammals possess two occipital condyles, so the skull is called **dicondylic**.
- (vii) Os penis : A bone supporting the penis of bats is called os penis.
- (viii) Os cordis : A bone supporting the heart of cattle is called oscordis.
- (ix) The end of two bones are connected by ligaments. While a muscle attaches with bone through tendon.
- (x) **Procoelous** - Centrum concave anteriorly but convex posteriorly 2nd to 7th vertebrae of frog. All reptilian vertebrae are procoelous.
Amphicoelous - Centrum concave on both sides. 8th vertebrae of frog is amphicoelous.
Acoelous - Centrum remain flat. 9th vertebra of frog is acoelous.
Heterocoelous - Centrum partly convex and partly concave on both sides.
 Vertebrae of birds are heterocoelous.
Coeloplantyn vertebrae - Centrum concave anteriorly but flat posteriorly.
Platycoelous vertebrae - Centrum flat anteriorly but concave posteriorly.
- (xi) Bones formed by ossification in the tendons at the joint is called **sesamoid bones** e.g. **Patella**.
- (xii) In Avian skull sutures remains absent.
- (xiii) **Weberian ossicles** - These are modified in vertebrae in cat and fishes. These help in sound production by connecting air bladder and internal ear.
- (xiv) Like mammals amphibian skull is also **dicondylic**.
 Skull of reptiles and aves are **monocondylic**.
- (xv) The pelvic girdle of birds is attached to a complex structure formed by the fusion of last thoracic all lumbar and first five caudal vertebra this structure is called **synsacrum**.
- (xvi) Talus in Rabbit is called as Astragalus.

- Human endoskeleton is made up of 206 bones. It is grouped into two parts -
- Appendicular skeleton - 126 bones.
- Axial Skeleton - 80 bones.
- Axial Skeleton
 - It consist skull, vertebral column, sternum and ribs.
- Skull is composed of cranial and facial bones. Total - 22 bones
- Cranial bones are 8 in number. Frontal(1), parietal(2), occipital(1), temporal(2), sphenoid(1), ethmoid(1).
- Facial bones are 14 in number. Mandible(1), maxilla(2), palatine(2), nasal, vomer(1), inferior turbinals(2), zygomatic(2), lacrimal bones(2).
- Each middle ear contains three tiny bones malleus, incus and stapes, collectively called ear ossicles.
- Hyoid bone:- A single U-shaped bone which is present at the base of the buccal cavity.
- Vertebral column:- Formed by 26 serially arranged vertebrae. Cervical (7) Thoracic (12) Lumber (5) Sacral (1 fused), coccygeal (1 fused)
- The number of cervical vertebrae are seven in almost all mammals including human beings.
- First vertebra is the atlas and it articulates with the occipital condyles of skull.
- Sternum:- A flat bone on the midventral line of thorax.
 - Ribs - 12 pairs
 - Ist 7 pairs - True ribs (vertebra-sternal ribs)
 - 8, 9, 10th pairs - vertebro-chondral ribs.
 - 11, 12th pairs - vertebral ribs (floating ribs)
- Each rib is a thin flat bone. It has two articulation surfaces on its dorsal end and is hence called bicephalic.
- Thoracic vertebrae, ribs and sternum together form the rib cage.
- Appendicular Skeleton
- The bones of limbs along with their girdles.
 - Fore Limb - 30 bones. Humerus, radius, ulna, carpals (wrist bones-8) metacarpals (palm-5) phalanges (digits-14)
 - Hind Limb - 30 bones. Femur, Patella, Tibia, Fibula, Tarsals (Ankle-7), metatarsals (sole-5), Phalanges (digits-14)
 - Femur is the longest bone of body .
 - Pectoral girdle - Each half is made up of a clavicle (collar bone) and a scapula bones.
 - Glenoid cavity is a depression in the scapula bone in which the head of the humerus bone articulate and form the shoulder joint.
 - Pelvic girdle - It consists of two coxal bones.
 - Each coxal bone is formed by fusion of ilium, ischium and pubis. At the point of fusion of the above bones acetabulum cavity is present in which head of femur articulates. The two halves of the pelvic girdle meet ventrally to form the pubic symphysis containing fibrous cartilage.

1. JOINTS

1. Fibrous joint - Do not allow any movement e.g.: Sutures (between skull bones)
2. Cartilaginous Joint - The bones involved are joined together with the help of cartilage e.g.: Intervertebral disc, pubic symphysis.
3. Synovial joint - Characterised by the presence of a fluid filled synovial cavity between the articulating surface of two bones. e.g.: Ball and Socket, Hinge, Pivot, Gliding, Saddle joints.
 - Ball and socket joint (between Humerus and Pectorial girdle)
 - Hinge Joint (Knee Joint, Elbow Joint)
 - Pivot Joint (between atlas and axis)
 - Gliding Joint (between the carpals, between the adjacent vertebrae).
 - Saddle Joint (between carpal and metacarpal of thumb)

SOLVED EXAMPLE

Ex.1 The collar bone is known as
 (A) Scapula (B) Coracoid
 (C) Stapes (D) Clavicle

Sol. (D)

Ex.2 Number of cranial nerves in mammal are
 (A) 10 pairs (B) 8 pairs
 (C) 12 pairs (D) 16 pairs

Sol. (C)

Ex.3 The number of vertebrae present in cervical, thoracic, lumbar, sacral and coccyx regions respectively are
 (A) 12, 7, 5, 1, 1 (B) 1, 7, 5, 12, 1
 (C) 7, 5, 1, 12, 1 (D) 7, 12, 5, 1, 1
 (E) 5, 12, 7, 1, 1

Sol. (D)

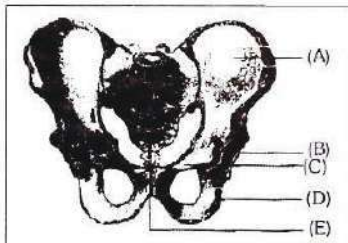
Ex.4 Find out the correct order of number of bones in the parts of skull such as cranial bone, facial bone, hyoid bone and middle ear bone respectively
 (A) 14, 8, 1 and 6 (B) 6, 8, 14 and 1
 (C) 14, 8, 6 and 1 (D) 8, 6, 14 and 1
 (E) 8, 14, 1 and 6

Sol. (E)

Ex.5 Which one is not cranial bone
 (A) Frontal (B) Zygomatic
 (C) Temporal (D) Sphenoid

Sol. (B)

Ex.6 In the pelvic girdle of man A, B, C, D and E respectively represents



- (A) A - pubis, B - acetabulum, C - ilium, D - ischium, E - pubic symphysis
 (B) A - ilium, B - acetabulum, C - pubis, D - ischium, E - pubic symphysis
 (C) A - ischium, B - acetabulum, C - pubis, D - ilium, E - pubic symphysis
 (D) A - ilium, B - pubis, C - acetabulum, D - pubic symphysis, E - ischium
 (E) A - ilium, B - acetabulum, C - pubic symphysis, D - ischium, E - pubis

Sol. (B)

Ex.7 A vertebra has a convexity both in front and behind it. It is called
 (A) Procoelous (B) Amphicoelous
 (C) Acoelous (D) Amphiplatyon

Sol. (C) : Acoelous means without cavity on either of its ends. It can be amphiplatyon with both ends flat or amphicoelous with both ends convex. Procoelous has anterior concavity, amphicoelous has both sides concave.

Ex.8 Number of bones in skull is
 (A) 26 (B) 28
 (C) 107 (D) 29

Sol. (B) : Number of Cranium = 8
 Facial bones = 14
 Ear ossicles = 6
 Total = 28

Ex.9 In human beings the cranium is formed by
 (A) Eight bones of which two are paired
 (B) Fourteen bones of which six are paired
 (C) Ten bones of which two are paired
 (D) Twelve bones of which four are paired

Sol. (A) : The cranium is formed by 8 bones. (1 frontal bone, 2 parietal, 2 temporal, 1 occipital, 1 sphenoid, 1 ethmoid).

Ex.10 Human vertebral column consists of 33 vertebrae and bones

- (A) 33 (B) 26
 (C) 27 (D) 29

Sol. (B)

Ex.11 The major function of the intervertebral discs is to
 (A) Absorb shock
 (B) String the vertebrae together
 (C) Prevent injuries
 (D) Prevent hyperextension

Sol. (A)

Ex.12 A shallow depression in the scapula which receives the head of the upper arm bone is known as the

- (A) Acetabulum (B) Neural arch
 (C) Glenoid cavity (D) None of the above

Sol. (C) : Glenoid cavity articulates humerus with scapula.

Ex.13 Symphysis contains

- (A) Hyaline cartilage (B) Fibrous cartilage
 (C) Calcified cartilage (D) None of these

Sol. (B)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Number of bones in the adult human body is-
(A) 206 (B) 406 (C) 106 (D) 306
2. Comparative study of skulls is-
(A) Craniology (B) Conchology
(C) Malacology (D) Osteology
3. Extremities of long bones possess-
(A) Calcified cartilage (B) Fibrous cartilage
(C) Hyaline cartilage (D) Elastic cartilage
4. Number of bones in human axial skeleton is-
(A) 120 (B) 142 (C) 80 (D) 206
5. Patella, the knee cap is an example of-
(A) Cartilaginous bone (B) Sesamoid bone
(C) Membrane bone (D) Investing bone
6. Human vertebra is an example of-
(A) Long bone (B) Flat bone
(C) Sesamoid bone (D) Irregular bone
7. The number of bone in the skull of man is-
(A) 14 (B) 29
(C) 8 (D) 20
8. The only movable bone in the skull is-
(A) Mandible (B) Maxilla
(C) Ethmoid (D) None
9. In man coccygeal bone is formed by the fusion of-
(A) 3 vertebrae (B) 4 vertebrae
(C) 5 vertebrae (D) 6 vertebrae
10. The total number of vertebrae in man is-
(A) 33 (B) 32 (C) 35 (D) 45
11. In man, the ribs are attached to-
(A) Clavicle (B) Sternum
(C) Scapula (D) Coracoid
12. Movable joints are called-
(A) Synovial joints (B) Fibrous joints
(C) Symphysis (D) Cartilaginous joint
13. Articulation of ulna with humerus at the elbow joint is-
(A) Hinge (B) Ball and socket
(C) Pivotal (D) Gliding
14. Pivot joint occurs at-
(A) The hip and shoulder joints
(B) Between the atlas and the odontoid process of the axis
(C) Sternoclavicular joints
(D) Temporomandibular joint
15. Stiffness of joints can be due to the -
(A) Decrease in synovial fluid
(B) Increase in synovial fluid
(C) Higher viscosity of synovial fluid
(D) None of these
16. A disease associated with joint is-
(A) Glaucoma (B) Arthritis
(C) Paget's disease (D) Horner's syndrome
17. Ilium is a bone of-
(A) Cranium (B) Pectoral girdle
(C) Pelvic girdle (D) Fore arm
18. Ankle joint is-
(A) Pivot joint
(B) Ball and socket joint
(C) Hinge joint
(D) Gliding joint
19. Avian (bird) skull is-
(A) Monocondylic (B) Dicondylic
(C) Acondylic (D) None of these
20. Coronary process is a part of-
(A) Upper jaw (B) Lower jaw
(C) Hyoid apparatus (D) Cranium
21. The only movable bone in the skull is-
(A) Maxilla (B) Frontoparietal
(C) Mandible (D) Nasal
22. Which one is bone of fore limb
(A) Humerus (B) Femur
(C) Tibia (D) Fibula
23. Number of bones present in human cranium is
(A) 8 (B) 10
(C) 12 (D) 16

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Immovable joints are called-
(A) Sutures (B) Amphiarthroses
(C) Diarthroses (D) None of the above
2. Glenoid cavity is found in-
(A) Humerus (B) Pectoral girdle
(C) Pelvic girdle (D) Skull
3. The number of pairs of true ribs in man is -
(A) 6 (B) 7
(C) 9 (D) 10
4. Deltoid ridge of humerus is meant for-
(A) Articulation
(B) Attachment of muscles
(C) Protection
(D) None of the above
5. Long neck of Camel or Giraffe has-
(A) Numerous cervical vertebrae
(B) Development of extra large intervertebral pads
(C) Longer vertebrae
(D) Development of extra bony plates between adjacent cervical vertebrae
6. Human vertebral formula is known as-
(A) $C_4T_8L_4S_8C_8$ (B) $C_7T_8L_5S_6C_7$
(C) $C_7T_{12}L_5S_4C_5$ (D) $C_7T_{12}L_5S_{(5)}C$
7. The number of carpals in each fore arm of human beings is-
(A) 5 (B) 6 (C) 7 (D) 8
8. Patella, the knee cap is the example of-
(A) Cartilage gland (B) Replacing bone
(C) Sesamoid bone (D) None of these
9. The joint present in the human neck is-
(A) Angular (B) Pivot
(C) Hinge (D) Fibrous
10. Coccygeal bone is formed by the fusion of bones in man-
(A) 3 vertebrae (B) 6 vertebrae
(C) 5 vertebrae (D) 4 vertebrae
11. In body membrane surrounding the bone is known as-
(A) Periosteum (B) Endo-osteum
(C) Perichondrium (D) Chondriocytes
12. The hardest substance in human body is present in-
(A) Bone-Ossein (B) Chitin - Protein
(C) Tooth - Enamel (D) Muscle - Myosin
13. In mammals, the largest vertebra is-
(A) Cervical (B) Lumbar
(C) Caudal (D) Sacral
14. Presence of furcula is a characteristics feature of
(A) Frogs (B) Reptiles
(C) Birds (D) Mammals
15. Obturator foramen in pelvic girdle of mammals is formed by-
(A) Pubis and ischium
(B) Pubis and ilium
(C) Ilium and ischium
(D) Ilium, ischium and pubis
16. When joint becomes inflamed and painful, condition is not called-
(A) Rheumatism (B) Sprain
(C) Osteoarthritis (D) Gouty arthritis
17. In the ball and socket joint the friction of two bones is lessened by-
(A) Pericardial fluid (B) Pleural fluid
(C) Synovial fluid (D) Coelomic fluid
18. Incus is modified-
(A) Parietal bone (B) Jugal bone
(C) Quadrate bone (D) Premaxilla bone
19. Heaviest vertebra in man is-
(A) Atlas (B) Axis
(C) Thoracic (D) Lumbar
20. Skull is formed of-
(A) 58 bones (B) 28 bones
(C) 29 bones (D) None
21. Number of floating ribs in man is-
(A) 7 pairs (B) 3 pairs
(C) 1 pair (D) 2 pairs

Exercise # 3**PART - 1****MATRIX MATCH COLUMN**

1. Match Column - I with Column - II and select the correct option from the codes given below.

Column I

- A. Amoeboid movement
B. Ciliary movement
C. Flagellar movement
D. Muscular movement

Column II

- i. Limbs
ii. Leucocytes
iii. Trachea
iv. Spermatozoa

A	B	C	D
(A) iii	ii	i	iv
(B) ii	iii	iv	i
(C) i	ii	iii	iv
(D) iv	ii	i	iii

2. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Structural and functional unit of a myofibril
B. Protein of thin filament
C. Protein of thick filament
D. The central part of thick filament not overlapped by thin filament

Column - II

- i. H-zone
ii. Myosin
iii. Sarcomere
iv. Actin

(A) A-i, B-ii, C-iii, D-iv	(B) A-i, B-iii, C-ii, D-iv
(C) A-i, B-iv, C-iii, D-ii	(D) A-iii, B-iv, C-ii, D-i

3. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Humerus
B. Hydrostatic skeleton
C. Femur

Column - II

- i. Thigh
ii. Upper arm
iii. Flatworms
iv. Acetabulum
v. Glenoid cavity
vi. Hydra

(A) A-ii, v, B-iii, vi, C-i, iv	(B) A-ii, iv, B-iii, vi, C-i, v
(C) A-i, v, B-ii, iv, C-iii, vi	(D) A-iii, vi, B-i, v, C-ii, iv

4. Match Column - I with Column - II and select the correct option from the codes given below.

Column I

- A. Smooth muscle
B. Tropomyosin
C. Red muscle
D. Skull

Column II

- i. Myoglobin
ii. Thin filament
iii. Sutures
iv. Involuntary

(A) A-iv, B-ii, C-i, D-iii	(B) A-ii, B-iv, C-iii, D-i
(C) A-iii, B-i, C-iv, D-ii	(D) A-i, B-iv, C-ii, D-iii

BIOLOGY FOR NEET & AIIMS**Exercise # 4****PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. The joint found between sternum and the ribs in humans is [CBSE AIPMT-2000]
(A) angular joint (B) fibrous joint
(C) cartilaginous joint (D) gliding joint
2. Which one of the following is a skull bone ? [CBSE AIPMT-2000]
(A) Atlas (B) Coracoid
(C) Arytenoid (D) Pterygoid
3. What is sarcomere ? [CBSE AIPMT-2001]
(A) Part between two H-lines
(B) Part between two A-lines
(C) Part between two I-bands
(D) Part between two Z-lines
4. Which statement is correct for muscle contraction ? [CBSE AIPMT-2001]
(A) Length of H-zone decrease
(B) length of A band remains constant
(C) Length of I-band increases
(D) Length of two Z--lines
5. What will happen if ligaments are cut or broken ? [CBSE AIPMT-2002]
(A) Bones will move freely at joints
(B) No movement at joint
(C) Bone will become unfixed
(D) Bone will become fixed
6. ATPase enzyme needed for muscle contraction is located in [CBSE AIPMT-2004]
(A) actinin (B) troponin
(C) myosin (D) actin
7. An acromion process is characteristically found in the [CBSE AIPMT-2004]
(A) pelvic girdle of mammals
(B) pectoral girdle of mammals
(C) skull of frog
(D) sperm of mammals
8. Which of the following pairs, is correctly matched? [CBSE AIPMT-2005]
(A) Hinge joint - Between vertebrae
(B) Gliding joint - Between zygapophyses of the successive vertebrae
(C) Cartilaginous joint - Skull bones
(D) Fibrous joint - Between phalanges
9. The contractile protein of skeletal muscle involving ATPase activity is [CBSE AIPMT-2006]
(A) myosin (B) a-actinin
(C) troponin (D) tropomyosin
10. Which one of the following is the correct pairing of a body part and the kind of muscle tissue that moves it ? [CBSE AIPMT-2009]
(A) Heart wall - Involuntary unstriated muscle
(B) Biceps of upper arm - Smooth muscle fibres
(C) Abdominal wall - Smooth muscle
(D) Iris - Involuntary smooth muscle
11. Elbow joint is an example of [CBSE AIPMT-2009]
(A) pivot joint (B) hinge joint
(C) gliding joint (D) ball and socket joint
12. Select the correct statement regarding the specific disorder of muscular or skeletal system [CBSE AIPMT-2012]
(A) Muscular dystrophy - Age related shortening of muscles
(B) Osteoporosis- Decrease in bone mass and higher chances of fractures with advancing age
(C) Myasthenia gravis - Autoimmune disorder which inhibits sliding of myosin filaments
(D) Gout - Inflammation of joints due to extra deposition of calcium
13. Select the correct statement with respect to locomotion in humans [CBSE AIPMT-2013]
(A) A decreased level of progesterone causes osteoporosis in old people
(B) Accumulation of uric acid crystals in joints causes their inflammation
(C) The vertebral column has 10 thoracic vertebrae
(D) The joint between adjacent vertebrae is a fibrous joint

MOCK TEST

1. The amoeboid movement results from
 - (A) interactions among actin, myosin and ATP etc
 - (B) coordinated beats of cilia
 - (C) whip like action of flagella
 - (D) action by the mitotic spindle, similar to what happens during mitosis and meiosis.

2. The H-zone in the skeletal muscle fibre is due to
 - (A) the central gap between actin filaments extending through myosin filaments in the A-band
 - (B) extension of myosin filaments in the central portion of the A-band.
 - (C) extension of myosin filaments in the central portion of the A-band
 - (D) the central gap between myosin filaments in the A-band.

3. Sarcomere is the functional unit of contraction in a muscle fibre. Identify the portion of myofibril that constitute a sarcomere.
 - (A) The portion of myofibril between two successive 'A' band.
 - (B) The portion of myofibril between two successive 'Z' line.
 - (C) The portion of myofibril between two successive 'M' line.
 - (D) The portion of myofibril between two successive 'I' band.

4. Muscles of the heart are

(A) striated and voluntary	(B) non-striated and voluntary
(C) striated, unbranched and involuntary	(D) non-striated and involuntary
(E) striated, branched and involuntary.	

5. Name the ion responsible for unmasking of active sites for myosin for cross-bridge activity during muscle contraction.

(A) Calcium	(B) Magnesium	(C) Sodium	(D) Potassium
-------------	---------------	------------	---------------

6. Anaerobic breakdown of glycogen due to repeated activation of muscles leads to the accumulation of

(A) uric acid	(B) phenylalanine	(C) lactic acid	(D) glutamic acid
(E) sarcoplasm			

7. The collagenous connective tissue layer holding the muscle bundles together is.

(A) pleura	(B) pericardium	(C) sarcolemma	(D) fascia
(E) sarcoplasm			

8. Which of the statements about the mechanism of muscle contraction are correct?
 - I. Acetylcholine is released when the neural signal reaches the motor end plate.
 - II. Muscle contraction is initiated by a signal sent by CNS *via* a sensory neuron.
 - III. During muscle contraction, isotropic band gets elongated.
 - IV. Repeated activation of the muscles can lead to lactic acid accumulation.

(A) I and IV are correct	(B) I and III are correct	(C) II and III are correct	(D) I, II and III are correct
(E) I and II are correct			

9. Which of the following is not a function of the skeletal system?

(A) Production of body heat	(B) Locomotion
(C) Production of erythrocytes	(D) Storage of minerals

www.blog.neetnearme.com

ECOSYSTEM

“We must trust to nothing but facts: These are presented to us by Nature, and cannot deceive. We ought, in every instance, to submit our reasoning to the test of experiment, and never to search for truth but by the natural road of experiment and observation.”

“ANTOINE LAVOISIER (1743-1794)”

INTRODUCTION

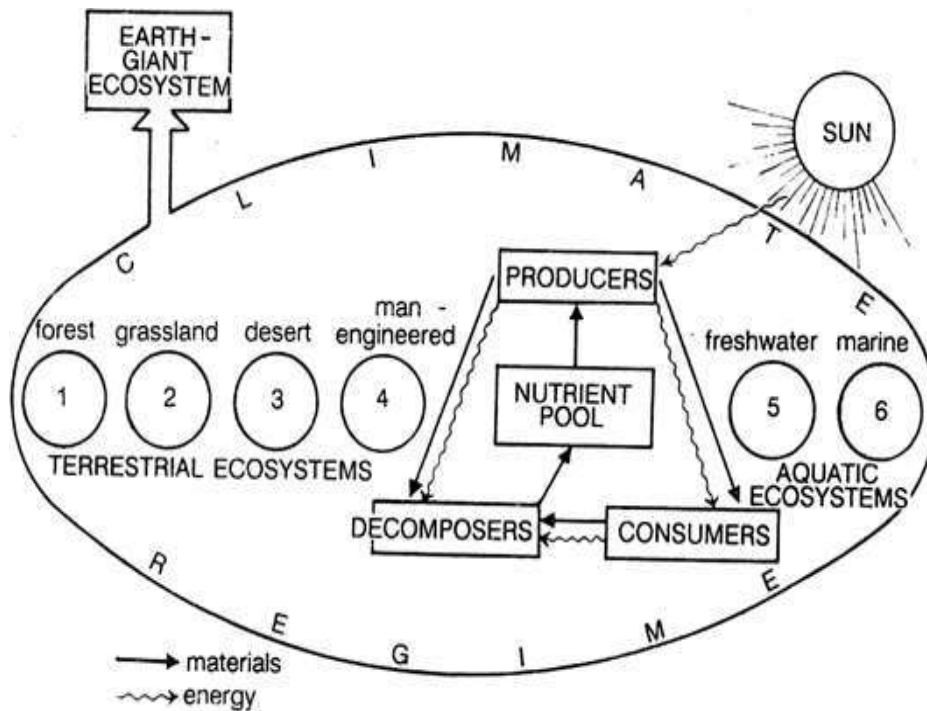
Ecosystem can be visualized as a functional unit of nature which varies greatly in size from a small pond to a large forest or a sea. Many ecologists regarding the entire biosphere as a global ecosystem, as a composite of all local ecosystems on earth. Wide range of living organisms are present on earth surface. All living organisms such as plants, animals and microorganisms interact among themselves and also with the surrounding physical environment and maintains a balance in nature. This forms a self-sustaining or functional unit of the living world known as **Ecosystem**. This system is too much big so that is why it is divided into two parts: terrestrial and aquatic. Forest, grasslands and desert are examples of terrestrial ecosystems; pond, lake, wetland, river and estuary are examples of aquatic ecosystems.

This chapter gives us an overview of different types of ecosystems, structural as well as functional aspects related to productivity, energy flow, decomposition, ecological efficiencies, nutrient cycling.

Ecosystem

Introduction

- **A.G.Tansley** - The term "Ecosystem" first of all coined by A.G. Tansley.
According to Tansley - Ecosystem is symbol of structure and function of nature.
- **E.P.Odum** - Father of ecosystem ecology.
According to E.P.Odum - Ecosystem is the smallest structural and functional unit of nature or environment.
- **Karl Mobius** - Used term **Biocoenosis** for ecosystem.
- **Thienmann** - Used term **Biosystem** for ecosystem.
- **Sukhachov** - Used term **Biogeocoenosis** for ecology.
- **Misra** - Used term **Ecosom** for ecosystem.
- **Forbes** - Used term **Microcosom** for ecosystem. For artificial ecosystem in laboratory.



- **Definition** - Total living (biotic) and non living (abiotic) components of the environment present in a particular area is called ecosystem.
- In any ecosystem, communities or living organisms interact with their physical environment in such a way that there is a well defined flow of energy forming clear **trophic (food) levels** and **material cycles** within this ecosystem.
- Ecosystem is normally an open system because there is a continuous and variable entry and loss of **energy** and **materials**.
- An ecosystem may be small like a drop (microsystem) of water and as large as sea or tract of forest.
- An ecosystem may be temporary as a fresh water pool or a field or permanent like a forest or sea.
- Thus any area of nature that includes living organisms and nonliving substances interacting, so that a **flow of energy** leads to characteristic **trophic structures** and **cycling of materials** makes the ecosystem.



ED OS KEY POINTS

(i) **Ecological efficiency** - The percentage of energy transferred from one trophic level to the next is called ecological efficiency or food chain efficiency.

$$E.E = \frac{\text{Energy in biomass production at a trophic level}}{\text{Energy in biomass production at previous trophic level}} \times 100$$

(ii) **Assimilation efficiency** - It is the production of consumed energy that is assimilated.

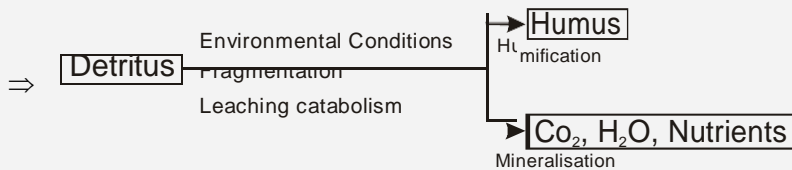
$$A.E. = \frac{\text{Food energy assimilated}}{\text{Food energy ingested}} \times 100$$

(iii) **Net production efficiency** -

$$N.P.E. = \frac{\text{Net primary productivity}}{G.P.P.} \times 100$$

(iv) **Photosynthetic efficiency** -

$$P.E. = \frac{G.P.P.}{\text{Incident total solar radiation}} \times 100$$



BIOLOGY FOR NEET & AIIMS

- Ecology is a subject which studies the interactions among organisms and between the organism and its physical (abiotic) environment.
- Key elements that lead to so much variation in the physical and chemical conditions of different habitats are temperature, water, light and soil.
- The productivity and distribution of plants is also heavily dependent on water.
- The salt concentration (measured as salinity in parts per thousand) is less than 5 percent in inland water 30-35 percent in the sea water and > 100 percent in some hypersaline lagoons. Some organisms are tolerant of a wide range of salinities (euryhaline) but others are restricted to a narrow range (stenohaline).
- Regulate : Some organisms are able to maintain homeostasis by physiological (sometimes behavioural also) means which ensures constant body temperature, constant osmotic concentration.
- Conform : An overwhelming majority (99 percent) of animals and nearly all plants cannot maintain a constant internal environment. Their body temperature changes with the ambient temperature. In aquatic animals, the osmotic concentration of the body fluids changes with that of the ambient water osmotic concentration.
- Heat loss or heat gain is a function of surface area. Since small animals have a larger surface area relative to their volume, they tend to lose body heat very fast when it is cold outside then they have to expend much energy to generate body heat through metabolism. This is the main reason why very small animals are rarely found in polar regions.
- If the stressful external conditions are localised or remain only for a short duration, the organism has two other alternatives. (i) Migration (ii) Suspension
- Under unfavourable conditions many zooplankton species in lakes and ponds are known to enter diapause, a stage of suspended development.
- Adaptation is any attribute of the organism (morphological, physiological, behavioural) that enables the organism to survive and reproduce in its habitat.
- Mammals from colder climates generally have shorter ears and limbs to minimise heat loss. (This is called the Allen's Rule).
- The body compensates low oxygen availability by increasing red blood cell production decreasing the binding capacity of haemoglobin and by increasing breathing rate.
- Some organisms show behavioural responses to cope with variations in their environment.
- Desert lizards bask in the sun and absorb heat when their body temperature drops below the comfort zone but move into shade when temperature rises above the comfort zone.
- Some organisms breed only once in their lifetime (Pacific salmon fish, bamboo) while others breed many times during their lifetime (most birds and mammals). Some produce a large number of small-sized offsprings (Oysters, pelagic fishes) while others produce a small number of large-sized offsprings (birds, mammals).
- Life history traits of organisms have evolved in relation to the constraints imposed by the abiotic and biotic components of the habitat in which they live.
- Predator acting as conduits for energy transfer across trophic level.
- Since the invaded land does not have its natural predators. The prickly pear cactus introduced into Australia in the early 1920's caused havoc by spreading rapidly into millions of hectares of rangeland.
- Biological control methods adopted in agricultural pest control are based on the ability of the predator to regulate prey population. Predators also help in maintaining species diversity in a community by reducing the intensity of competition among competing prey species.
- Nearly 25 percent of all insects are known to be phytophagous (feeding on plant sap and other parts of plants) Thorns (Acacia, Cactus) are the most common morphological means of defence .
- Calotropis grow in abandoned fields. The plant produces highly poisonous cardiac glycosides and that is why you will never see any cattle or goat browsing on the plant.
- Competition : Competition occurs when closely related species compete for the same resources that are limiting.
- Resources need not be limiting for competition to occur, in interference competition, the feeding efficiency of one

SOLVED EXAMPLE

Ex.1 In an aquatic ecosystem, the trophical level equivalent to cows in grassland is

- (A) Phytoplankton (B) Zooplankton
(C) Nekton (D) Benthos

Sol. (B)

Ex.2 When peacock eats snakes which eat insects thriving on green plants, the peacock is

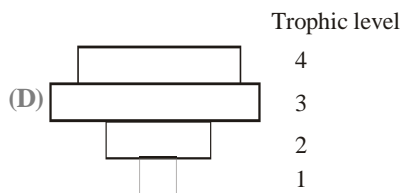
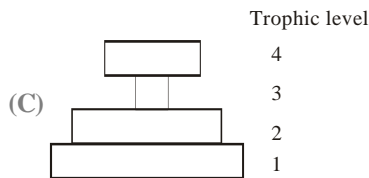
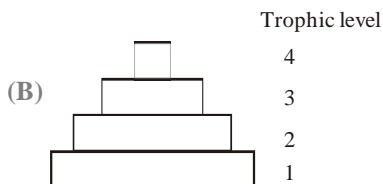
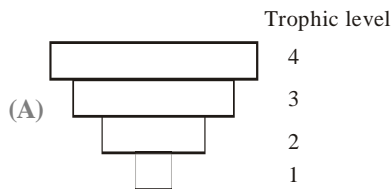
- (A) A primary consumer
(B) A primary decomposer
(C) Final decomposer
(D) The apex of food pyramid

Sol. (D) : Because Peacock is the top consumer

Ex.3 Two food chains are given below

Tree → aphid → insectivorous bird → bird of prey
→ carnivorous fish

Which diagram is a pyramid of energy representing both food chains

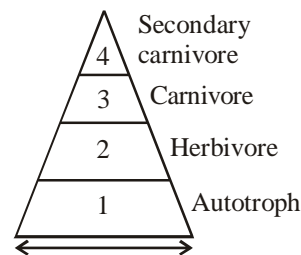


Sol. (B)

Ex.4 Using the figure, determine which animals would be found in the same trophic level

A. Trophic level	Feeding strategy	Grazing food chain	Decomposer food chain
4	Secondary carnivore	Cooper's hawk	Owl
3	Carnivore	Robin	Shrew
2	Herbivore	Cricket	Earthworm
1	Autotrophs	Maple tree leaves	Dead maple leaves

B. Pyramid of productivity



- (A) Humans and horses
(B) Eagles and blue jays
(C) Pine trees and garden snakes
(D) Cricket and cows

Sol. (D)

Ex.5 In a food chain herbivores are

- (A) Primary producers
(B) Primary consumers
(C) Secondary consumers
(D) Decomposers

Sol. (B) : Primary consumers or herbivores of first order are depend upon producers or green plants for their food.

Ex.6 Of the total incident solar radiation the proportion of PAR is

- (A) More than 80 % (B) About 70 %
(C) About 60 % (D) Less than 50 %

Sol. (D) : Plants capture 2-10 % of PAR

Ex.7 Plants growing on sandstone are

- (A) Psammophytes (B) Oxylophytes
(C) Lithophytes (D) Phanerophytes

Sol. (C)

Exercise # 1

SINGLE OBJECTIVE

NEET LEVEL

1. In a pond if there is too much wastage, then the BOD of pond will
 (A) Increase (B) Decrease
 (C) Remain same (D) (A) and (B) both
2. Which of the following abundantly occurs in pond ecosystem
 (A) Producer (B) Consumer
 (C) Top consumer (D) Decomposers
3. If all decomposers are removed from an ecosystem, what will happen
 (A) All consumers will die
 (B) Energy cycle will be affected
 (C) Balance of biogeochemical cycle will be disturbed
 (D) Only herbivores will die
4. Which of the following is the most stable ecosystem
 (A) Mountain (B) Desert
 (C) Forest (D) Ocean
5. In a biotic community, primary consumers are
 (A) Omnivores (B) Carnivores
 (C) Detritivores (D) Herbivores
6. Which of the following does not effect the forest ecosystem
 (A) Deforestation (B) Soil erosion
 (C) Climatic variation (D) None of these
7. The pyramid of energy in a forest ecosystem is
 (A) Always upright
 (B) Always inverted
 (C) Both upright and inverted
 (D) None of the above
8. In an ecosystem, there is flow of energy at different trophic levels. This is as follows :
 (A) Primary consumers - Tertiary consumers - Secondary consumers - Decomposers - Producers
 (B) Producers - Primary consumers - Secondary consumers - Tertiary consumers - Decomposers
 (C) Producers - Decomposers - Primary consumers - Tertiary consumers - Secondary consumers
 (D) Producers - Primary consumers - Tertiary consumers - Secondary consumers - Decomposers
9. We refer to the following as the food chain
 (A) Large number of animals near a source of food
 (B) Transfer of food energy from the green plants through a series of consumer organisms
 (C) Large number of human beings forming a human chain near a source of food
 (D) None of these
10. In a food chain, lion is a
 (A) Secondary consumer (B) Primary consumer
 (C) Tertiary consumer (D) Secondary producer
11. In a pond ecosystem, benthos means
 (A) Primary consumers in the depth of a pond
 (B) Zooplankton on the water surface
 (C) Periphyton
 (D) Epineuston
12. Transfer of energy from one trophic level to other trophic level is according to the second law of thermodynamics. The efficiency of energy transfer from herbivorous to carnivorous is
 (A) 25% (B) 50%
 (C) 10% (D) 5%
13. In a food chain, which of the following produces in the largest amount
 (A) Producers (B) Decomposers
 (C) Tertiary consumers (D) Primary consumers
14. If forest area is reduced to half, which one of the following will be a long term effect
 (A) The natives (tribals) of that area will die on account of hunger
 (B) Cattles of that area will die due to scarcity of fodder
 (C) To diversity in germplasm will effect the crop breeding
 (D) It will be converted into large desert
15. The first link in any food chain is always a green plant because
 (A) They are widely distributed
 (B) They are firmly fixed to the soil
 (C) They alone have a capacity to fix atmospheric CO₂ in the presence of sunlight
 (D) All of the above
16. Food levels in an ecosystem are called
 (A) Trophic levels (B) Consumer levels
 (C) Producer levels (D) Herbivore levels

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Food chain consists of
(A) Producer, consumer and decomposer
(B) Producer, carnivore and decomposer
(C) Producer and primary consumer
(D) Producer, herbivore and carnivore
2. Animals which live at the bottom of sea are
(A) Nekton (B) Diatom
(C) Benthos (D) Plankton
3. Green plants are
(A) Autotrophs (B) Heterotrophs
(C) Chemotrophs (D) None of these
4. Pyramid of energy is
(A) Upright (B) Inverted
(C) Oblique (D) None of these
5. The flora and fauna in lakes or ponds are
(A) Lentic biota (B) Lotic biota
(C) Abiotic biota (D) Field layer
6. During food chain the maximum energy is stored in
(A) Producers (B) Decomposers
(C) Herbivores (D) Carnivores
7. Transition zone between two ecosystems or vegetational regions is termed
(A) Ecocline (B) Ecotone
(C) Ecad (D) Barrier
8. The ecosystem consists of
(A) Producers (B) Consumers
(C) Decomposers (D) All of these
9. In a food chain, the total amount of living material is depicted by
(A) Pyramid of energy (B) Pyramid of numbers
(C) Pyramid of biomass (D) All of these
10. The biotic part of ecosystem includes
(A) Producers (B) Consumers
(C) Decomposers (D) All of these
11. When the number of organisms at successive levels are plotted, they assume the shape of a pyramid. This is called the pyramid of
(A) Energy (B) Number
(C) Biomass (D) Both (A) and (C)
12. The two vegetation of ecosystem are separated by
(A) Ecotone (B) Ecoline
(C) Ecosystem (D) Ecesis
13. Energy enters into the ecosystem through
(A) Herbivores (B) Carnivores
(C) Producers (D) Decomposers
14. Which of the following is an artificial ecosystem
(A) Rice-field (B) Forest
(C) Grassland (D) Lake
15. Which are the biotic components of forest ecosystem
(A) Producers (B) Decomposers
(C) Consumers (D) All of the above
16. Which of the following is most important abiotic factor in pond ecosystem
(A) Water (B) Phytoplankton
(C) Zooplankton (D) Temperature
17. The bacteria that attack dead organic matter are
(A) Producer (B) Herbivore
(C) Carnivores (D) Decomposers
18. 10% law of flow of energy in ecosystem was proposed by
(A) Lindemann (B) Carl Mobius
(C) Tensely (D) Darwin
19. A plant being eaten by a herbivorous which in turn is eaten by a carnivorous makes
(A) Food chain (B) Food web
(C) Omnivorous (D) Interdependent
20. When peacock eats snakes which eat insects thriving on green plants, the peacock is
(A) A primary consumer
(B) A primary decomposer
(C) Final decomposer
(D) The apex of food pyramid
21. Acacia arabica is a
(A) Mesophyte (B) Hydrophyte
(C) Xerophyte (D) Halophyte
22. Casuarina equisetifolia is a
(A) Mesophyte (B) Xerophyte
(C) Halophyte (D) Forest epiphyte
23. The plants in which vascular tissues are absent and well developed aerenchyma is present, are
(A) Xerophytes (B) Halophytes
(C) Hydrophytes (D) Mesophytes

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match Column - I (Indian forest types) with Column - II (dominant tree genera) and choose the correct option

Column - I

- (A) Tropical rain forest
- (B) Tropical deciduous
- (C) Temperate broad leaf forest
- (D) Temperate coniferous forest

(A) A - 1, B - 2, C - 3, D - 4

(C) A - 3, B - 2, C - 1, D - 4

(E) A - 4, B - 3, C - 2, D - 1

Column - II

- (1) Hopea
- (2) Shoera
- (3) Quercus
- (4) Picea
- (B) A - 2, B - 1, C - 4, D - 3
- (D) A - 1, B - 2, C - 4, D - 3

2. Match Column - I with Column - II and choose the correct answer from the code given below.

Column - I

- (A) Population
- (B) Community
- (C) Ecosystem
- (D) Ecosphere

(A) A - (iii), B - (ii), C - (i), D - (v)

(C) A - (ii), B - (iii), C - (i), D - (iv)

Column - II

- (i) Part of the earth consisting of all the ecosystems of the world
- (ii) Assemblage of all the individuals belonging to different species occurring in an area
- (iii) Group of similar individuals belonging
- (iv) Interaction between the living organisms and their physical environment
- (v) Classification of organisms based on the type of environment
- (B) A - (iv), B - (v), C - (iii), D - (i)
- (D) A - (iii), B - (ii), C - (iv), D - (i)

3. Match Column - I with Column - II and choose the correct answer from the code given below.

Column - I

- (A) Gross primary productivity
- (B) Net primary productivity
- (C) Pond
- (D) Aquarium
- (E) Decomposition
- (A) A - (iv), B - (ii), C - (i), D - (iii), E - (v)
- (C) A - (i), B - (iii), C - (ii), D - (iv), E - (v)

Column - II

- (i) Self-sustainable ecosystem
- (ii) Aquatic
- (iii) O₂ requiring process
- (iv) Photosynthetic production
- (v) Available to secondary consumers
- (B) A - (iv), B - (v), C - (i), D - (ii), E - (iii)
- (D) A - (ii), B - (i), C - (iii), D - (v), E - (iv)

4. Match Column - I with Column - II and choose the correct answer from the code given below.

Column - I

- (A) Gross primary products
- (B) Secondary productivity
- (C) Transducers
- (D) Food web
- (A) A - (i), B - (ii), C - (iii), D - (iv)
- (C) A - (iii), B - (iv), C - (i), D - (ii)

Column - II

- (i) Green plants
- (ii) Rate of synthesis of organic matter by consumers
- (iii) Total organic matter produced from solar energy
- (iv) Interlocking pattern
- (B) A - (iii), B - (ii), C - (i), D - (iv)
- (D) A - (ii), B - (i), C - (iv), D - (iii)

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. The greatest biomass of autotrophs in the world's oceans is that of
 - (A) Benthic brown algae, coastal red algae and diatoms
 - (B) Benthic diatoms and marine viruses
 - (C) Sea grasses and slime molds
 - (D) Free-floating micro-algae, cyanobacteria and nanoplankton
2. Bamboo plant is growing in a far forest then what will be the trophic level of it :-
 - (A) First trophic level (T1)
 - (B) Second trophic level (T2)
 - (C) Third trophic level (T3)
 - (D) Fourth trophic level (T4)
3. Choose the correct match Bladderwort, sundew, Venus flytrap :-
 - (A) Nepenthes, Dionaea, Drosera
 - (B) Nepenthes, Utricularia, Vanda
 - (C) Utricularia, Drosera, Dionaea
 - (D) Dionaea, Trapa, Vanda
4. An ecosystem which can be easily damaged but can recover after some time if damaging effect stops will be having -
 - (A) Low stability and high resilience
 - (B) High stability and low resilience
 - (C) Low stability and low resilience
 - (D) High stability and high resilience
5. If by radiation all nitrogenase enzyme are inactivated, then there will be no :-
 - (A) Fixation of nitrogen in legumes
 - (B) Fixation of atmospheric nitrogen
 - (C) Conversion from nitrate to nitrite in legumes
 - (D) Conversion from ammonium to nitrate in soil
6. Which of the following is expected to have the highest value ($\text{gm/m}^2/\text{yr}$) in a grassland ecosystem :-
 - (A) Secondary production (SP)
 - (B) Tertiary production (TP)
 - (C) Gross production (GP)
 - (D) Net production (NP)
7. Which one of the following pairs is mismatched-
 - (A) Biomass burning – Release of CO_2
 - (B) Nuclear power – Radioactive wastes
 - (C) Solar energy – Green house effect
 - (D) Fossil fuel burning – Release of CO_2
8. More than 70% of world's fresh water is contained in –
 - (A) Antarctica
 - (B) Glaciers and Mountains
 - (C) Greenland
 - (D) Polar ice
9. Prolonged liberal irrigation of agricultural fields is likely to create the problem of -
 - (A) Acidity
 - (B) Aridity
 - (C) Metal toxicity
 - (D) Salinity
10. Which one of the following is not used for construction of ecological pyramids ?
 - (A) Dry weight
 - (B) Number of individuals
 - (C) Rate of energy flow
 - (D) Fresh weight
11. Which one of the following ecosystem types has the highest annual net primary productivity?
 - (A) Tropical rain forest
 - (B) Tropical deciduous forest
 - (C) Temperate evergreen forest.
 - (D) Temperate deciduous forest
12. A lake near a village suffered heavy mortality of fishes within a few days. Consider the following reasons for this?
 - (I) Lots of urea and phosphate fertilizer were used in the crops in the vicinity
 - (II) The area was sprayed with DDT by an aircraft
 - (III) The lake water turned green and stinky
 - (IV) Phytoplankton populations in the lake declined initially thereby greatly reducing photosynthesisWhich two of the above were the main causes of fish mortality in the lake?
 - (A) II and III
 - (B) III and IV
 - (C) I and III
 - (D) I and II
13. The slow rate of decomposition of fallen logs in nature is due to their:
 - (A) Low moisture content
 - (B) poor nitrogen content
 - (C) anaerobic environment around them
 - (D) low cellulose content
14. About 70% of total global carbon is found in:
 - (A) Grasslands
 - (B) Agroecosystems
 - (C) Oceans
 - (D) Forests

MOCK TEST

- The primary producers of the deep-sea hydrothermal vent ecosystem are
 (A) Green algae (B) Chemosynthetic bacteria
 (C) Blue-green algae (D) Coral reefs
- The rate of formation of new organic matter by deer in a forest ecosystem is called
 (A) Standing crop (B) primary productivity
 (C) Net primary productivity (D) Secondary productivity
- Identify the ecologist from the given hints.
 (i) He carried out long-term ecosystem experiments using outdoor plots
 (ii) In his experiments he showed that “increased diversity contributed to higher productivity”
 (A) Ahmed Khan (B) David Tilman (C) Stanley Cohen (D) Ernest Chain
- Which one of the following is a characteristic feature of cropland ecosystem ?
 (A) Absence of weeds (B) Ecological succession
 (C) Absence of soil organisms (D) Least genetic diversity
- Which of the following relations is correct regarding GPP and NPP of an ecosystem ?
 (A) $NPP = GPP - \text{Animal consumption}$ (B) $NPP = GPP + \text{Plant respiration}$
 (C) $NPP = GPP - \text{Plant respiration}$ (D) $NPP = GPP + \text{Animal consumption}$
- Which of the following statements about productivity is true
 (A) Primary productivity of all ecosystems is a constant.
 (B) The annual net primary productivity of the whole of the biosphere is 17 billion tons (dry weight) of organic matter.
 (C) Net primary productivity is the amount of biomass available for consumption by carnivores.
 (D) Secondary productivity is defined as the rate of formation of new organic matter by decomposers.
 (E) Primary productivity depends on the plant species inhabiting a particular area.
- The biomass available for consumption to heterotrophs and the rate of formation of new organic matter by consumers are defined as
 (A) Gross primary productivity and net primary productivity respectively
 (B) Net primary productivity and gross primary productivity respectively
 (C) Gross primary productivity and secondary productivity respectively
 (D) Net primary productivity and secondary productivity respectively
 (E) Secondary productivity and net primary productivity respectively.
- The breakdown of detritus into small particles by detritivores is called
 (A) Leaching (B) Humification (C) Fragmentation (D) Catabolism
- Lindeman for the first time gave energy transfer law, which states that
 (A) only 20% of the energy is transferred to each trophic level
 (B) only 10% of the energy is transferred to each trophic level
 (C) only 30% of the energy is transferred to each trophic level
 (D) only 50% of the energy is transferred to each trophic level.
- The gross primary productivity of an ecosystem is 170 tons of organic matter and amount used in respiration is 50 tons. Calculate the net primary productivity of the ecosystem
 (A) 120 tons (B) 100 tons (C) 70 tons (D) 12 tons
 (E) 17 tons

www.blog.neetnearme.com

DIGESTION AND ABSORPTION

“Happiness: a good bank account, a good cook, and a good digestion”

“ JEAN-JACQUES ROUSSEAU (1712-1778)”

INTRODUCTION

Food is one of the basic requirements of all living organisms. The major and important component of our food are carbohydrates, proteins and fats. Vitamins and minerals are also required in small quantities. Bio-macromolecules in food cannot be utilized by our body in their original form. They have to be broken down and converted into simple substances in the digestive system. This process of conversion of complex food substances to simple absorbable forms is called digestion and is carried out by our digestive system by mechanical and biochemical methods.

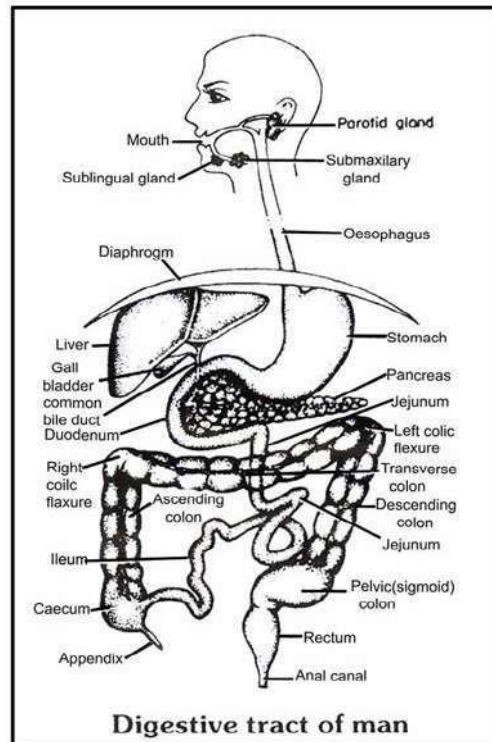
The water we take in, plays an important role in the metabolic processes and also prevents dehydration of the body.

DIGESTION & ABSORPTION

INTRODUCTION

Food is one of the basic requirements of the living organisms. To perform various functions of the body energy is required, which is obtained from food. The process of conversion of complex food material into simple and diffusible forms by hydrolysis is termed as **Digestion**.

Major components of food are carbohydrates, proteins and fats, vitamins and minerals are also required in small quantities.



The alimentary canal is a tubular structure which extends from the mouth to the anus. It develops from ectoderm and endoderm.

Ectoderm – up to the hard palate

Endoderm – from the soft palate to the rectum

Ectoderm – from the anal canal to the anus

The alimentary canal is divided into the following parts—

- (1) Mouth and Buccopharyngeal cavity, Pharynx
- (2) Oesophagus
- (3) Stomach
- (4) Intestine



ED OS KEY POINTS

1. Spoil hay of Sweet clover (*Melilotus indica*) (Fodder and green manure) contains a substance called dicumarol. Dicumarol prevents the action of vitamin 'K'
2. Non-secretion of HCl is called as achlorhydria condition.
3. Chologogues are substances which cause the contraction of gall bladder
4. Choloretic are substances which increase bile juice from liver.
5. 'Achalasia Cardia' condition is characterized by failure of cardiac sphincter to relax completely on swallowing causing accumulation of food in oesophagus and proximal oesophagus dilates.
6. One pair of vomerine teeth is found in the palate of frog.
7. Fangs are the poison teeth of snakes, these are the maxillary teeth.
8. Upper incisor teeth are modified into tusk in elephant.
9. Upper canine teeth are modified into tusk in walrus.
10. Homodont type dentition are found in toothed whale.
11. Enamel is absent in sloth and Armadillo.
12. Salivary glands are absent in whale.
13. The tongue is non-motile in whale.
14. Gall bladder is absent in lemprey, whale, rat and horse.
15. The main pancreatic duct is also known as **duct of wirsung** while accessory pancreatic duct is known as **duct of santorini**.
16. Citrin is also known as vitamin 'P' and controls vascular permeability.
17. Vitamin B₁₇ – It is recently discovered anticancer vitamin.
18. Vitamin Q – helps in blood clotting.
19. Vita B₁₅ – It is also known as pogenic acid, deficiency causes disorder in liver.
20. Vitamin B₆ also used in the treatment of tuberculosis.
21. Thecodont teeth are also found in crocodile.

→ Biomacromolecules in food cannot be utilised by our body in their original form. They have been broken down and converted into simple substances in the digestive system. This process of conversion of complex food substances to simple absorbable forms is called digestion.

→ No significant digestive activity occurs in the large intestine. The functions of large intestine are

- (a) absorption of some water, minerals and certain drugs.
- (b) secretion of mucous, which helps on adhering the waste particles together and lubricating it for an easy passage.

→ The undigested, unabsorbed substances called faeces enter into the caecum of large intestine through ileocaecal valve, which prevents the backflow of the faecal matter. It is temporarily stored in the rectum till defaecation.

→ Absorption of digested product :

→ Absorption is the process by which the end products of digestion pass through the intestinal mucosa into the blood or lymph.

1. Disorders of digestive system :

→ Jaundice : The liver is affected, skin and eyes turn yellow due to the deposit of bile pigments.

→ Vomiting : It is the ejection of stomach contents through the mouth. This reflex action is controlled by the vomit centre in the medulla. A feeling of nausea precedes vomiting.

→ Diarrhoea : The abnormal frequency of bowel movement and increased liquidity of the faecal discharge is known as diarrhoea. It reduces the absorption of food.

→ Constipation : In constipation, the faeces are retained within the rectum as the bowel movements occur irregularly.

→ Indigestion : In this condition, the food is not properly digested leading to a feeling of fullness. The causes of indigestion are inadequate enzyme secretion, anxiety, food poisoning, over eating and spicy food.

→ When chyme enters into duodenum HCL of chyme stimulates different enteroendocrine cells of intestine to secrete following hormones.

1. Secretin - 1st discovered hormone, stimulates pancreas to synthesise and secrete nonenzymatic part of pancreatic juice.
2. Pancreozymin stimulates pancreas to synthesise and secrete enzymatic part of pancreatic juice.
3. Hepatocinin stimulates liver cells for synthesis and secretion of bile juice.
4. Cholecystokinin stimulates liver and Gall Bladder for secretion of bile juice.

SOLVED EXAMPLE

- Ex.1** In mammals the lower jaw is made up of
(A) Dentary (B) Maxilla
(C) Premaxilla (D) Palatine
- Sol.** (A) : The lower jaw of man is formed by the fusion of dentary bone only.
- Ex.2** The hardest substance of vertebrate body is
Or
Crown of teeth is covered by
(A) Keratin (B) Enamel
(C) Dentine (D) Chondrin
- Sol.** (B) : Crown of the teeth is covered by the hardest substance of the body called enamel
- Ex.3** In mammals the teeth are
(i) Of different types
(ii) Embedded in the cup-like socket of the jaw bones
(iii) Only two sets, present throughout life
These conditions are referred as
Or
Teeth of rabbits are
(A) Heterodont, thecodont and diphyodont
(B) Thecodont, heterodont and diphyodont
(C) Diphyodont, thecodont, and heterodont
(D) Heterodont, diphyodont and thecodont
(E) Thecodont, diphyodont and heterodont
- Sol.** (A)
- Ex.4** The mucosal layer in the stomach form irregular folds known as
(A) Villi
(B) Lumen
(C) Rugae
(D) Crypts of Lieberkuhn
(E) Lacteals
- Sol.** (C)
- Ex.5** Dental formula of human beings is
(A) I_2, C_2, P_1, M_3 (B) I_2, C_1, P_2, M_3
(C) I_3, C_1, P_2, M_2 (D) I_2, C_2, P_3, M_1
- Sol.** (B) : Dental formula of human is
$$\frac{2,1,2,3}{2,1,2,3} = \frac{8}{8} \times 2 = 32$$
. It shows the number of incisor 2, canine 1, premolar 2 molar 3 in each half upper and half lower jaw with 32 teeth in buccal cavity.
- Ex.6** The site of protein digestion is
Or
A rabbit eats a lot of gram, Then its digestion starts in
(A) Gullet (B) Stomach-Fat
(C) Small intestine-Protein (D) Mouth-Starch
- Sol.** (B) : The site of protein digestion is stomach where pepsin enzyme occur which changes protein to peptones + proteases.
- Ex.7** Which of the following statement is not correct
(A) Goblet cells are present in the mucosa of intestine and secrete mucus
(B) Oxyntic cells are present in the mucosa of stomach and secrete HCl
(C) Acini are present in the pancreas and secrete carboxypeptodase
(D) Brunner's glands are present in the submucosa of stomach and secrete pepsinogen
- Sol.** (D) : Brunner's glands are present in the submucosa of duodenum and secrete HCO_3^-
- Ex.8** The predominant antibody in saliva is
(A) IgG (B) IgA
(C) IgM (D) IgD
- Sol.** (B)
- Ex.9** In man, Glisson's capsule is associated with the
(A) Digestive system
(B) Excretory system
(C) Nervous system
(D) Reproductive system
(E) Endocrine system
- Sol.** (A)
- Ex.10** Which of the following is the symptom of Ulcerative colitis
(A) Watery stools containing blood and mucus
(B) Difficulty in swallowing
(C) Loss of appetite
(D) Eyes turn yellow
- Sol.** (A)

Exercise # 1

SINGLE OBJECTIVE

NEET LEVEL

1. Bacteria entering with contaminated food are killed in stomach by –
 (A) Pepsin (B) Renin
 (C) Sodium bicarbonate (D) HCl
2. Glycogen is stored in –
 (A) Blood (B) Liver
 (C) Lungs (D) Kidney
3. Chymotrypsin is –
 (A) Proteolytic enzyme
 (B) Fat digestive Enzyme
 (C) Vitamin
 (D) Hormone
4. Excess amino acids are deaminated & converted into urea in –
 (A) Kidneys (B) Liver
 (C) Spleen (D) Pancreas
5. Secretin hormone is produced in –
 (A) Stomach and stimulates gastric glands
 (B) Intestine and stimulates Pancreatic glands
 (C) Liver and stimulates gall bladder
 (D) Intestine and stimulates crypts of lieberkuhn
6. Digestion of Carbohydrates, Proteins and fats completes in –
 (A) Stomach (B) Liver
 (C) Small intestine (D) Colon
7. Number of teeth which are monophyodont in man is
 (A) 4 (B) 22
 (C) 32 (D) 12
8. Absorption of digested food chiefly occurs in –
 (A) Stomach (B) Colon
 (C) Small Intestine (D) Large Intestine
9. Pancreatic juice takes part in digestion of –
 (A) Proteins Carbohydrate and fats
 (B) Proteins and fats
 (C) Protein, Carbohydrate
 (D) Proteins only
10. The enzyme trypsinogen is secreted by –
 (A) Duodenum (B) Pancreas
 (C) Liver (D) Stomach
11. Ricketts is caused by the def. of –
 (A) Vit A (B) Vit C
 (C) Vit D (D) Vit B
12. Which is the sources of vitamin 'C' –
 (A) Banana (B) Potato
 (C) Orange (D) Mango
13. Our food mainly contains –
 (A) Carbohydrates (B) Cellulose
 (C) Sucrose (D) Glucose
14. Which one is differ from the category of other three
 (A) Gastrin (B) Glucagon
 (C) Secretin (D) Ptyalin
15. How many teeth in man grow twice in life–
 (A) 20 (B) 28
 (C) 30 (D) 32
26. The cells of the epithelial lining in the vertebrate stomach are not damaged by HCl because of –
 (A) Mucus secretion covering the epithelium
 (B) Neutrilization of HCl by alkaline gastric juice
 (C) HCl being to dilute
 (D) Crypts of Lieberkuhn
17. Stomach is the main site for the digestion of
 (A) Fats (B) Carbohydrate
 (C) Protein (D) All of these
18. The hormone involved in the discharge of pancreatic juice in mammal is called –
 (A) Gastrin (B) Secretin
 (C) Secretin & CCK (D) Enterogastrin
19. Function of HCl in stomach is to –
 (A) Kill micro-organism of food
 (B) Facilitate absorption of food
 (C) Dissolve enzymes secreted by gastric glands
 (D) Active trypsinogen to trypsin
20. Which is sweet in taste but is not sugar –
 (A) Starch (B) Saccharine
 (C) Lactose (D) Protein

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. If a man is allowed to live exclusively on the diet of milk, egg & bread he would suffer from -
 (A) Rickets (B) Beri-Beri
 (C) Night blindness (D) Scurvey
2. Islets of langerhans are -
 (A) Modified lymph glands
 (B) Ductless glands in pancreas
 (C) Specialized area in pituitary
 (D) Small tubules in kidney
3. Scurvy is a disease caused by -
 (A) A virus
 (B) Deficiency of Vit E
 (C) Def. of Vit. C
 (D) Def. of Vit.D
4. Bilirubin and bilivirdin are found in -
 (A) Blood (B) Bile
 (C) Saliva (D) None of these
5. Vitamins are-
 (A) Inorganic substances and can't be synthesised by animals.
 (B) Inorganic substances and can be synthesised by animals.
 (C) Organic substances which cannot mostly be synthesised by animals.
 (D) Organic substances which can mostly be synthesised by animals.
6. Which of the following is the best source of Vit-A
 (A) Carrot (B) Apple
 (C) Peanuts (D) Honey
7. Vitamin necessary for blood clotting -
 (A) A (B) E
 (C) C (D) K
8. Dental formula of adult man is -
 (A) $\frac{2,1,2,3}{2,1,2,3}$ (B) $\frac{2,1,2,3}{2,1,2,2}$
 (C) $\frac{2,1,2,3}{2,1,2,4}$ (D) $\frac{2,1,3,2}{2,1,3,2}$
9. Islets of Langerhans are found in -
 (A) Testis (B) Adrenal
 (C) Pancreas (D) Ovary
10. Man needs carbohydrates as a source of energy nd gets these from -
 (A) Starch (B) Cellulose
 (C) Both (D) None of these
11. To keep people healthy, strong and energetic and long lived, it is necessary to provide them -
 (A) high energy food
 (B) large amt. of food
 (C) Balanced diet
 (D) Initiative and spirit
12. Beri-Beri is caused due to -
 (A) Def. of Vit B₁ (B) Def. of Vit B₂
 (C) Det. of Vit. B₁₂ (D) Def. of Vit C
13. Which one of these are most essential for body growth and formation of new cells -
 (A) Sugar (B) Fats
 (C) Nucleic acid (D) Protein
14. The most common concentrated source of proteins for vegetarians in our country is -
 (A) Potatoes (B) Meat
 (C) Eggs (D) Pulses
15. Casien present in milk, which is -
 (A) Bacterium (B) Sugar
 (C) Protein (D) Fat
16. The largest gland in human body is-
 (A) Pancreas (B) Liver
 (C) Thyroid (D) Pituitary
17. Sucrose is found in -
 (A) Milk (B) Honey
 (C) Sugarcane (D) Orange
18. Vit A from carotene is synthesised in -
 (A) Spleen (B) Skin
 (C) Pancreas (D) Liver

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

(Types of cell)

- A. Peptic cells
- B. Oxyntic cells
- C. Goblet cells

Column - II

(Secretions)

- i. Mucus
- ii. Alkaline fluid
- iii. Pro-enzymes
- iv. HCl

- (A) A-ii, B-i, C-iv (B) A-iv, B-iii, C-ii (C) A-iv, B-i, C-ii (D) A-iii, B-iv, C-i

2. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Van Kupffer cells
- B. β -cells
- C. Oxyntic cells
- D. Paneth cells

Column - II

- i. Islets of Langerhans
- ii. Liver sinusoids
- iii. Thyroid gland
- iv. Stomach
- v. Small intestine

- (A) A-iv, B-v, C-i, D-ii (B) A-iii, B-i, C-iv, D-ii (C) A-iv, B-v, C-iii, D-i (D) A-ii, B-i, C-iv, D-v

3. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Crypts of Lieberkuhn
- B. Pancreas
- C. Adrenal gland
- D. Gastric gland

Column - II

- i. Loop of duodenum
- ii. Stomach
- iii. Intestine
- iv. Kidney

- (A) A-iii, B-i, C-ii, D-iv (B) A-iii, B-i, C-iv, D-ii (C) A-i, B-iii, C-iv, D-ii (D) A-iv, B-ii, C-iii, D-i

4. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Goblet cells
- B. Lysozyme
- C. Saliva
- D. Oxyntic cells

Column - II

- i. Antibacterial agent
- ii. Mucus
- iii. HCl
- iv. Sublingual gland

- (A) A-iii, B-i, C-iv, D-ii (B) A-i, B-iii, C-iv, D-ii (C) A-ii, B-iii, C-i, D-iv (D) A-ii, B-i, C-iv, D-iii

5. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Sphincter of ani internus
- B. Cardiac sphincter
- C. Sphincter of Oddi
- D. Ileocaecal sphincter
- E. Pyloric sphincter

Column - II

- i. Opening of hepato-pancreatic ampulla into duodenum
- ii. Between duodenum and posterior stomach
- iii. Guarding the terminal part of alimentary canal
- iv. Between oesophagus and anterior stomach
- v. Between small intestine and large intestine

- (A) A-iii, B-ii, C-iv, D-i, E-v (B) A-ii, B-v, C-i, D-iv, E-iii (C) A-iii, B-iv, C-i, D-v, E-ii (D) A-iv, B-iii, C-i, D-ii, E-v

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. Which one of the following amino acids is an essential part of human diet? [CBSE AIPMT 2000]

(A) Glycine (B) Phenylalanine
(C) Serine (D) Aspartic acid
2. In a person of advanced age, the hair becomes thinner gradually. It happens because of decrease in [CBSE AIPMT 2000]

(A) Synthesis of glucose
(B) Synthesis of proteins
(C) Energy availability
(D) Blood supply
3. A certain person eats boiled potato; one of the food components in it is [CBSE AIPMT 2000]

(A) Lactose which is indigestible
(B) Starch which does not get digested
(C) Cellulose which is digested by intestinal cellulase
(D) DNA which gets digested by pancreatic DNAase
4. Which one is correctly matched: - [CBSE AIPMT 2001]

(A) Vit. - E - Tocopherol
(B) Vit. - D - Riboflavin
(C) Vit. - B - Calciferole
(D) Vit. - A - Thiamine
5. Stool of a person contains whitish grey colour due to malfunction of which type of organ: [CBSE AIPMT 2002]

(A) Pancreas (B) Spleen
(C) Kidney (D) Liver
6. During prolonged fasting, in what sequence are the following organic compounds used up by the body: [CBSE AIPMT 2003]

(A) First carbohydrates, next proteins and lastly lipids
(B) First proteins, next lipids and lastly carbohydrates
(C) First carbohydrates, next fats and lastly proteins
(D) First fats, next carbohydrates and lastly proteins
7. The richest sources of vitamin B₁₂ are: - [CBSE AIPMT 2004]

(A) Goat's liver and Spirulina
(B) Chocolate and green gram
(C) Rice and hen's egg
(D) Carrot and chicken's breast
8. Which one of the following is the correct matching of a vitamin, its nature and its deficiency disease: [CBSE AIPMT 2004]

(A) Vitamin A - Fat soluble - Night blindness
(B) Vitamin K - Fat soluble - Beri Beri
(C) Vitamin A - Fat soluble - Beri Beri
(D) Vitamin K - Water soluble - Pellagra
9. Duodenum has characteristic Brunner's glands which secrete two hormones called - [CBSE AIPMT 2004]

(A) Kinase, estrogen
(B) Secretin, Cholecystokinin
(C) Prolactin, parathormone
(D) Estradiol, progesterone
10. Which one of the following pairs is not correctly matched: - [CBSE AIPMT 2005]

(A) Vitamin B₁₂ - Pernicious anaemia
(B) Vitamin B₁ - Beri-beri
(C) Vitamin C - Scurvy
(D) Vitamin B₂ - Pellagra
11. Which group of three of the following five statements (a-e) contains all the three correct statements regarding beri-beri - [CBSE AIPMT 2005]

A. A crippling disease prevalent among the native population of sub-Saharan Africa.
B. A deficiency disease caused by lack of thiamine (vitamin - B₁).
C. A nutritional disorder in infants and young children when the diet is persistently deficient in essential protein.
D. Occurs in those countries where the staple diet is polished rice.
E. The symptoms are pain from neuritis, paralysis, muscle wasting, progressive oedema, mental deterioration and finally heart failure.

(A) A, B and D (B) B, C and E
(C) A, C and E (D) B, D and E

MOCK TEST

- Which one of the following vitamins is not fat soluble?
(A) A (B) B (C) D (D) E
- The purplish red pigment rhodopsin contained in the rods type of photoreceptor cells of the human eye, is a derivative of
(A) vitamin B₁ (B) vitamin C (C) vitamin D (D) vitamin A
- A balanced diet does not include
(A) carbohydrates and fats (B) nucleic acids and enzymes
(C) proteins and vitamins (D) minerals and salts
- Which of the following is true for vitamin C?
(A) Also called as ascorbic acid (B) Also called as fumaric acid
(C) Obtained from citrus fruits (D) Both (A) and (C)
- Which of the following guards the opening of hepatopancreatic duct into the duodenum?
(A) Pyloric sphincter (B) Sphincter of Oddi
(C) Semilunar valve (D) Ileocaecal valve
- In the stomach, gastric acid is secreted by the
(A) peptic cells (B) acidic cells
(C) gastrin secreting cells (D) parietal cells
- The primary dentition in human differs from permanent dentition in not having one of the following type of teeth.
(A) Molars (B) Incisors (C) Canines (D) Premolars
- Choose the correct statement among the following.
(A) The intestinal mucosal epithelium has oxyntic cells.
(B) Ptyalin converts proteins into proteoses and peptones.
(C) Crypts of Lieberkuhn is seen between the bases of villin in the intestine.
(D) Sphincter of Oddi is present at the junction of oesophagus and cardiac stomach.
(E) Goblet cells secrete hydrochloric acid in stomach.
- Column I contains names of the sphincter muscles of the alimentary canal and column II contains their locations. Match them properly and choose the correct answer.

Column I	Column II
A. Sphincter of ani internus	1. Opening of hepatopancreatic duct into duodenum
B. Cardiac sphincter	2. Between duodenum and posterior stomach
C. Sphincter of Oddi	3. Guarding the terminal part of alimentary canal
D. Ileocaecal sphincter	4. Between oesophagus and anterior stomach
E. Pyloric sphincter	5. Between small intestine and bowel

(A) A-3, B-2, C-4, D-1, E-5
(B) A-2, B-5, C-1, D-4, E-3
(C) A-3, B-4, C-1, D-5, E-2
(D) A-4, B-3, C-1, D-2, E-5
- Identify the correctly matched structure and its secretion.
(A) Brunner's gland - Salivary amylase (B) Intestinal mucosa - Insulin
(C) Gallbladder - Bile (D) Salivary gland - Lysozyme
(E) Goblet cells - HCl

www.blog.neetnearme.com

ENVIRONMENTAL ISSUES

“The human mind adjusts itself to a certain point of view, and those who have regarded nature from one angle, during a portion of their life, can adopt new ideas only with difficulty.”

“ANTOINE LAVOISIER (1743-1794)”

INTRODUCTION

Human population size has grown enormously over the last hundred years. This means increase in demand for food, water, home, electricity, roads, automobiles and numerous other commodities. These demands are exerting tremendous pressure on our natural resources, and are also contributing to pollution of air, water and soil. The need of the hour is to check the degradation and depletion of our resources and pollution without halting the process of development.

Pollution is any desirable change in physical, chemical or biological characteristics of air, land, water or soil. Agents that bring about such a desirable change are called as pollutants. In order to control environmental pollution, the Government of India has passed the Environment (Protection) Act, 1986 to protect and improve the quality of our environment (air, water and soil).

Environmental Issues

Pollution :

"Any undesirable change in physical, chemical or biological characteristic of air, water and land which is harmful to the man directly or indirectly through the animals, plants industrial unit or raw materials is called **pollution**."

Pollutants : "Any material or product of man or nature which leads to pollution is called pollutants".

Type of Pollutants Usually Pollutants are Divided into Following Categories

1. **Nondegradable pollutants** : Many of such pollutants are usually not degraded or degraded partially in environment. Such as **aluminium packs, Mercury compounds of phenols, Glass, D.D.T., Benzene, BHC pesticides**, etc.

They are collected in the environment and cause pollution. These pollutants are harmful even in low concentration and harm increases with their increasing concentration. No treatment is found in the nature for their recycling. There are only two methods by which we can stop the pollution caused by pollutant.

- (i) Such type of substance should be banned by law.
- (ii) Use their alternative substance.

2. **Biodegradable pollutants** - The **domestic sewage papers, woods, garbage, live stock wastes**, etc. are easily degraded completely by microorganisms, it becomes useful. But if these materials enter the environment in such large quantities, that they can not be degraded completely then addition of these materials cause pollution in environment.

1. **Primary pollutants** - These persists in the form in which they are added to the environment.
eg., DDT, CO etc.
2. **Secondary pollutants** - These are formed by chemical reaction amongst primary pollutants.
eg., Photochemical smog, London smog, PAN, O₃.

Synergism - Formation of secondary pollutants is known as synergism. Secondary pollutants are more toxic than primary pollutants.

1. **Quantitative pollutants** - These are the substance which occur in nature but become pollutant when their concentration reaches beyond a threshold value in the environment.
eg., CO₂, Nitrogen oxide.
2. **Qualitative pollutants** - These are the substance which do not occur in the environment but are passed in through human activity.
eg., Fungicides, Herbicides, DDT etc.

Other type of pollution :

1. **Natural pollution** - Caused by natural sources like, **CH₄ from paddy fields and cattle, marsh, forest fire**.
2. **Anthropogenic pollution** - Caused by **human activities**.

Main sources of pollution :

- (i) **Point source pollution** - Where the effluent discharge occur at a specific site.
eg., Factory outlet and Municipal sewage
- (ii) **Line source pollution** - It is passed along a narrow belt, roads,
eg., Roads, Railway tracks.
- (iii) **Diffuse source pollution** - It is over a large area.
eg., sprayed fertilizer or pesticides through run off.
- (iv) **Area source pollution** - Industrial estate and mining area.



ED OS KEY POINTS

Wildlife organisations

I.U.C.N.	=	The International Union for Conservation of Nature and Natural Resources. (Switzerland)
W.W.F.	=	The World Wildlife Fund.
I.B.W.L.	=	India Board for Wildlife.
B.N.H.S.	=	The Bombay Natural History Society.
W.P.S.I.	=	The Wildlife Preservation Society of India.
C.P.C.B.	=	Central Pollution Control Board.
I.B.P.	=	International Biology Programme.
M.A.B.	=	Man and Biosphere Programme.
U.N.E.P.	=	United Nation Environment Programme.
N.M.N.H.	=	National Museum of Natural History.
U.N.D.P.	=	United Nations Development Programme.
B.R.P.	=	Biosphere Reserve Programme.
Z.S.I.	=	Zoological Survey of India.
B.S.I.	=	Botanical Survey of India.
C.A.Z.R.I.	=	Central Arid Zone Research Institute, Jodhpur.
C.I.T.E.S.	=	Convention and International Trade in Endangered Species of Wild Fauna and Flora. (1976)
F.R.I.	=	Forest Research Institute, Deharadun.
W.I.I.	=	Wild Life Institute of India, Dehradun.
U.N.E.S.C.O.	=	United Nations Educational Scientific and Cultural Organization.

28 th February	-	Science Day
21 st March	-	World Forest Day
22 nd April	-	Earth Day
5 th June	-	World Environment Day
7 th July	-	Van Mahotsav Day
11 th July	-	World Population Day
16 th September	-	World Ozone Day
3 rd October	-	World Animal Day
4 th October	-	World Habitat Day
1 st Week of October	-	Wild life week
2 nd December	-	National Pollution prevention day or National environment day
3 rd Decemebr	-	World Conservation Day
22 th May	-	World Biodiversity Day

- **MIC Methyl Isoocyanate]** was released in Bhopal gas tragedy on **3rd December 1984**. Which is used in the production of "Savin" insecticide in Union Carbide.
 - Tetraethyl lead and tetramethyl lead are formed by combustion of petroleum. They are known to hamper haemoglobin formation.
 - The disease produced by use of lead polluted water is called as **plumbism**.
 - Lead caused nervousness anaemia in human beings. It also damages kidney.

- In order to control environmental pollution, the government of India has passed the Environment (Protection) Act, 1986 to protect and improve the quality of our environment.
- There are several ways of removing particulate matter; the most widely used of which is the electrostatic precipitator, which can remove over 99 percent particulate matter present in the exhaust from a thermal power plant.
- A scrubber can remove gases like sulphur dioxide. In a scrubber the exhaust is passed through a spray of water or lime.
- According to Central Pollution Control Board (CPCB), particulate size 2.5 micrometers or less in diameter (PM 2.5) are responsible for causing the greatest harm to human health.
- Automobiles are a major cause for atmospheric pollution atleast in the metro cities.
- Catalytic converters, having expensive metals namely platinum-palladium and rhodium as the catalysts, are fitted into automobiles for reducing emission of poisonous gases. As the exhaust passes through the catalytic converter, unburnt hydrocarbons are converted into carbon dioxide and water, and carbon monoxide and nitric oxide are changed to carbon dioxide and nitrogen gas respectively.
- All the buses of Delhi were converted to run on CNG by the end of 2002.
- Euro II norms, for example stipulates that sulphur be controlled at 350 parts per million (ppm) in diesel and 150 ppm in petrol. Aromatic hydrocarbons are to be contained at 42 percent of the concerned fuel. The goal, according to the roadmap, is to reduce sulphur to 50 ppm in petrol and diesel and bring down the level to 35 percent.
- In India, the Air (Prevention and Control of Pollution) Act came into force in 1981, but was amended in 1987 to include noise as an air pollutant.
- The Government of India has passed the Water (Prevention and Control of Pollution) Act 1974 to safeguard our water resources.
- A mere 0.1 percent impurities make domestic sewage unfit for human use .
- Water hyacinth (*Eichhornia crassipes*), the world most problematic aquatic weed, also called 'Terror of Bangal' . They grow abundantly in eutrophic water bodies, and lead to an imbalance in the ecosystem dynamics of the water body.
- Biomagnification: The concentration of DDT is increased at successive trophic levels; say if it starts at 0.003 ppb (ppb = parts per billion) in water, it can ultimately can reach 25 ppm (ppm = parts per million) in fish eating birds, through biomagnification.
- Eutrophication is the natural aging of a lake by biological (nutrient) enrichment of its water.
- The natural aging of a lake may span thousands of years. However, pollutants from man's activities like effluents from the industries and homes can radically accelerate the aging process. This phenomenon has been called Cultural or Accelerated Eutrophication.
- Biologists from the Humboldt State University, the towns people created an integrated waste water treatment process within a natural system.
- The biologists developed a series of six connected marshes over 60 hectares of marshland. Appropriate plants, algae, fungi and bacteria were seeded into this area, which neutralise absorb and assimilate the pollutants. Hence, as the water flow through the marshes, it gets purified naturally.
- A citizens group called Friends of the Arcata Marsh (FOAM) are responsible for the upkeep and safeguarding of this wonderful project.

SOLVED EXAMPLE

- Ex.1** Biochemical Oxygen Demand (BOD) in a river water
 (A) Remains unchanged when algal bloom occurs
 (B) Has no relationship with concentration of oxygen in the water
 (C) Gives a measure of salmonella in the river water
 (D) Increases when sewage gets mixed with river water

Sol. (D) : The degree of pollution is directly proportional to BOD, therefore more the organic pollution (specially sewage), the more would be BOD of water.

- Ex.2** If global warming continues, the organism which may face more server threat is

- (A) Cow (B) Banana
 (C) Snow leopard (D) Dolphin

Sol. (C)

- Ex.3** Cleaning Environment with biological options such as microbes & plants is called

Or

A process that uses micro-organisms to convert harmful industrial wastes to less toxic or non-toxic compounds is

- (A) Bioremediation (B) Biotechnology
 (C) Biowarware (D) Incineration

Sol. (A)

- Ex.4** Ozone layer in upper atmosphere (stratosphere) is destroyed by or which one of the chemicals is responsible for the reduction of ozone content of atmosphere

Or

What are the chief pollutants of the atmosphere which are most likely to deplete the ozone layer

- (A) Hydrochloric acid
 (B) Photochemical smog
 (C) Chlorofluoro carbon (CFC) and Nitrogen oxide
 (D) Sulphur dioxide

Sol. (C) : CFC is strong enemy of ozone and causes depletion of ozone layer.

- Ex.5** In 1984, Bhopal gas tragedy was caused due to leakage of

- (A) Sodium monoxide (B) Sodium thiocyanate
 (C) Potassium isocyanate (D) Methyl isocyanate

Sol. (D)

- Ex.6** Which one of the following pairs is mismatched

- (A) Fossil fuel - release of CO₂ burning
 (B) Nuclear - radioactive wastes power
 (C) Solar energy - greenhouse effect
 (D) Biomass - release of CO₂ burning

Sol. (C) : Solar energy is not responsible for green house effect instead it is a source of energy for the plants and animals.

- Ex.7** According to the Central Pollution Control Board, the diameter of particles that are responsible for causing great harm to human health is

- (A) 2.5 micrometer (B) 5.0 micrometer
 (C) 10.0 micrometer (D) 7.5 micrometer

Sol. (A)

- Ex.8** Which of the following exhibits biomagnification

- (A) SO₂ (B) Mercury
 (C) DDT (D) Both (B) and (C)

Sol. (D)

- Ex.9** Match the following and choose the correct option

- | | |
|--|-------------|
| Column - I | Column - II |
| (i) Environment Protection Act | (A) 1974 |
| (ii) Air Prevention & Control of Pollution Act | (B) 1987 |
| (iii) water Act | (C) 1986 |
| (iv) Amendment of Air Act to include noise as an air pollutant | (D) 1981 |

The correct matches is

- (A) i - C, ii - D, iii - A, iv - B
 (B) i - A, ii - C, iii - B, iv - D
 (C) i - D, ii - A, iii - B, iv - C
 (D) i - C, ii - D, iii - B, iv - A

Sol. (A)

- Ex.10** Which one of the following diseases is not caused due to contamination of water

- (A) Hepatitis-B (B) Jaundice
 (C) Cholera (D) Typhoid

Sol. (A)

Exercise # 1

SINGLE OBJECTIVE

NEET LEVEL

1. The excessive discharge of fertilizers into water bodies results in
 (A) Growth of fish
 (B) Death of hydrophytes
 (C) Eutrophication
 (D) Silt
2. Ozone layer in upper atmosphere (stratosphere) is destroyed by or which one of the chemicals is responsible for the reduction of ozone content of atmosphere
 (A) Hydrochloric acid
 (B) Photochemical smog
 (C) Chlorofluoro carbon (CFC)
 (D) Sulphur dioxide
3. What are the chief pollutants of the atmosphere which are most likely to deplete the ozone layer
 (A) Sulphur dioxide
 (B) Nitrogen oxide and fluorocarbons
 (C) Carbon dioxide
 (D) Carbon monoxide
4. The pollutants emitted by jet aeroplanes in outer atmosphere fluorocarbons are known as
 (A) Smog
 (B) Photochemical oxidants
 (C) Aerosols (D) Loess
5. Acid rain is caused due to increase in concentration of (in atmosphere)
 (A) SO₂ and NO₂ (B) CO and CO₂
 (C) CO and SO₃ (D) O₃ and dust
6. Today the concentration of green house gases is very high because of
 (A) Use of refrigerator
 (B) Increased combustion of oils and coal
 (C) Deforestation
 (D) All of the above
7. Increase in the percentage of fauna and decrease in flora may be dangerous because it enhances
 (A) Percentage of CO₂
 (B) Percentage of radioactive fall out
 (C) Percentage of O₂
 (D) Percentage of diseases
8. The pollution in city like Delhi may be controlled to great extent
 (A) By proper sewage and proper exit of chemicals from factories
 (B) By wide roads and factories away from the city
 (C) By cleaning city and scanty use of pesticides
 (D) All of the above
9. Domestic waste contains
 (A) Non-biodegradable pollutants
 (B) Biodegradable pollutants
 (C) Hydrocarbons
 (D) None of the above
10. Foul smell in the water of tanks, ponds etc. is due to
 (A) Anaerobiosis
 (B) Aerobiosis
 (C) Biological magnification
 (D) Psammophytes
11. Measurement of the rate of O₂ consumption in unit volume of water over a period of time is done to find out
 (A) Biogas generation
 (B) Biological oxygen demand
 (C) Biosynthetic pathways
 (D) Fermentation
12. Formation of ozone hole is maximum over
 (A) India (B) Antarctica
 (C) Europe (D) Africa
13. Which one of the following organisms is used as indicator of water quality
 (A) Biggiata (B) Chlorella
 Azospirillum (D) Escherichia
14. Which of the following serves as an indicator of atmospheric pollution
 (A) Ferns (B) Liverworts
 (C) Hornworts (D) Epiphytic lichens
15. Lead (Pb) causes
 (A) Soil pollution (B) Air pollution
 (C) Radioactive pollution (D) All the above
16. The stratospheric ozone depletion leads to
 (A) Global warming
 (B) Increase in the incidence of skin cancers
 (C) Forest fires
 (D) All the above

(C)

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Green house effect refers to
(A) Cooling of earth (B) Trapping of UV rays
(C) Production of cereals (D) Warming of earth
2. Which of the following is pollution related disorder
(A) Hypertension (B) Leprosis
(C) Silicosis (D) Pneumonicosis
3. Which of the following organism is likely to have more concentration of D.D.T in its body
(A) Herbivores (B) Carnivores
(C) Top carnivores (D) Primary producers
4. Increasing of temperature due to scattering of energy is determine by ozone, and water vapour, is known as
(A) Radioactivity (B) Ozone effect
(C) Solar reaction (D) Green house effect
5. Water pollution is caused due to
(A) Sewage and other wastes
(B) Industrial effluents
(C) Agricultural discharges
(D) All of these
6. Which among the following is likely to have the highest levels of D.D.T. depositions in its body
(A) Eel (B) Crab
(C) Sea gull (D) Phytoplankton
7. The ultimate environmental hazard to mankind is
(A) Air pollution (B) Water pollution
(C) Noise pollution (D) Nuclear pollution
8. Aerosols reduce primary productivity by
(A) Destroying leaf tissue (B) Premature leaf fall
(C) Reducing crop yields (D) All of these
9. Water pollution is caused by
(A) Ammonia (B) Phytoplankton
(C) Industrial effluents (D) Smoke
10. The most adverse effect of radioactive pollutant is
(A) Gene mutation (B) Hepatitis
(C) Polio (D) T.B.
11. The result of ozone hole is
(A) Acid rain (B) UV radiations
(C) Global warming (D) Green house effect
12. Increase in the concentration of pollutants in higher trophic levels is called
(A) Recycling (B) Eutrophication
(C) Biodegradation (D) Biomagnification
13. What is the intensity of sound in normal conversation
(A) 10-20 dB (B) 40-60dB
(C) 90-120 dB (D) 120-150dB
14. Which of the following is most poisonous
(A) CO (B) CO₂
(C) C (D) SO₂
15. The high amount of E. coli in water is the indicator of
(A) Hardness of water (B) Industrial pollution
(C) Sewage pollution
(D) Presence of chlorine in water
16. Which is a degradable pollutant
(A) D.D.T. (B) Aluminium foil
(C) Domestic wastes (D) Mercury salts
17. Which is a green house gas
(A) CO (B) CO₂
(C) H₂ (D) N₂
18. Which of the following is biodegradable pollutant
(A) Sewage (B) Plastic
(C) Polythene (D) DDT
19. Effect of pollution first marked on
(A) Micro-organisms
(B) Green vegetation of an area
(C) Food crop (D) None of these
20. Green muffler is used against which type of pollution
(A) Air (B) Water
(C) Soil (D) Noise
21. Positive pollution of soil is due to
(A) Excessive use of fertilizers
(B) Addition of wastes on soil
(C) Reduction in soil productivity
(D) All of these
22. CO is more toxic than CO₂ because
(A) It affects the nervous system
(B) It damages lungs
(C) It reduces the oxygen carrying capacity of hemoglobin
(D) It forms acid with water

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match the following items in column I with column II and choose the correct answer

Column - I

- (A) Arsenic
- (B) Nitrate
- (C) Mercury
- (D) Cadmium
- (E) Fluoride

(A) A-2, B-3, C-5, D-1, E-4

(C) A-3, B-4, C-5, D-1, E-2

(E) A-2, B-5, C-4, D-3, E-1

Column - II

- (1) Minamata disease
- (2) Itai-Itai
- (3) Blue-baby syndrome
- (4) Skeletal fluorosis
- (5) Black-foot disease

(B) A-5, B-3, C-1, D-2, E-4

(D) A-5, B-4, C-3, D-2, E-1

2. Match the following and choose the correct combination from the option given below

Column - I

(Green house gases)

- (A) CO₂
- (B) CH₄
- (C) N₂O
- (D) CFC + HFC

(A) (A) - (3), (B) - (4), (C) - (2), (D) - (1)

(C) (A) - (2), (B) - (3), (C) - (4), (D) - (1)

(E) (A) - (1), (B) - (2), (C) - (3), (D) - (4)

Column - II

(Concentration in 2000 AD)

- (1) 282 ppt
- (2) 316 ppb
- (3) 368 ppm
- (4) 1750 ppb

(B) (A) - (4), (B) - (3), (C) - (2), (D) - (1)

(D) (A) - (1), (B) - (4), (C) - (2), (D) - (3)

3. Match the following and choose the correct combinations from the options given

Column - I

- (A) DDT
- (B) PAN
- (C) Acid rain
- (D) Global warming

(A) (a)-(s), (b)-(r), (c)-(q), (d)-(p)

(C) (a)-(q), (b)-(r), (c)-(s), (d)-(p)

(E) (a)-(r), (b)-(s), (c)-(p), (d)-(q)

Column - II

- (p) CO, CO₂
- (q) Smog
- (r) Biological magnification
- (s) SO₂

(B) (a)-(p), (b)-(r), (c)-(q), (d)-(s)

(D) (a)-(r), (b)-(q), (c)-(s), (d)-(p)

4. Match the following and choose the correct option:

Column - I

- (i) Environment Protection Act
- (ii) Air Prevention & Control of Pollution Act
- (iii) Water Act
- (iv) Amendment of Air Act to include

noise as an air pollutant

The correct matches is

(A) i-C, ii-D, iii-A, iv-B

(C) i-D, ii-A, iii-B, iv-C

Column - II

- (A) 1974
- (B) 1987
- (C) 1986
- (D) 1981

(B) i-A, ii-C, iii-B, iv-D

(D) i-C, ii-D, iii-B, iv-A

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. Relative Biological Effectiveness (RBE) refers to the damages caused by
(A) low temperature (B) high temperature
(C) radiation (D) pollution
2. What is the intensity of sound in normal conversation?
(A) 0-20 dB (B) 30-60 dB
(C) 70-90 dB (D) 120-150 dB
3. What is BOD?
(A) The amount of O₂ utilised by organisms in water
(B) The amount of O₂ utilised by microorganisms for decomposition
(C) The total amount of O₂ present in water
(D) All of the above
4. Which of the following is absent in polluted water?
(A) Hydrilla (B) Water hyacinth
(C) Larva of stone fly (D) Blue-green algae
5. Fluoride pollution mainly affects
(A) teeth (B) kidney
(C) brain (D) heart
6. If by radiation all nitrogenase enzymes are inactivated, then there will be no
(A) Fixation of nitrogen in legumes
(B) Fixation of atmospheric nitrogen
(C) Conversion from nitrate to nitrite in legumes
(D) Conversion from ammonium to nitrate in soil
7. In 1984, the Bhopal gas tragedy took place because methyl isocyanate
(A) reacted with DOT
(B) reacted with ammonia
(C) reacted with CO₂
(D) reacted with water
8. Identify the correctly matched pair.
(A) Montreal protocol - Global warming
(B) Kyoto protocol - Climate change
(C) Ramsar convention - Ground water pollution
(D) Basal convention - Biodiversity conservation
9. Lead concentration in blood is considered alarming if it is
(A) 20ng/100ml (B) 30 p.g/100ml
(C) 4-6ng/100ml (D) 10ng/100ml
10. Recently Govt. of India has allowed mixing of alcohol in petrol. What is the amount of alcohol permitted for mixing in petrol?
(A) 2.5% (B) 10-15%
(C) 10% (D) 5%
11. Which of the following is not used for disinfection of drinking water?
(A) Phenyl (B) Chloramine
(C) Chlorine (D) Ozone
12. Which one of the following pair is mismatched?
(A) Biomass burning - Release of CO₂
(B) Fossil fuel burning - Release of CO₂
(C) Nuclear power - Radioactive wastes
(D) Solar energy - Greenhouse effect
13. Limit of BOD prescribed by Central Pollution Control Board for the discharge of industrial and municipal waste water into natural surface water, is
(A) < 3.0 ppm (B) < 10 ppm
(C) < 100 ppm (D) < 30 ppm
14. Montreal protocol, which calls for appropriate action to protect the ozone layer from human activities was passed in the year
(A) 1986 (B) 1987
(C) 1988 (D) 1985
15. Photochemical smog pollution does not contain
(A) ozone
(B) nitrogen dioxide
(C) carbon dioxide
(D) PAN (Peroxy Acyl Nitrate)
16. In which one of the following, the BOD (Biochemical Oxygen Demand) of sewage (S), distillery effluent (DE), paper mill effluent (PE) and sugar mill effluent (SE) have been arranged in ascending order?
(A) SE < S < PE < DE (B) SE < PE < S < DE
(C) PE < S < SE < DE (D) S < DE < PE < SE
17. In a coal fired power plant, electrostatic precipitators are installed to control emission of
(A) SO₂ (B) NO₂
(C) SPM (D) CO
18. Which one of the following is not a bioindicator of water pollution?
(A) Sludge worms (B) Blood worms
(C) Stone flies (D) Sewage fungus

(C)

MOCK TEST

- A scrubber in the exhaust of a chemical industry removes
 (A) Nitrous oxide (B) Hydrogen sulphide (C) Carbon dioxide (D) Sulphur dioxide
- Effect of pollution is observed first on
 (A) Micro-organisms (B) Food crop (C) Green vegetation (D) Herbivores
- Match column I with column II

Column - I	Column - II
(P) Pollen grains	(i) Photochemical smog
(Q) PAN	(ii) Particulate pollution
(R) CO ₂	(iii) Global warming
(S) Cadmium	(iv) Itai itai disease
(A) P - (ii) , Q - (i), R - (iii), S - (iv)	(B) P - (iv) , Q - (ii), R - (i), S - (iii)
(C) P - (i) , Q - (ii), R - (iii), S - (iv)	(D) P - (iii) , Q - (i), R - (ii), S - (iv)
- Consider the following statements with respect to pollution.

(A) To control air pollution problems, by the end of 2002 all the buses of Delhi were converted to run on unleaded petrol.

(B) Electrostatic precipitator can remove over 99% particulated matter present in the exhaust from a thermal power plant.

(C) It is possible to estimate the amount of organic matter in sewage water by measuring BOD.

(A) A alone is correct (B) B alone is correct (C) C alone is correct (D) A and B are correct
 (E) B and C are correct
- Match the items of column I with column II and select the correct option.

Column - I	Column - II
(A) Electrostatic	(1) Removes gases like SO ₂
(B) Scrubber	(2) Reduces automobile emission
(C) Catalytic converter	(3) Removes particulate matter
(A) A - 2, B - 3, C - 1 (B) A - 3, B - 2, C - 1	(C) A - 1, B - 2, C - 3 (D) A - 3, B - 1, C - 2
(E) A - 1, B - 3, C - 2	
- 'Floc' is

(A) A mesh-like structure formed by the association of bacteria and fungal filaments in sewage treatment
 (B) The primary sludge produced in sewage treatment
 (C) The effluent in primary treatment tank obtained during sewage treatment
 (D) A type of biofortified food
- Biochemical Oxygen Demand (BOD) may not be a good index for pollution for water bodies receiving effluents from
 (A) Domestic sewage (B) Dairy industry (C) Petroleum industry (D) Sugar industry
- Find the correct order of biomagnification of DDT in an aquatic food chain

(A) Water (0.003 ppm), zooplankton (0.5 ppm), small fish (0.04 ppm), large fish (2 ppm), fish eating birds (25 ppm)
 (B) Water (0.003 ppm), zooplankton (0.04 ppm), small fish (0.5 ppm), large fish (2 ppm), fish eating birds (25 ppm)
 (C) Water (0.003 ppm), fish eating birds (25 ppm), zooplankton (0.5 ppm), small fish (0.04 ppm), large fish (2 ppm)
 (D) Water (0.003 ppm), small fish (0.04 ppm), zooplankton (0.5 ppm), large fish (2 ppm), fish eating birds (25 ppm)
 (E) Water (0.003 ppm), large fish (0.04 ppm), small fish (0.5 ppm), zooplankton (2 ppm), fish eating birds (25 ppm)

www.blog.neetnearnme.com

MORPHOLOGY IN FLOWERING PLANTS

"Time is the most valuable thing a man can spend."

THEOPHRASTUS (371-287 BC)

INTRODUCTION

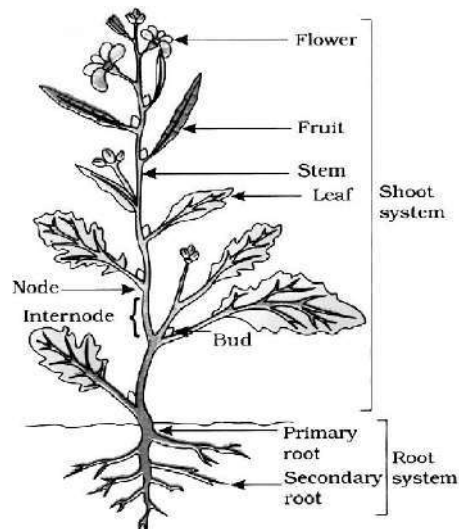
As we all know that all flowering plants are multicellular organism. They grow by cell division, morphological features and trait are genetically determined. Even though the angiosperms show such a large diversity in external structure or morphology, they are all characterised by presence of roots, stems, leaves, flowers and fruits.

We also need to know about the possible variations in different parts, found as adaptations of the plants to their environment, e.g., adaptations to various habitats, for protection, climbing, storage, etc.

In this chapter you will learn how different parts of plants are modified to serve specific needs including defence from their enemies. You will also get an idea to know about plant families.

PLANT MORPHOLOGY

INTRODUCTION:



Parts of a flowering plant

Morphology – (Morphe = form + logos = study). It deals with the **study of forms and features** of different plant organs like roots, stems, leaves, flowers, seeds, fruits etc.

The body of a typical angiospermic plant is differentiated into :

- (1) An underground root system
- (2) An aerial shoot system.

The shoot system consists of stem (including branches), leaves, flowers and fruits.

The roots, stems and leaves are **vegetative parts**, while flowers constitute the **reproductive part**.

CLASSIFICATION OF PLANTS :

Depending upon their life span, plants are classified as –

a. Annuals – Plants that complete their life cycle in **one year** or **single growing season** or few weeks to a few months. They pass the unfavourable period in the form of **seeds** eg. Mustard, Pea.

b. Biennials – Plants that complete their life cycle in two years-**growing, vegetative** and storing food **in the first year, flowering and fruiting in the second year**. They die off after producing flowers and fruits

Radish, turnip, carrot are **biennial** in **colder** areas. They become **annual** in **warmer** places.

c. Perennials – Plants that survive for several years. These plants usually bear flowers and fruits every year and do not die after producing flowers. eg. Mango, Banana, Guava.

ROOT

Radicle comes out/arise from the seed coat in the form of soft structure and move toward the soil. It develops and forms primary root.

General Characters :

1. Roots are **non green, underground**, (+) geotropic, (-) phototropic and (+) hydrotropic.
2. Buds present for vegetative propagation in sweet potato (**Ipomea**) and Indian red wood (**Dalbergia**)
3. Roots do not bear buds, nodes and internodes
4. Roots have **unicellular** root hairs.

TYPES OF ROOTS :

Roots are of two types :

1. Tap root

MORPHOLOGY IN FLOWERING PLANTS

2. Adventitious root

Tap root : It develops from radicle and made up of one main branch and other sub branches.

Adventitious roots : When root is originated from any other part of plant than radicle. It is known as Adventitious root.

Root System :

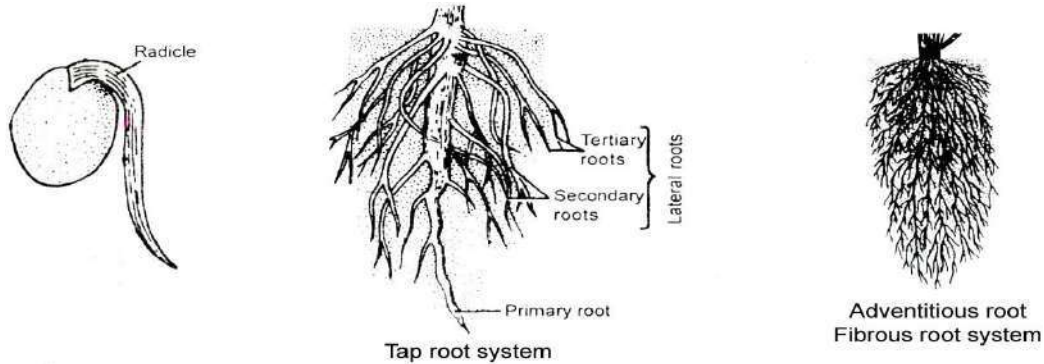
Root systems are of two type :

(i) Tap Root System,

(ii) Fibrous Root System

(i) **Tap root system** - Primary root and its branches constitute tap root system. e.g., Dicot

(ii) **Fibrous root system** – In some plant mainly in monocots, after sometime growth of tap root stop and than roots develop from other part of plant which are highly branched and fibrous and form fibrous root system.



REGIONS OF ROOTS :

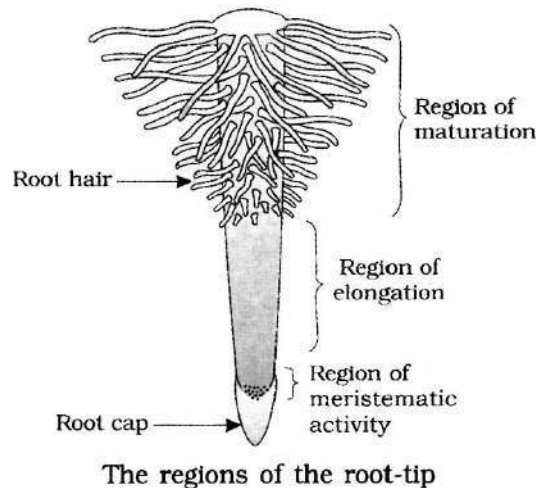
Morphologically four distinct regions are present in roots.

Root cap : It is terminal structure. It protects tender apex of root.

Meristematic zone : Cells of this regions are very small and thin walled. They divide repeatedly and increase cell number

Elongation region : The cells proximal to meristematic zone undergo rapid elongation and enlargement and are responsible for rapid growth of roots.

Maturation region : Cells proximal to region of elongation gradually differentiate and mature. Root hairs are present in maturation zone.



MODIFICATION OF ROOTS :

1. Modified tap root for storage :

Conical roots : These roots are thicker at their upper side and tapering at basal end. eg. Carrot.

FAMILY OF ANGIOSPERM**FAMILIES OF ANGIOSPERMS :****The symbols used in Floral Formula -**

Bracteate	=	Br
Ebracteate	=	Ebr
Actinomorphic	=	⊕
Zygomorphic	=	% or ⊖
Bisexual	=	♂ ♀
Unisexual male (staminate)	=	♂
Unisexual female (Pistillate)	=	♀
Epicalyx	=	Epi
Calyx	=	K or if joined = K _()
Corolla	=	C or if joined = C _()
Perianth	=	P or if joined = P _()
Androecium	=	A or if joined = A _()
Gynoecium	=	G or if joined = G _()
Superior ovary / Hypogynous flower	=	<u>G</u>
Inferior ovary / Epigynous flower	=	G
Ovary half inferior or half superior / Perigynous flower	=	G –

Adhesion

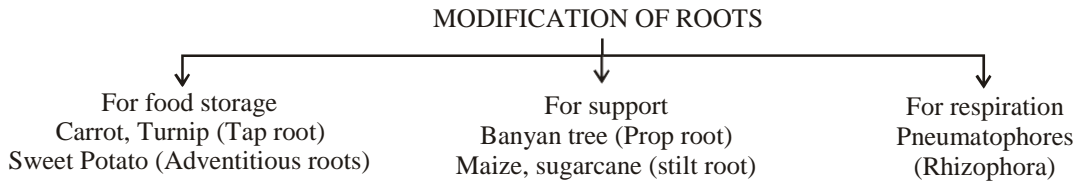
Epiphyllous	=	P A
Epipetalous	=	C A

CRUCIFERAE (BRASSICACEAE) (Mustard family)**Distinguishing Features of Cruciferae -**

The plant organs usually have pungent odour. This odour is due to presence of sulphur containing glucosides compound. Myrosin enzyme (present in secondary cells) hydrolyse then into glucose & different isothiocyanates (Various oils).

Inflorescence – Typical raceme.

1. Direct elongation of the radicle leads to the formation of primary root and lateral roots are called secondary and tertiary roots, (are collectively called tap root system). eg most of the dicot plants (Mustard).
2. In monocots primary root is replaced by the large numbers of roots which is originated from the base of stem called fibrous roots. eg - wheat
3. Roots arise from parts of the plant other than radicle are called adventitious roots. eg. Grass, Monstera, Banyan.



4. STEM

It develops from the plumule. The main function of the stem is spreading out branches bearing leaves, flowers and fruits.

MODIFICATIONS OF STEM

- For food storage - underground stem (Potato, ginger, turmeric, zaminkand, Colocasia)
- Stem tendrils - Help plants to climb
e.g.- Gourds (Cucumber, Pumpkins, Watermelon) and grapevines
- Thorns - Protect plants from browsing animals
e.g - Citrus, Bougainvillea.
- Phylloclade - Perform photosynthesis
e.g. - Opuntia (Flat), Euphorbia (Cylindrical)
- Offset - Pistia, Eichhornia
- Sucker - Banana, Pineapple, Chrysanthemum

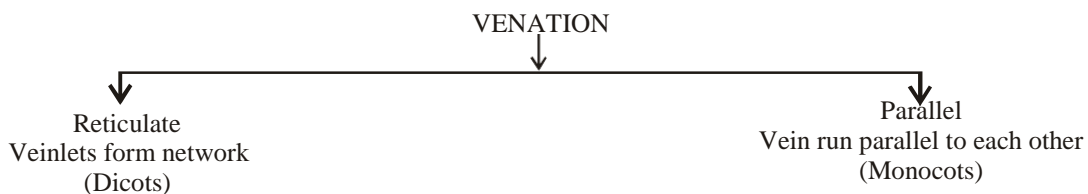
5. LEAF

Leaves originate from shoot apical meristem and are arranged in an acropetal manner.

The leaf is attached to the stem by leaf base and may bear two lateral small leaf like structures called stipules.

Swollen leaf bases are called pulvinus. e.g. Some leguminous plants.

Venation - Arrangement of veins and veinlets in the lamina of leaf is termed as venation



SOLVED EXAMPLE

Ex.1 If a primary root continues to grow, the type of root system will be known as

- (A) Secondary (B) Fibrous
(C) Tap (D) Stilt

Sol. (C)

Ex.2 Roots developing from plant parts other than radical are

- (A) Epiphyllous (B) Epicaulous
(C) Adventitious (D) Fibrous

Sol. (C) : In monocotyledonous plants the radicle dies immediately after germination of seeds and later these roots arise from any germination of seeds and later these roots arise from any other portion (stem, leaves etc.) of the plant.

Ex.3 In which the pneumatophores are found

- (A) Tinospora (B) Pinus
(C) Rhizophora (D) None of these

Sol. (C) : Pneumatophores develop from horizontal roots. They bear a number of lenticels or pneumathodes. Exchange of gases occurs through these pores. e.g., Rhizophora.

Ex.4 Stilt roots which grow obliquely from basal nodes of culm stem and acting as brace are found in

- (A) Sorghum (B) Maize
(C) Sugarcane (D) All of these

Sol. (D)

Ex.5 Find out correct order of vegetative propagules of plants like potato, ginger Agave, Bryophyllum and water hyacinth

- (A) Offset, bulbil, leaf bud, rhizome and eyes
(B) Leaf bud, bulbil, offset, rhizome and eyes
(C) Rhizome, bulbil, leaf bud, eyes and offset
(D) Offset, bulbil, leaf bud, rhizome and eyes

Sol. (C)

Ex.6 Thorn is a stem structure because it

- (A) Develops from thrunk
(B) Develops from axillary bud
(C) Grows from external surface
(D) Is pointed

Sol. (B) : Thorns are actually modified axillary buds or terminal buds, and they possess vascular supply.

Ex.7 An example of edible underground stem is

- (A) Sweet potato (B) Potato
(C) Carrot (D) Groundnut

Sol. (B) : Sweet potato, Carrot – Edible root.
Potato – Edible underground stem.

Ex.8 Which one of the following is correctly matched

- (A) Onion - Bulb
(B) Ginger - Sucker
(C) Chlamydomonas - Conidia
(D) Yeast - Zoospores

Sol. (A) : Onion – Bulb – underground stem, Ginger – Rhizome - Chlamydomonas – Zoospore.

Ex.9 Succulent stem is found in

- (A) Pisum (B) Casuarina
(C) Oxalis (D) Euphorbia

Sol. (D)

Ex.10 Presence of sheathing leaf base and ligule are characteristic of

- (A) Cycas leaf (B) Fern leaf
(C) Banana leaf (D) Grass leaf

Sol. (D) : In grasses and many monocots, the leaf base is broad and surrounds the stem as an envelope, such a leaf base is called sheathing leaf base. An additional outgrowth is present between leaf base and lamina. It is called ligule, e.g., Grasses.

Ex.11 Identify the correct types of phyllotaxy which shown in the following figures

- (A) A - Whorled, B - Alternate, C - Opposite
(B) A - Alternate, B - Whorled, C - Opposite
(C) A - Whorled, B - Opposite, C - Alternate
(D) A - Alternate, B - Opposite, C - Whorled

Sol. (D)

Ex.12 Study the following statements and select the correct option

- (A) Buds are present in the axil of leaflets of the compound leaf
(B) Pulvinus leaf-base is present in some leguminous plants
(C) In Alstonia, the petioles expand, become green and synthesize food
(D) Opposite phyllotaxy is seen in guava

- (A) (B) and (D) are correct but (A) and (C) are wrong
(B) (A) and (C) are correct but (B) and (D) are wrong
(C) (B), (C) and (D) are correct but (A) are wrong
(D) (A) and (B) are correct but (C) and (D) are wrong

Sol. (A)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Roots developing from plant parts other than radicle are -
(A) Tap root (B) Adventitious root
(C) Both (A) & (B) (D) None of the above
2. A plant with parallel venation is -
(A) Castor (B) Grass
(C) Colocasia (D) Mustard
3. An edible inflorescence is -
(A) *Brassica rapa* (B) *Mustard*
(C) *Raphanus sativus* (D) *Brassica oleracea*
4. Main function of leaf is -
(A) Manufacture of food (B) Exchange of gases
(C) Both (A) and (B) (D) None of the above
5. Cruciform corolla is found in -
(A) Pea (B) China rose
(C) Radish (D) Sunflower
6. Siliqua is the fruit of -
(A) Cruciferae (B) Malvaceae
(C) Liliaceae (D) Solanaceae
7. Chlorophyll containing fleshy cylindrical structures found in *Euphorbia* are modified
(A) Roots (B) Fruit
(C) Leaves (D) Stem
8. In *Pistia* and *Eichhornia*, stems are modified to form
(A) Offsets (B) Tendrils
(C) Stolons (D) Suckers
9. Leaves originate from _____ and modified to form
(A) Root apical meristem, acropetal
(B) Floral meristem, basipetal
(C) Shoot apical meristem, acropetal
(D) Internodes, basipetal
10. Leaf base may bear two lateral small leaf like structures called
(A) Lamina (B) Pulvinus
(C) Stipules (D) Sepals
11. Mark the incorrect statement
(A) Flower is a modified shoot
(B) In cymose inflorescence, the main axis terminates in a flower
(C) Flower are borne on successive internodes on the stems and roots
(D) When a shoot tip transforms into a flower, the flower is always solitary
12. The four whorls of a flower are arranged on the
(A) Thalamus (B) Petiole
(C) Corolla (D) Stamens
13. Radial symmetry is found in flowers of
(A) Cassia (B) Chili
(C) Gulmohur (D) Canna
14. The flower of which of the following plants is zygomorphic ?
(A) Bean (B) *Datura*
(C) Mustard (D) Canna
15. Which of the following plant has epigynous flower ?
(A) Cucumber (B) Brinjal
(C) Mustard (D) Peach
16. Parallel venation is a characteristic of monocots. Which of the following is an exception to this generalization?
(A) *Smilax* (B) *Colocasia*
(C) *Alocasia* (D) All of these
17. Carpels are fused in the flowers of
(A) Lotus (B) Tomato
(C) Rose (D) Both (A) & (C)
18. The stony hard part of the mango represents
(A) Mesocarp (B) Epicarp
(C) Endocarp (D) Marginal

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Occurrence of different types of leaves on the same plant is -
(A) Heterophylly (B) Heteotrophy
(C) Heteronasty (D) All
2. Which one of the following is of related type -
(A) Catkin and Hypanthodium
(B) Raceme and Cyathium
(C) Corymb and Umbel
(D) Verticillaster and spike
3. Didynamous condition is related to -
(A) Androecium (B) Inflorescence
(C) Gynoecium (D) All
4. The floral organs arise from -
(A) Mother axis (B) Thalamus
(C) Root (D) Pedicel
5. A typical flower with superior ovary and other floral parts inferior is -
(A) Polygamous (B) Hypogynous
(C) Perigynous (D) Epigynous
6. A characteristic of angiosperm is -
(A) Flowers (B) Roots
(C) Seed (D) All
7. A berry fruit is -
(A) Fleshy and single seeded
(B) Fleshy and multiseeded
(C) Dry and multiseeded
(D) Dehiscent & single seeded
8. Water melon is -
(A) Pome (B) Sorosis
(C) Pepo (D) Drupe
9. Fruit of *Halianthus annuus* is -
(A) Legume (B) Follicle
(C) Cypsella (D) Capsule
10. Monadelphous stamens are formed by the fusion of -
(A) Anther lobes of all stamens
(B) Anther lobes of two stamens
(C) Filaments of all stamens
(D) None of these
11. In a 'phylloclade' the function of photosynthesis is taken up by -
(A) Leaves (B) Stipules
(C) Stem (D) Buds
12. Plants disperse their seeds and fruits because -
(A) They produce them
(B) They are good and edible
(C) They want to eliminate struggle for existence
(D) None of the above
13. Rolling mechanism of dispersal is found in -
(A) *Amaranthus* (B) *Acer*
(C) *Shorea* (D) *Moringa*
14. Clove is -
(A) Bud (B) Fruit
(C) Seed (D) Mature flower
15. A perennial plant which flower once in its life time is known as
(A) Annual (B) Perennial
(C) Monocarpic (D) Polycarpic
16. Imparipinnate leaf is characterized by -
(A) Large leaflet
(B) Rachis terminating in by unpaired odd leaflet
(C) Strong Rachis
(D) Leaflets are in pair
17. Presence of monocarpellary, unilocular ovary with marginal placentation are characteristic of -
(A) Solanaceae (B) Cruciferae
(C) Leguminosae (D) Compositae
18. Thorns and spines are -
(A) Defensive organs
(B) Respiratory organs
(C) Both (A) & (B)
(D) Storage organs

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match the items in Column - I with column - II and choose the correct alternative

Column - I

- A. Tubercular storage roots
- B. Pneumatophores
- C. Haustoria
- D. Prop-roots
- E. Assimilatory roots

- (A) A - ii, B - iii, C - iv, D - v, E - i
- (C) A - iii, B - i, C - ii, D - v, E - iv
- (E) A - iii, B - ii, C - iv, D - v, E - i

Column - II

- i. Tinospora
- ii. Heritiera
- iii. Asparagus
- iv. Viscum
- v. Screwpine

- (B) A - iii, B - iv, C - v, D - i, E - ii
- (D) A - v, B - iv, C - v, D - ii, E - i

2. Match the following and select the correct combination from the options given below

Column - I

(Stem Modifications)

- A. Underground stem
- B. Stem tendril
- C. Stem thorns
- D. Flattened stem
- E. Fleshy cylindrical stem

- (A) A - ii, B - iii, C - iv, D - v, E - i
- (C) A - iii, B - i, C - ii, D - v, E - iv
- (E) A - iii, B - ii, C - iv, D - v, E - i

Column - II

(Found in)

- i. Euphorbia
- ii. Opuntia
- iii. Potato
- iv. Citrus
- v. Cucumber

- (B) A - iii, B - iv, C - v, D - i, E - ii
- (D) A - v, B - iv, C - v, D - ii, E - i

3. Study the following lists

Column-I

- A. Entire leaf modified into a spine
- B. Leaf except stipules modified into a tendril
- C. Stipules modified into a tendril
- D. First leaf of axillary bud modified into a spine

Column-II

- i. Clematis
- ii. Citrus
- iii. Euphorbia
- iv. Lathyrus
- v. Smilax

The correct match is

A	B	C	D
(A) iii	iv	i	ii
(B) iii	i	iv	ii
(C) ii	iii	i	v
(D) v	ii	i	iii

4. Match list I with list II and select the correct option

Column- I

- A. Gemmules
- B. Leaf-buds
- C. Bulbil
- D. Offset
- E. Conidia

- (A) A - 4, B - 5, C - 1, D - 3, E - 2
- (C) A - 3, B - 5, C - 4, D - 2, E - 1
- (E) A - 3, B - 5, C - 4, D - 1, E - 2

Column- II

- i. Agave
- ii. Penicillium
- iii. Water hyacinth
- iv. Sponges
- v. Bryophyllum

- (B) A - 4, B - 3, C - 2, D - 1, E - 5
- (D) A - 4, B - 1, C - 5, D - 3, E - 2

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. Edible part in lichi is [CBSE AIPMT-1999, 05, 06]
(A) mesocarp (B) fleshy aril
(C) endosperm (D) pericarp
2. Match the following and indicate which is correct ? [CBSE AIPMT-2000]
(A) Cucurbitaceae - Orange
(B) Malvaceae - Cotton
(C) Brassicaceae - Wheat
(D) Leguminosae - Sunflower
3. Edible part of banana is [CBSE AIPMT-2001]
(A) epicarp
(B) mesocarp and less developed endocarp
(C) endocarp and less developed mesocarp
(D) epicarp and mesocarp
4. Which is correct pair for edible part ? [CBSE AIPMT-2001]
(A) Tomato - Thalamus
(B) Maize - Cotyledons
(C) Guava - Mesocarp
(D) Date plam - Pericarp
5. Roots of which plant contains an oxidising agent ? [CBSE AIPMT-2001]
(A) Carrot (B) Soyabean
(C) Mustard (D) Radish
6. Bicarpellary gynoecium and oblique ovary occurs in [CBSE AIPMT-2001]
(A) mustard (B) banana
(C) *Pisum* (D) brinjal
7. Geocarpic fruit is [CBSE AIPMT-2002]
(A) potato (B) groundnut
(C) onion (D) garlic
8. Edible part in mango is [CBSE AIPMT-2002,04]
(A) mesocarp (B) epicarp
(C) endocarp (D) epidermis
9. Which of the following is a correct pair ? [CBSE AIPMT-2002]
(A) *Cuscuta* - Parasite
(B) *Dischidia* - Insectivorous
(C) *Opuntia* - Predator
(D) *Capsella* - Hydrophyte
10. Juicy hair-like structures observed in the femon fruit develop from [CBSE AIPMT-2003]
(A) mesocarp and endocarp
(B) exocarp
(C) mesocarp
(D) endocarp
11. Long filamentous threads protruding at the end of the young cob of maize are [CBSE AIPMT-2006]
(A) styles (B) ovaries
(C) hairs (D) anthers
12. In a cereal grain the single cotyledon of embryo is represented by [CBSE AIPMT-2006]
(A) scutellum (B) prophyll
(C) coleoptile (D) coleorhiza
13. Pineapple (anasas) fruit develops from [CBSE AIPMT-2006]
(A) a multipistillate syncarpous flower
(B) a cluster of compactly borne flowers on a common axis
(C) a multilocular monocarpellary flower
(D) a unilocular polycarpellary flower
14. What type of placentation is seen sweet pea ? [CBSE AIPMT-2006]
(A) Axile (B) Freecentral
(C) Marginal (D) Basal
15. Dry indehiscent single-seeded fruit formed from bicarpellary syncarpous inferior ovary is [CBSE AIPMT-2008]
(A) caryopsis (B) cypsela
(C) berry (D) cremocarp

MOCK TEST

- Assertion :** Presence of pneumatophores is a special adaptation of hydrophytes.
Reason : Pneumatophores are positively geotropic shoots that have lenticels and help in gaseous exchange.

(A) If both assertion and reason are true and reason is the correct explanation of assertion.
 (B) If both assertion and reason are true but reason is not the correct explanation of assertion.
 (C) If assertion is true but reason is false.
 (D) If both assertion and reason are false.
- The modified supporting roots called prop roots and stilt roots are seen respectively in

(i) banyan and maize	(ii) banyan and sugarcane
(iii) maize and banyan	(iv) sugarcane and maize.

(A) (i) only
 (B) (ii) only
 (C) (iii) only
 (D) (i) and (ii) only
 (E) (i) and (iv) only
- Which of the following is correctly matched.

(A) <i>Monstera</i> – Fibrous root	(B) <i>Dahlia</i> – Fasciculated root
(C) <i>Azadirachta</i> – Adventitious root	(D) <i>Basil</i> – Prop roots
- Select the correct statements.

(A) From the region of elongation, some of the epidermal cells form root hairs.
 (B) Pneumatophores are seen in *Rhizophora*.
 (C) Adventitious roots are seen in the banyan tree.
 (D) Maize and sugarcane have prop roots.

(A) (A) and (D)	(B) (A), (C) and (D)
(C) (C) and (D)	(D) (B) and (C)
(E) (A), (B) and (D)	
- Which of the following is not a stem modification?

(A) Tendrils of cucumber	(B) Flattened structures of <i>Opuntia</i>
(C) Pitcher of <i>Nepenthes</i>	(D) Thorns of citrus
- Match the vegetative propagules listed under column I with the plants given under column II choose the appropriate option from the given choices.

Column I	Column II
A. Rhizome	i. <i>Agave</i>
B. Offset	ii. <i>Bryophyllum</i>
C. Sucker	iii. <i>Ginger</i>
D. Leaf buds	iv. <i>Chrysanthemum</i>
	v. <i>Eichhornia</i>

(A) A-iii, B-v, C-iv, D-ii	(B) A - iii, B - iv, C -i, D - ii
(C) A - ii, B - i, C - v, D - iv	(D) A - iv, B - v, C - ii, D -iii

www.blog.neetnarme.com

DIVERSITY IN THE LIVING WORLD

"Man perfected by society is the best of all animals he is the most terrible of all when he lives without law, and without justice".

“ARISTOTLE (384-322 BC)”

INTRODUCTION

The living world around us exhibits a vast range of life forms which make this planet a wonderful and amazing place to reside. The variety of living organism flourishing on earth is infinite. Similarly variety of relationships are known to occur at micro level, i.e. cellular level too. Such molecular interactions occur inside, around and among the cells, which reveal astonishing facts about life. The Second approach is philosophical one, which mainly focuses on purpose of life to living organisms. Biological classification is the scientific procedure to classify the organisms into different groups on the basis of their similarities and dissimilarities also placing the groups in a hierarchy of categories.

Life is a characteristic quality that differentiate an inanimate (non-living) object from the animate (living) forms. It is a unique, complex organisation of molecules that expresses itself through chemical reactions which lead to growth, development, responsiveness, adaptation and reproduction. The objects exhibiting growth, development, responsiveness and other characteristics of life are designated as **living beings**.

Diversity in the Living World

Science :

The word science cover from the Latin word '*Scientia*' which means knowledge.
So the definition of science is : Knowledge attained through practice or study.

'OR'

Knowledge or a system of knowledge covering general truth by actual observation, found correct on verification.

Biology :

It is a fusion or composition of 2 Greek words bios and logos.

Bios = Life

Logos = Study

Thus, biology is the science of life or living matter in all its forms and phenomenon especially with reference to origin, growth, reproduction, structure & behaviour.

'OR'

It is the science of life forms and living process.

The first major biological observation was made by ancient Greek naturalist named as '**Aristotle**' (384 - 322 B.C.). Aristotle was awarded by the title as 'Father of Biology'. French biologist, Jean - Baptiste Pierre Antoine de Monet de Lamarck (1744 – 1829) & Gottfried Peinhold Trevirances coined the term biology.

Biology is then further divided into two parts :-

- (1) Botany (2) Zoology

Botany :

The science or study of plants is called Botany.

The term 'Botany' come from the Ancient Greek word botane which means pasture or fadder. Although, technically botany is called Phytology (Phyto means plants) & logy (study).

Theophrastus (320 – 287 B.C.) is known as Father of Botany.

Zoology :

The science or study of animals is called Zoology. The term 'Zoology' came from the ancient Greek word zoion which means animal and logy means study. The father of zoology is Aristotle.

Microbiology :

It is the branch of biology which deals with different aspects of micro-organism. Leuwenhoek is called Father of Microbiology.

TAXONOMY

All living organisms are arranged into various groups based on their features according to the principle of identification, nomenclature and classification. This branch of study is called as Taxonomy.

Taxis = arrangement, nomos = law → Taxonomy is the study of principles and procedures of classification.

This word was proposed by **A.P. de. Candolle** in his book "**Theories elementaire de la botanique**" (Theory of elementary botany)

Taxonomy includes study of following 4 points

- (1) **Identification** - Identification of living organisms
- (2) **Nomenclature** - Nomenclature of living organisms
- (3) **Classification** - Classification of living organisms in groups
- (4) **Affinities** - Study of inter relationship between living organisms

KINGDOM PROTISTA

Protista are unicellular eukaryotes. They do not form tissues. Characteristics of Protista:

1. They are mostly aquatic organisms.
2. Their cell structure is eukaryotic type that have membrane bound organelle. They have 80 s cytoplasmic ribosomes and they may possess cellulosic cell wall.
3. Their movement is by flagella or cilia or pseudopodia where ciliary mode is fastest.
4. Reproduction in protista occurs by both sexual and asexual means.
5. They bear two types of life cycle:
 - a. Showing zygotic meiosis
 - b. Showing gametic meiosis
6. They are parasitic decomposers and also photosynthetic.

Living organisms included in Protista are as follow Dinoflagellates, Diatoms, Euglenoids , Slime molds, Protozoans

All the organism included in Protista are unicellular (acellular) eukaryotes.

NUTRITION:

Mode of nutrition in protist is of different types

(1) Holophytic or Photosynthetic :-

They synthesize their own food through photosynthesis.

(2) Holozoic :-

Some protist have holozoic mode of nutrition, which is similar to animals i.e. food is first ingested and then digested.

(3) Absorptive :-

Some protists obtain their food from dead organic substances. These protists secrete some extracellular enzymes. These enzymes convert the complex organic substances into simpler substances. Now these simple substance can be easily absorbed through the body surface.

(4) Mixotrophic :-

Some Protists have both holophytic and saprophytic type of nutrition.

REPRODUCTION:

Protists reproduce Asexually and Sexually

1. Asexual Reproduction :-

This is the most common method of reproduction in protists. Asexual reproduction takes place in favourable condition.

It is of following types

- (a) **Binary fission :-** Two daughter cells are formed by the division of one mother cell. After this each daughter cell grows to form a normal organism.
- (b) **Spore formation :-** Some protists have special structure known as sporangia. Spores are formed in this sporangia. The sporangia bursts after sometime and all the spores become free. These spores form a new cell after germination.

2. Sexual Reproduction :

Sexual reproduction was first of all seen in protists. In sexual reproduction two haploid gametes fuse to form a diploid zygote. This process is known as **syngamy**.

Syngamy is of three types

- (a) **Isogamy :-** It is the easiest way of sexual reproduction. In isogamy the fusing gametes are morphologically (i.e. shape, size, structure) similar but physiologically (i.e. functionally or genetically) they may be similar or dissimilar. when fusing gametes are physiologically dissimilar, process is called **physiological anisogamy**.

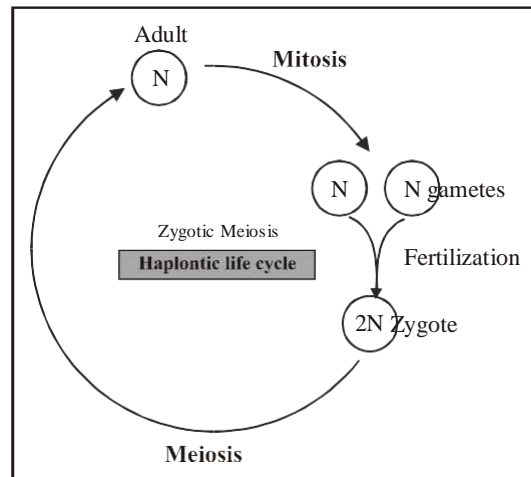
- (b) **Anisogamy** :- The fusing gametes are morphologically dissimilar (smaller - larger, motile - immotile) but physiologically they may be similar or dissimilar.
- (c) **Oogamy** :- It is the developed form of anisogamy. Male gamete is small and motile while female gamete is large and non motile. This female gamete is known as egg. In it the formation of male & female gametes take place in **sex organs**.

LIFECYCLE OF PROTISTA**(1) Life cycle showing zygotic meiosis :-**

When Protist is haploid and meiosis occurs in zygote then it is known as **zygotic meiosis**.

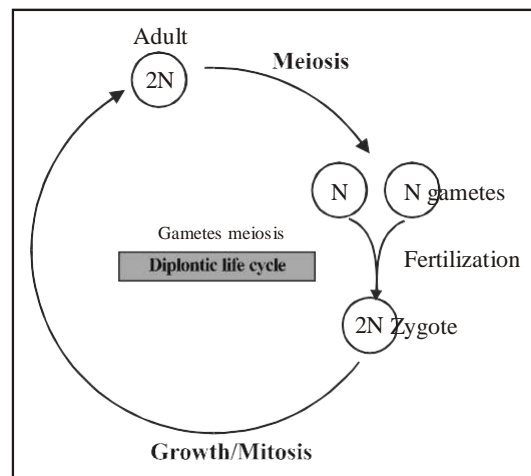
In this type of life cycle during sexual reproduction gametes are formed by mitosis. These gametes are haploid. These gametes fuse to form a diploid zygote. After that meiosis takes place in zygote, as a result haploid cells are formed again.

Note : In this type of life cycle the zygotic phase is only diploid and remaining all the phases are haploid so this type of life cycle is known as **haplontic life cycle**.

**(2) Life cycle showing gametic meiosis :-**

When Protist is diploid and meiosis takes place during gamete formation, then it is called **gametic meiosis**.

In this type of life cycle during sexual reproduction, meiosis takes place in diploid cell, due to which haploid gametes are formed. Now haploid gametes fuse to form diploid zygote. And after that mitosis takes place in zygote, due to which diploid cells are formed again.



BIOLOGY FOR NEET & AIIMS

- Ernst Mayer has been called as “The Darwin of 20th century” He worked on Taxonomy, Zoogeography, Evolution, Systematics and History & Philosophy of biology. He gave the biological concept of species.
- The number of species that are known and described ranges between 1.7 - 1.8 million
- ICBN - International Code of Botanical Nomenclature
- ICZN - International Code of Zoological Nomenclature
- Each biological name is made up of two components, generic name and specific epithet. This system is called as binomial system.
- Biological names are generally in Latin and written in italics. They are latinised or derived from Latin irrespective to their origin.
- Both the words in a biological name, when handwritten, are separately underlined, or printed in italics to indicate their Latin origin.
- Classification is the process by which any thing is grouped into convenient categories based on some easily observable characters.
- The group included in taxonomic categories is called as taxon.
- Characterisation, identification, nomenclature and classification are the processes that are basic to taxonomy.
- Category is a part of overall taxonomic arrangement and all categories together constitute the taxonomic hierarchy.
- As we go higher from species to kingdom the number of common characteristics goes on decreasing.
- Herbarium is a store house of collected plant specimens that are dried, pressed and preserved on sheets.
- Keys : The keys are based on the contrasting characters generally in a pair called couplet. Each statement in the key is called a lead.
- Keys are generally analytical in nature.
- Flora : It contains the actual account of habitat and distribution of plants of a given area. These provide the index to the plant species found in a particular area.
- Monograph : It contains complete informations on any one taxon.
- Aristotle was the earliest to attempt a more scientific basis for classification.
- Aristotle divided animals into two groups (1) Having red blood cells and (2) Do not having red blood cells.
- R.H. Whittaker's Classification is phylogenetic classification.
- Archaeobacteria differ from other bacteria in having a different cell wall structure and this feature is responsible for their survival in extreme conditions.
- Some cyanobacteria can fix atmospheric N_2 in their specialised cells called heterocysts. eg. Nostoc & Anabaena.
- In diatoms the cell walls form two thin overlapping shells, which fit together as in a soap box.
- The cell wall of diatoms (chrysophytes) are embedded with silica and thus the walls are indestructible.
- Red dinoflagellates undergo very rapid multiplication so they make the sea appear red, called as red tides.
- The cell wall of fungi is composed of chitin and polysaccharides.
- Some fungi can live as symbionts in association with algae (lichen) and with roots of higher plants as mycorrhiza.
- In fungi the sexual cycle involves.
(1) Plasmogamy (2) Karyogamy (3) Meiosis.
- Phycomycetes are found in aquatic habitats, on decaying wood on moist or damp places or as obligate parasites on plants.
- In ascomycetes and basidiomycetes dikaryotic ($n + n$, two nuclei per cell) condition is also found called as dikaryophase.
- Many members of ascomycetes like morels and bufftes are edible fungi.
- Members of basidiomycetes are mushrooms, bracket fungi and puffballs. They produce basidiospores exogenously on their basidium (pl. basidia). Some times basidia are arranged in fruiting bodies called basidiocarp.
- Deuteromycetes : they are commonly known as imperfect fungi because they reproduce only by asexual or vegetative reproduction, not by sexual reproduction. They produce septate and branched mycelium. Some members are saprophytes or parasites while- a large number of them are decomposers of litter and help in mineral cycling.

SOLVED EXAMPLE

THE LIVING WORLD

Ex.1 As we go from species to kingdom in a taxonomic hierarchy, the number of common characteristics
 (A) Will decrease
 (B) Will increase
 (C) Remain same
 (D) May increase or decrease

Sol. (A) Will decrease

Ex.2 Which of the following 'suffixes' used for units of classification in plants indicates a taxonomic category of 'family'.

- (A) – Ales (B) – Onae
 (C) – Aceae (D) – Ae

Sol. (C) Aceae

Ex.3 The term 'systematics' refers to:

- (A) Identification and classification of plants and animals
 (B) Nomenclature and identification of plants and animals
 (C) Diversity of kinds of organisms and their relationship
 (D) Different kinds of organisms and their classification

Sol. (C) Diversity of kinds of organisms and their relationship

Ex.4 Genus represents

- (A) An individual plant or animal
 (B) A collection of plants or animals
 (C) Group of closely related species of plants or animals
 (D) None of these

Sol. (C) Group of closely related species of plants or animals

Ex.5 Botanical gardens and zoological parks have

- (A) Collection of endemic living species only
 (B) Collection of exotic living species only
 (C) Collection of endemic and exotic living species
 (D) Collection of only local plants and animals

Sol. (C) Collection of endemic and exotic living species

Ex.6 Taxonomic key is one of the taxonomic tools in the identification and classification of plants and animals. It is used in the preparation of

- (A) Monographs (B) Flora
 (C) Both a & b (D) None of these

Sol. (C) Both a & b

Ex.7 Which of the following is a defining characteristic of living organisms?

- (A) Growth
 (B) Ability to make sound
 (C) Reproduction
 (D) Response to external stimuli

Sol. (D) Response to external stimuli

Ex.8 The term "biology" was introduced by

- (A) Aristotle
 (B) Darwin
 (C) Lamarck and Treviranus
 (D) Linnaeus

Sol. (C)

Ex.9 'Father of Biology' is

- (A) Curvier (B) Aristotle
 (C) Lamarck (D) Theophrastus

Sol. (B)

Ex.10 Who is called 'Father of Zoology'?

- (A) Aristotle (B) Darwin
 (C) Hippocrates (D) Theophrastus

Sol. (A)

Ex.11. 'Father of Botany' is

- (A) Brunfels (B) Aristotle
 (C) Theophrastus (D) Linnaeus

Sol. (C)

Ex.12 Crick, one of the discoverer of DNA double helical structure, was the man of

- (A) Physics (B) Chemistry
 (C) Zoology (D) Botany

Sol. (A)

Ex.13 Which one of the following aspects is an exclusive characteristic of living things.

- (A) Perception of events happening in the environment and their memory
 (B) Increase in mass by accumulation of material both on surface as well as internally
 (C) Isolated metabolic reactions occurs in vitro
 (D) Increase in mass from inside only

Sol. (A)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Most acceptable concept of species is :-
(A) Static concept (B) Biological concept
(C) Typological concept (D) Genetic concept
2. Artificial system of classification classifies plants on the basis of :-
(A) One or two characters
(B) Phylogenetic trends
(C) Many naturally existing characters
(D) None of the above
3. The term new systematics was introduced by :-
(A) Linnaeus (B) Bentham
(C) Hutchinson (D) Huxley
4. Group of organisms that closely resemble each other and freely interbreed in nature, constitute a :-
(A) Species (B) Genus
(C) Family (D) Taxon
5. ICBN was first revised in :-
(A) 1961 (B) 1964
(C) 1975 (D) 1753
6. The term taxon refers to :-
(A) Name of a species
(B) Name of genus
(C) Name of family
(D) A taxonomic group of any rank
7. The herbarium specimen on whose basis a new species is described for the first time is called as :-
(A) Syntype (B) Holotype
(C) Paratype (D) Neotype
8. The scientific naming of plants began with publication of Linnaeus book :-
(A) Genera plantarum (B) Systema naturae
(C) Species plantarum (D) Charaka samhita
9. Which book most impressed the opinion of taxonomists :-
(A) Enquiry into plants (B) Origin of life
(C) Genera plantarum (D) Origin of species
10. The basic smallest unit of classifications is :-
(A) Genus (B) Species
(C) Order (D) All of the above
11. Suffix for subspecies is :-
(A) Phytina (B) Oideae
(C) Ineae (D) None
12. Individuals of same species having non-genetic differences due to environment are called :-
(A) Biotypes (B) Ecotype
(C) Ecophenes (D) None
13. Morphologically similar but reproductively isolated species are called :-
(A) Neontological species (B) Siblingspecies
(C) Allopatric species (D) Morpho-species
14. Plant nomenclature means :-
(A) To give names to plants without any rules
(B) Nomenclature of plants under the international rules
(C) Nomenclature of plants in local language
(D) Nomenclature of plants in english language
15. Taxonomy refers to :-
(A) Plant classification (B) Plant nomenclature
(C) Plant affinity (D) All the above
16. Which of the following is a correct name :-
(A) Solanum tuberosum
(B) Solanum Tuberosum
(C) Solanum tuberosum Linn.
(D) All the above
17. Systematics deals with :-
(A) Classification (B) Nomenclature
(C) Plant description (D) Identification

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. Static concept of species is given by :-
(A) Linnaeus (B) Bentham
(C) Koch (D) Mayr
2. In taxonomy the first step is :-
(A) Identification (B) Nomenclature
(C) Classification (D) Affinities
3. The suffix – inae signifies the rank :-
(A) Tribe (B) Subtribe
(C) Suborder (D) Subfamily
4. Species living in different geographical areas are called
(A) Allochronic (B) Allopatric
(C) Sympatric (D) Siblings
5. A large number of unknown species of plants and animals are believed to be present in :-
(A) Temperate forests (B) Antarctica
(C) Taiga (D) Tropical forest
6. Biological concept of species proposed by :-
(A) Linnaeus (B) Mayr
(C) John Ray (D) DeCandolle
7. For higher plants, flowers are chiefly used as a basis of classification, because :-
(A) These show a great variety in colour
(B) It can be preserved easily
(C) Reproductive parts are more conservative than vegetative parts
(D) None of these
8. Individuals of same species having genetic variation and occur in same environment are called:-
(A) Biotypes (B) Ecotype
(C) Ecophenes (D) Ecads
9. The binomial system of nomenclature was initially proposed by :-
(A) Magnus (B) Bauhin
(C) Caesalpinno (D) Discorides
10. Biochemical resemblances are used in the identification of:-
(A) Protistan species (B) Moneran species
(C) Fungal species (D) Higher plants
11. Concept of phylogeny was proposed by :-
(A) John Ray (B) Lamarck
(C) Ernest Haeckel (D) Darwin
12. A division is formed by combining several :-
(A) Orders (B) Families
(C) Classes (D) Tribes
13. An international code of botanical nomenclature was first proposed in the year :-
(A) 1930 (B) 1830
(C) 1913 (D) 1813
14. For declaration of new species of higher plants what characters are used :-
(A) Floral character of new species
(B) Anatomical characters of new species
(C) Physiological character of new species
(D) Character of endosperm
15. The standard size of herbarium sheets is :-
(A) 11.5" × 16.5" (B) 15.5" × 16.5"
(C) 18.5" × 10.5" (D) 20.5" × 21.5"
16. Which statement is true :-
(A) Tautonyms are not allowed in plants
(B) Tautonyms are not allowed in animals
(C) Tautonyms normally allowed in animals and some time allowed in plants
(D) Tautonyms allowed only in bacteria
17. Trinomial nomenclature of classification was proposed by :-
(A) Linnaeus
(B) Huxley and Stricklandt
(C) John-Ray
(D) Theophrastus

Exercise # 3**PART - 1****MATRIX MATCH COLUMN**

1. Match Column - I with column - II and select the correct option from codes given below :

Column - I	Column - II
A. Planaria	i. Binary fission
B. Fungi	ii. Asexual spores
C. Yeast	iii. Budding
D. Amoeba	iv. True regeneration
	v. Fragmentation

(A) A-i, B-ii, C-iii, D-iv
(B) A-iv, B-ii, v, C-iii, D-i
(C) A-ii, B-v, C-i, D-iv
(D) A-v, B-ii, i, C-iii, D-iv

2. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I	Column - II
A. Binomial nomenclature	i. Hippocrates
B. The Darwin of the 20 th century	ii. Earnst Mayr
C. Father of Botany	iii. Linnaeus
D. Father of medicine	iv. Theophrastus

(A) A-iii, B-ii, C-iv, D-i
(B) A-iii, B-ii, C-i, D-iv
(C) A-i, B-ii, C-iii, D-iv
(D) A-ii, B-iii, C-iv, D-i

3. Match column - I with column - II and select the correct option from codes given below.

Column - I	Column - II
A. John Ray	i. Gave the concept of new systematics
B. C. Linnaeus	ii. First described species as a unit of classification
C. Aristotle	iii. Father of Zoology
D. Julian	iv. Introduced binomial nomenclature

(A) A- i, B- ii, C- iii, D- iv
(B) A- iv, B- iii, C- ii, D- i
(C) A- ii, B- iii, C- i, D- iv
(D) A- ii, B- iv, C- iii, D- i

4. Match Column - I with Column - II and select the correct option from codes given below.

Column - I	Column - II
A. Royal botanical garden,	i. Lucknow
B. Indian botanical garden,	ii. England
C. National Botanical Research Institute	iii. Howrah
D. Llyord Botanical garden	iv. Darjeeling

(A) A- ii, B- iii, C- i, D- iv
(B) A- i, B- iii, C- ii, D- iv
(C) A- iv, B- ii, C- i, D- iii
(D) A- iv, B- iii, C- ii, D- i

5. Match Column - I with Column - II and select the correct option from codes given below.

Column - I	Column - II
A. Botanical garden	i. Preserved plant specimens
B. Zoogical park	ii. Preserved plant and animal specimens
C. Museum	iii. Living plants
D. Herbarium	iv. Living wild animals

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. The most important feature of all living systems is to [CBSE AIPMT-2000]
 - (A) utilise oxygen to generate energy
 - (B) replicate the genetic information
 - (C) Produce gametes
 - (D) Utilise solar energy for metabolic activities
2. Relative Biological Effectiveness (RBE) is usually referred to damages caused by. [CBSE AIPMT-2000]
 - (A) Low temperature
 - (B) high temperature
 - (C) encephalitis
 - (D) radiation
3. First life on earth was. [CBSE AIPMT-2001]
 - (A) cyanobacteria
 - (B) chemoheterotrophs
 - (C) autotrophs
 - (D) photoautotrophs
4. Reason of diversity in living being is . [CBSE AIPMT-2001]
 - (A) mutation
 - (B) gradual change
 - (C) long term evolutionary
 - (D) short term evolutionary change
5. There is no life on moon due to the absence of. [CBSE AIPMT-2002]
 - (A) O₂
 - (B) water
 - (C) light
 - (D) temperature
6. More than 70% of world's fresh water is. [CBSE AIPMT-2002]
 - (A) antarctica
 - (B) greenland
 - (C) glaciers and mountains
 - (D) polar ice
7. Carbohydrates the most abundant biomolecules on earth, are produced by. [CBSE AIPMT-2005]
 - (A) All bacteria, fungi and algae
 - (B) fungi, algae and green plant cells
 - (C) some bacteria, algae and green plant cells
 - (D) viruses, fungi and bacteria
8. Which one of the following is an example of negative feedback loop in humans ? [CBSE AIPMT-2007]
 - (A) Constriction of skin blood vessels and contraction of skeletal muscles when it is too cold
 - (B) Secretion of tears after falling of sand particles into the eye
 - (C) Salivation of mouth at the sight of delicious food
 - (D) Secretion of sweat glands and constriction of skin blood vessels when it is too hot
9. The living organisms can be un-exceptionally distinguished from the non - living things on the basis of their ability. for. [CBSE AIPMT-2007]
 - (A) responsiveness to touch
 - (B) interaction with the environment and progressive evolution
 - (C) reproduction
 - (D) growth and movement
10. Biological organisation starts with. [CBSE AIPMT-2007]
 - (A) Sub-microscopic molecular level
 - (B) cellular level
 - (C) organismic level
 - (D) atomic level
11. Study the four statements (I-VI) given below and select the two correct ones out of them : [CBSE AIPMT-2016]
 - (I) Definition of biological species was given by Ernst Mayr.
 - (II) Photoperiod does not affect reproduction in plants
 - (III) Binomial nomenclature system was given by R.H Whittaker
 - (IV) In unicellular organisms, reproduction is synonymous with growth.
 - (A) II and III
 - (B) III and IV
 - (C) I and IV
 - (D) I and II
12. The label of a herbarium sheet does not carry information on [CBSE AIPMT-2016]
 - (A) date of collection
 - (B) name of collector
 - (C) local names
 - (D) height of the plant
13. Nomenclature is governed by certain universal rules. Which one of the following is contrary rules. Which one of the following ? [CBSE AIPMT-2016]
 - (A) The first word in a biological name represents the genus name and the second is a specific epithet
 - (B) The names are written in Latin and are Italicised
 - (C) When written by hand, the names are to be underlined
 - (D) Biological names can be written in any language

1. Nomenclature is governed by certain universal rules. Which one of the following is contrary to the rules of nomenclature?
(A) The names are written in Latin and are italicised.
(B) When written by hand the names are to be underlined.
(C) Biological names can be written in any language
(D) The first word in a biological name represents the genus name and the second is a specific epithet.
2. Which of the following is the correct scientific name of wheat derived by binomial nomenclature?
(A) *Triticum Vulgare* (B) *Triticum aestivum*
(C) *Oryza sativa* (D) *Zea mays*
3. **Assertion :** Consciousness is considered as the defining property of living organisms.
Reason : All organisms, from the prokaryotes to the most complex eukaryotes can sense and respond to environmental stimuli.
(A) If both assertion and reason are true and reason is the correct explanation of assertion.
(B) If both assertion and reason are true but reason is not the correct explanation of assertion.
(C) If assertion is true but reason is false.
(D) If both assertion and reason are false.
4. ICBN stands for
(A) Indian Council of British Nature (B) International Code for Biological Nomenclature
(C) International Code for Botanical Nomenclature (D) Indian Code for Biological Nomenclature.
5. Binomial nomenclature means
(A) one name given by two taxonomists
(B) two names, the latinized, one of a person
(C) two names, one scientific, other local
(D) two-word names, the first indicates genus, and other species.
6. Scientific names of plants are based on principles and criteria agreed by and are given in
(A) IUCN (B) ICZN
(C) ICBN (D) ICPN
7. Point out the correct method of showing scientific name of coconut palm derived by binomial nomenclature.
(A) *Cocos nucifera* (B) *Cocos Nucifera*
(C) *cocos Nucifera* (D) *Cocos nucifera*
8. Read the statements given below and identify the incorrect statement.
(A) Scientific names are used all over the world.
(B) Scientific names are often descriptive and tell us some important character of an organism.
(C) Scientific names indicate relationship between species.
(D) Scientific names favour multiple naming for the same kind of an organism.

ANIMAL KINGDOM

“In natural science the principles of truth ought to be confirmed by observation”.

“ CARL LINNAEUS (1707-1778)”

INTRODUCTION

When we look around we see wide range of different animals with different structure, body and forms. You see parrots, cockroaches, cats, elephants, dogs, cow, buffalo, crow, pigeon, hen, monkey, sparrow, butterflies, mosquito, frogs, human beings, etc. We see them some creep, jump, walk or some swim. All these organisms we are observing in our day to day life, can you imagine these all livings come under Kingdom Animalia.

As over a million species have been described till now, the need for classification becomes more important. But before classifying them, let's study the basic features of all the animals that distinguish them from other living organisms.

ANIMAL KINGDOM

ANIMAL- CLASSIFICATION (PORIFERATO ECHINODERMATA)

BRIEF HISTORY OF ANIMAL TAXONOMY

TAXONOMY

Taxonomy is the branch which deals with the study of nomenclature, classification and their principles. Three steps:

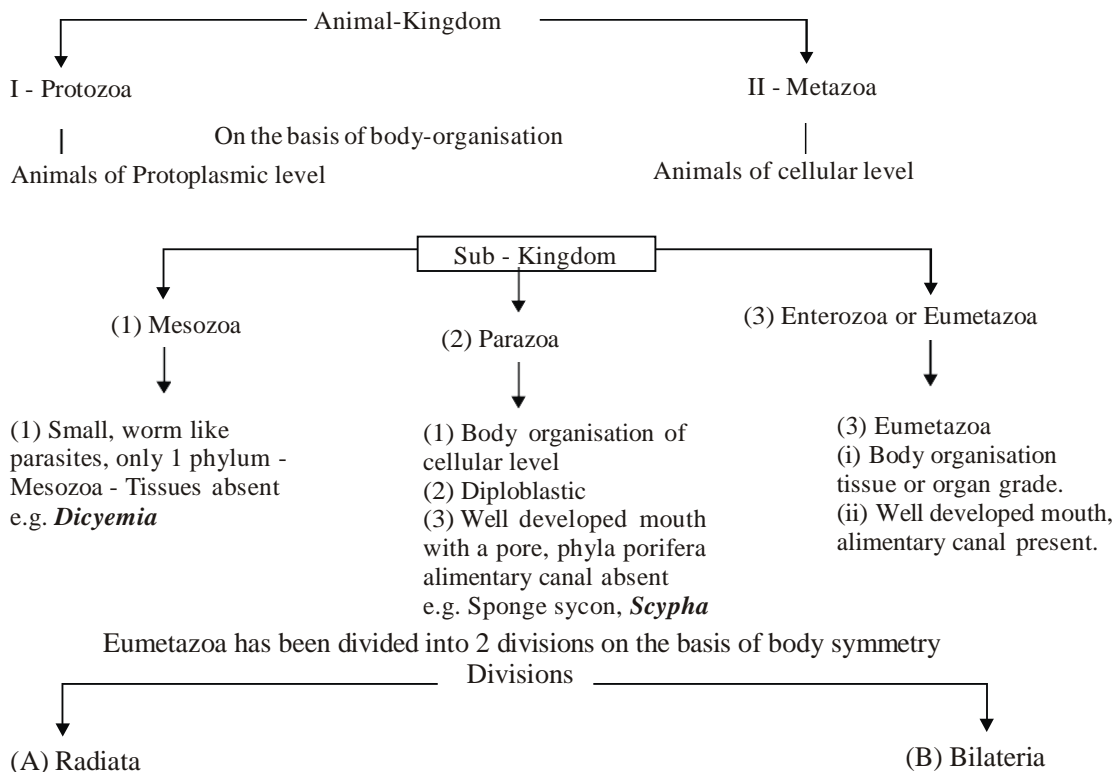
- (1) Identification (2) Nomenclature (3) Classification

Taxonomy word was given by “Candole. It is a Greek word.

Taxis - arrangements (systematics)

Nomos - Law / Rules

Outline of Animal-classification



(A) Division Radiata-

- (i) Diploblastic / Triploblastic
- (ii) Radial symmetry is found, body is bilayered and tissue-grade.
- (iii) Mouth and digestive cavity present - Coelentron / Gastrovascular cavity
- (iv) Anus absent i.e. alimentary canal incomplete.

Radiata includes two phyla -

- (i) Cnidaria or Coelenterata (eg. **Hydra**) - Diploblastic, radial
- (ii) Ctenophora (e.g. **Beroe**) - Triploblastic, biradial (According to modern view.)

[B] CLASS- HEXACTINELLIDA OR HYALOSPONGIAE

1. All members are marine.
2. These are of moderate shape and upto 1 m in length.
3. Body is vase or bell or cup-shaped.
4. Endoskeleton is made of silica-spicules, spicules are 6-rayed. These are colourless, shining and also transparent so called "Glass-sponges".
5. Choanocytes are in finger shaped chamber.
6. Canal system is complex leucon type.

Examples

- (i) **Euplectella** - "Venus's flower basket". In Japan given as a Bridal-gift. Male and Female shrimps live in it till death.
- (ii) **Hyalonema** - Glass-rope sponge
- (iii) **Pheronema** - Bowl-sponge
- (iv) **Monorhaphis**

(C) CLASS - DEMOSPONGIAE –

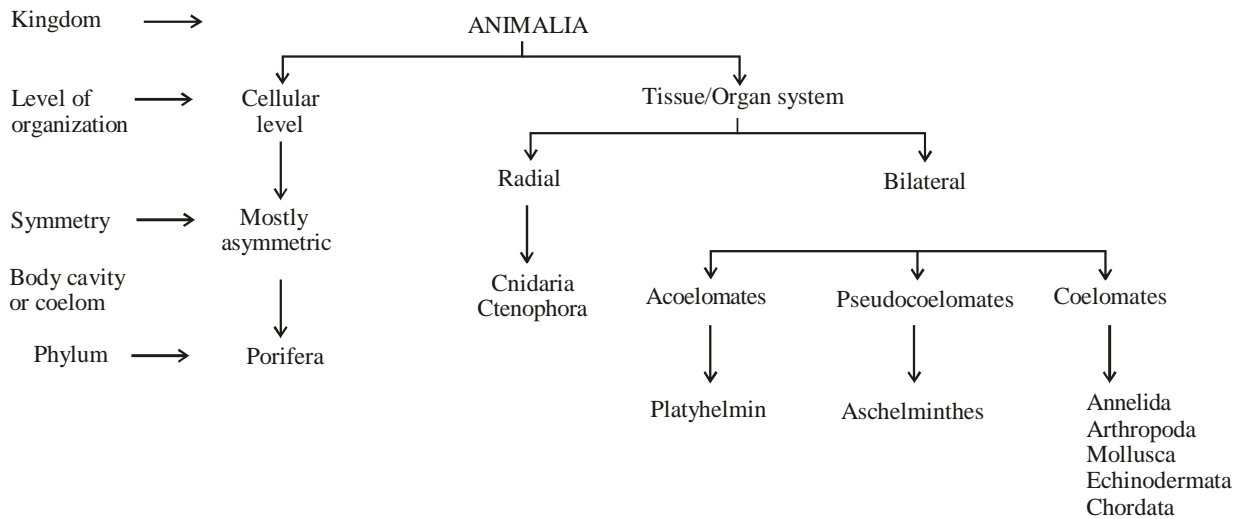
1. Majority are marine but some species are found in fresh water. Mostly large and asymmetrical sponges which may be solitary or colonial.
2. In some skeleton is absent, in some of siliceous spicules, in some made up of Sulphur-containing Spongin protein fibres skeleton, and in some skeleton is made of both spongin fibres and siliceous spicules.
3. Spicules if present are mono or tetra axon.
4. Canal-system Leucon or Rhagon type.
5. They have the capacity of contraction due to special Fibrocytes.

Example

1. **Euspongia** – Bath sponge
2. **Spongilla** - Fresh water sponge. It has zoochlorella living in it as a symbiont.
3. **Ephydatia** - Fresh water sponge.
4. **Cliona** - Boring - sponge.
5. **Chalina** - Mermaid's gloves
6. **Hippospongia** - Horse sponge or Horny sponge
7. **Phyllospongia** - Leaf sponge
8. **Patreon** - Cup shaped sponge.
9. **Oscarella** - Skeleton is absent.
10. **Halichondria** - Bread sponge.
11. **Chondrosia** - Skeleton is absent.
12. **Haliclona** - Fingersponge.
13. **Spongia officinalis** - Turkish bath sponge - Great economic value.

**ETD OS KEY POINTS**

1. Chromocytes are pigmented amoebocytes which provide colour to the animal.
2. Gemmules are formed as endogenous buds.
3. Choanocytes of sponges were discovered by **H.J. Clark**.
4. Sponges have a high power of regeneration due to archaeocyte cells.
5. Several sponges pass, during their embryonic development, through a structure, called **olyntus**. It is called hypothetical ancestor of sponges.
6. Monoaxon spicules are found around the osculum.



1. INTRODUCTION

- Animals show different types of body organisation
 - (i) Protoplasmic level Eg. - Protozoa
 - (ii) Cellular level Eg. - Porifera
 - (iii) Tissue level Eg. - Coelenterata & Ctenophora
 - (iv) Organ/organ system level Eg. - Platyhelminthes onwards to Chordata.
- Animals can be Asymmetric, Radial and Bilateral symmetric.
- Most of the animals are triploblastic.
- Flatworms are Acoelomate, Round worms are pseudocoelomate where as rest of the animals are coelomates. Digestive tract is incomplete in coelenterata, ctenophora and platyhelminthes where as it is complete in rest of the phyla.
- Modes of respiration can be Body surface, cutaneous branchial and pulmonary.
- Circulatory system is open in Arthropoda, Mollusca, Echinodermata, Hemichordata and in Urochordata where as it is closed in annelida and rest of the chordates
- Modes of Excretory system includes Flame cells, Nephridia. Malpighian tubules, Green glands and Kidneys in animals.

2. PORIFERA

- Mostly marine, cellular level body organisation with water transport system / Canal system having ostia, osculum and choanocytes (Collar cell) etc.
- Sponges are hermaphrodite and their Fertilization is internal.
 - Eg. - Sponges, Like - Sycon (Scypha), Spongilla (Fresh water sponge), Euspongia (Bath sponge)

3. COELENTERATA

- Mostly marine, radially symmetrical with stinging cell known as Cnidoblast. Mainly two forms i.e. polyp & medusa which exhibit alternation of generation (Metagenesis)
 - Eg. - Hydra Aurelia (Jelly Fish), Adamsia (Sea anemone), Pennatula (Sea pen), Gorgonia (Sea Fan), Meandrina (Brain coral), Physalia (Portuguese man-of-war).

4. CTENOPHORA

- Exclusively marine popularly known as sea walnuts or comb jellies due to presence of 8-cillary comb plates which help in locomotion. They show Bioluminescence.
 - Eg. → Ctenoplana, Pleurobrachia

SOLVED EXAMPLE

- Ex.1** The body of the animal can be divided into identical halves in only one plane is
(A) Asymmetry (B) Bilateral symmetry
(C) Radial symmetry (D) Biradial symmetry
Sol. (B)
- Ex.2** The space between body wall and alimentary canal lined by mesoderm is called
(A) Acoelom (B) Pseudocoelom
(C) Coelom (D) None of these
Sol. (C)
- Ex.3** What is characteristic of deuterostomes
(A) Spiral cleavage, blastopore becoming mouth
(B) Radial cleavage, blastopore becoming anus
(C) Spiral cleavage, blastopore becoming anus
(D) Radial cleavage, blastopore becoming mouth
Sol. (B)
- Ex.4** Coelom is cavity between alimentary canal and body wall enclosed by
(A) Ectoderm and endoderm
(B) Mesoderm and ectoderm
(C) Ectoderm on both sides
(D) Mesoderm on both sides
Sol. (D)
- Ex.5** Metameric segmentation is the characteristic of
(A) Annelida and Arthropoda
(B) Mollusca and chordata
(C) Platyhelminthes and Arthropoda
(D) Echinodermata and Annelida
Sol. (A)
- Ex.6** Radial symmetry is often exhibited by animal is
(A) One opening of alimentary canal
(B) Aquatic mode of living
(C) Benthos/sedentary nature
(D) Ciliary mode of feeding
Sol. (C)
- Ex.7** True coelom or body cavity occurs in
(A) Hydra (B) Taenia
(C) Pheretima (D) Sycon
Sol. (C)
- Ex.8** Which one of the following categories of animals, is correctly described with no single exception in it
(A) All reptiles possess scales, have a three chambered heart and are cold blooded (poikilothermal)
(B) All bony fishes have four pairs of gills and an operculum on each side
(C) All sponges are marine and have collared cells
(D) All mammals are viviparous and possess diaphragm for breathing
Sol. (C)
- Ex.9** In porifera, skeletonforming cells are
(A) Sclerocytes (B) Archaeocytes
(C) Thesocytes (D) Amoebocytes
Sol. (A)
- Ex.10** Common bath sponge is
(A) Spongilla (B) Euspongia
(C) Leucosolenia (D) Sycon
Sol. (B)
- Ex.11** One of the following is not a characteristic feature of sponges
(A) Cellular level of organization
(B) Presence of ostia
(C) Intracellular digestion
(D) Body supported by chitin
(E) Indirect development
Sol. (D)
- Ex.12** Metagenesis refers to
(A) Alternation of generation between asexual and sexual phases of an organisms
(B) Occurrence of a drastic change in form during post embryonic development
(C) Presence of a segmented body and parthenogenetic mode of reproduction
(D) Presence of different morphic forms

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. The animals of phylum porifera are—
(A) Acellular
(B) Diploblastic
(C) Multicellular with cellular grade of organisation
(D) None
2. Porous animals which lack division of labour & which are fixed belong to—
(A) Radiata (B) Bilateria
(C) Parazoa (D) Eumetazoa
3. Which of the following structure is similar to anus in porifera—
(A) Ostia (B) Osculum
(C) Prostonia (D) Cytopye
4. One of the following is smallest sponge—
(A) Spheciosongia (B) Leucosolenia
(C) Sycon (D) Scypha
5. Scientist who for the first time reported sponges as animal-
(A) Leeuwenhock (B) Robert Brown
(C) Robert Grant (D) Trumbley
6. Water canal system & water vascular system are found respectively in—
(A) Sycon & Hydra
(B) Star fish & Sycon
(C) Echinoderms
(D) Porifera & Echinoderms
7. Which character differentiates sponges from other metazoa animals—
(A) Absence of blood
(B) Absence of nerve cell
(C) Absence of many ostia & one osculum
(D) All
8. Sponges exhibits—
(A) Only intracellular digestion
(B) Only intercellular digestion
(C) Only extra cellular digestion
(D) A & B
9. The role of porocyte cells is—
(A) Excretion in flat worms
(B) To form excurrent opening for water current in sponge
(C) To secrete sweat in mammals
(D) To form incurrent opening for water current in sponge
10. What is lagoon-
(A) A type of sponge
(B) A type of coral
(C) Central water pool in coral reef
(D) A type of coral reef.
11. Choanocytes are -
(A) Collar cells (B) Thesocytes
(C) Porocytes (D) Pinacocytes
12. Phylum-porifera includes various sponges which has various types of cells to perform different functions. The cells responsible for reproduction are—
(A) Choanocytes (B) Archeocytes
(C) Amoebocytes (D) Porocytes
13. Role of gemmules is—
(A) Sexual reproduction
(B) Asexual reproduction
(C) Dispersal
(D) None
14. Collar cells are found in—
(A) Star fish (B) Sponge
(C) Earthworm (D) Hydra
15. The character on which the classification of sponges is based—
(A) Nutrition (2) Spicules
(C) Locomotion (D) None
16. What will happen if a sponge is mashed by hand & put in a suitable culture medium. ,
(A) The cells will aggregate & form small sponge bodies
(B) The cells will die
(C) The cells will grow enormously.
(D) The cells will lead independent life
17. Mesogloea is found in-
(A) Rabbit (B) Sponge & hydra
(C) Hydra (D) Sponge
18. Phylum-porifera is divided into following classes-
(A) Calcarea, Hexactinillida & Demospongiae
(B) Sarcodina, Sporozoa & Ciliata
(C) Calcarea, Hexactinillida & Sarcodina
(D) Mastigophora & Demospongiae
19. Which of the following lack locomotion -
(A) Amoeba (B) Earthworm
(C) Maggot of house fly (D) Leucosolenia

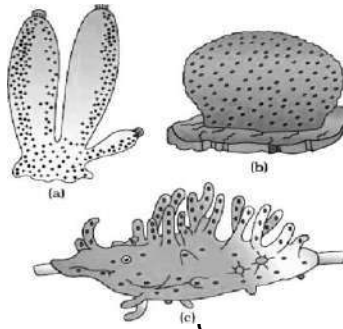
Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. The infective stage of *Taenia solium* for secondary host-
(A) Onchosphere (B) Hexacanth
(C) Cysticercus (D) Bladder worm
2. The cause of filariasis is -
(A) Mosquito (B) Bacteria
(C) Helminthes (D) Protozoan
3. Life cycle of which lack secondary host-
(A) Plasmodium (B) Fasciola
(C) Ascaris (D) Taenia
4. The cause of "Naru disease" is-
(A) *Taenia solium* (B) Fasciola
(C) Dracunculus (D) Ascaris
5. Infection of tape worm causes-
(A) Irritation in the alimentary canal (B) Loss of appetite
(C) Spots on the skin (D) Itching
6. Leech is -
(A) Insectivorous (B) Larvaevorous
(C) Frugivorous (D) Sanguivorous
7. Which of the following is living fossil-
(A) Peripatus (B) Limulus
(C) Neopilina (D) All
8. Annelid which has Hb & haemocoel-
(A) Earthworm (B) Leech
(C) Nereis (D) All
9. Peripatus is a connecting link between-
(A) Arthropoda & Mollusca
(B) Annelida & Arthropoda
(C) Annelida & Mollusca
(D) Coelenterata & Platyhelminthes
10. Which is found in all annelids-
(A) Haemocoelom (B) Pseudocoelom
(C) True worm (D) Paragastric cavity
11. One of the following is a correct pair -
(A) Star fish - Segmented foot
(B) Scolopendra - Pseudopodia
(C) Amoeba - Tube feet
(D) Nereis - Parapodia
12. Which of the following is bioluminescent-
(A) Aphrodite (B) Polynoe
(C) Chaetopterus (D) All
13. Metamorphosis is absent in -
(A) Polychaets (B) Oligochaets
(C) Cnidarians (D) All
14. Animal which has unstalked compound eyes & abdomen is without appendages-
(A) Termite (B) Bedbug
(C) All ants (D) All
15. Following is a larva of class Crustacea-
(A) Maggot (B) Hexacanth
(C) Zoea (D) Rediae
16. Arthropoda is largest phylum. The number of species in it is-
(A) About 9,00,000 (B) About 1 crore
(C) About 10,000 (D) Not definite
17. Which of the following is a absurd group-
(A) Hydra, Obelia, Sea anemone
(B) Cuttle fish, Silver fish, Hag fish, Dog fish
(C) Sea lily, Sea cucumber, Sea urchin
(D) Scorpion, Spider, Cockroach
18. One of the following character is similar in leech, mosquito & bedbug-
(A) All insects
(B) Lay eggs in stagnant water
(C) All are endoparasite
(D) Their saliva contains anti-coagulant
19. Haemocoel is found in -
(A) Insects (B) Crustacea
(C) Arachnida (D) All
20. Rearing of hens is called as poultry. Similarly, rearing of honey bees is called as-
(A) Sericulture (B) Animal culture
(C) Apiculture (D) Entomology
21. Respiration in the largest phylum arthropoda takes place by-
(A) Trachea (B) Gills
(C) Book lungs (D) All

1. Identify the names of the following figure from the given option



- | | | |
|---------------|-----------|-------------|
| A | B | |
| (A) Euspongia | Sycon | Spongilla |
| (B) Spongilla | Sycon | Eusporangia |
| (C) Euspongia | Spongilla | Sycon |
| (D) Sycon | Euspongia | Spongilla |

2. Match the following and choose the correct option

- | | |
|------------------------------------|------------------------------------|
| A. Physalia | i. Sea anemone |
| B. Meandrina | ii. Brain coral |
| C. Gorgonia | iii. Sea fan |
| D. Adamsia | iv. Portuguese man of war |
| (A) A - iii; B - ii; C - i; D - iv | (B) A - iv; B - iii; C - ii; D - i |
| (C) A - iv; B - ii; C - iii; D - i | (D) A - ii; B - iii; C - i; D - iv |
| (E) A - i; B - ii; C - iii; D - iv | |

3. Select the right option in which all the following figures are correctly identified

- | | | | |
|-------------------|---------------|---------------|---------------|
| A | B | C | D |
| (A) Adamsia | Aurelia | Pleurobrachia | Cnidoblast |
| (B) Cnidoblast | Pleurobrachia | Adamsia | Aurelia |
| (C) Aurelia | Adamsia | Cnidoblast | Pleurobrachia |
| (D) Pleurobrachia | Cnidoblast | Aurelia | Adamsia |

4. Give the correct match in the following :

- | | |
|----------------------------|-----------------------------|
| Column - I | Column - II |
| A. Flame cells | i. Sponges |
| B. Collar cells | ii. Hydra |
| C. Stinging cells | iii. Planaria |
| | iv. Ascaris |
| (A) A = iii, B = i, C = ii | (B) A = iii, B = i, C = iv |
| (C) A = iii, B = iv, C = i | (D) A = iii, B = ii, C = iv |

5. Identify the following structures labelled A to E in the diagram given below from the list I to V

- | | | | | |
|--|-----------------------------------|-----|-----|-----|
| I. Septal nephridia | II. Pharynx | | | |
| III. Forest of integumentary nephridia | IV. Tufts of Pharyngeal nephridia | | | |
| A | B | C | D | E |
| (A) II | III | IV | I | V |
| (B) II | IV | V | I | III |
| (C) II | V | IV | III | I |
| (D) II | I | III | IV | V |

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. What is common between *Ascaris lumbricoides* and *Anopheles stephensi* ? [CBSE AIPMT-2000]

(A) Hibernation (B) Metamerism
(C) Anaerobic respiration (D) Sexual dimorphism
2. In which of the following animal, post-anal tail is found? [CBSE AIPMT-2001]

(A) Earthworm (B) Lower invertebrate
(C) Scorpion (D) Snake
3. In which of the following chlorocruorin pigment is found ? [CBSE AIPMT-2001]

(A) Annelida (B) Echinodermata
(C) Insecta (D) Lower Chordata
4. In which of the following notochord is present in embryonic stage ? [CBSE AIPMT-2002]

(A) All chordates (B) Some chordates
(C) Vertebrates (D) Non-chordates
5. In which animal, dimorphic nucleus is found ? [CBSE AIPMT-2002]

(A) *Amoeba*
(B) *Trypanosoma gambiense*
(C) *Plasmodium vivax*
(D) *Paramecium caudatum*
6. Given below are four matchings of an animal and its kind of respiratory organ [CBSE AIPMT-2003]

(i) silver fish - trachea
(ii) scorpion - book lung
(iii) sea squirt - Pharyngeal gills
(iv) dolphin - skin

The correct matchings are

(A) (ii) and (iv) (B) (iii) and (ii)
(C) (i) and (iv) (D) (i), (ii) and (iii)
7. Which one of the following is correct matching pair of an animal and a certain phenomenon it exhibits? [CBSE AIPMT-2003]

(A) *Chameleon* - Mimicry
(B) *Taenia* - Polymorphism
(C) *Pheretima* - Sexual dimorphism
(D) *Musca* - Complete metamorphosis
8. *Sycon* belongs to a group of animals which are best described as [CBSE AIPMT-2003]

(A) multicellular with a gastrovascular system
(B) multicellular having tissue organisation, but no body cavity
(C) unicellular or acellular
(D) multicellular without any tissue organisation
9. During its life cycle, *Fasciola hepatica* (liver fluke) infects its intermediate host and primary host at the following larval stages respectively [CBSE AIPMT-2003]

(A) metacercaria and cercaria
(B) miracidium and metacercaria
(C) redia and miracidium
(D) cercaria and redia
10. A terrestrial animal must be able to [CBSE AIPMT-2004]

(A) excrete large amounts of water in urine
(B) conserve water
(C) actively pump salts out through the skin
(D) excrete large amounts of salts in urine
11. The presence of gills in the tadpole of frog indicates that [CBSE AIPMT-2004]

(A) fishes were amphibious in the past
(B) fishes evolved from frog like ancestors
(C) frogs will have gills in future
(D) frogs evolved from gilled ancestors
12. In Arthropoda, head and thorax are often fused to form cephalothorax, but in which one of the following classes, is the body divided into head, thorax and abdomen ? [CBSE AIPMT-2004]

(A) Insecta (B) Myriapoda
(C) Crustacea (D) Arachnida and Crustacea
13. The animal with bilateral symmetry in young stage and radial pentamerous symmetry in the adult stage belong to the phylum. [CBSE AIPMT-2004]

(A) Annelida (B) Mollusca
(C) Cnidaria (D) Echinodermata

1. Body having meshwork of cells, internal cavities lined with food filtering flagellated cells and indirect development are the characteristics of Phylum
(A) Mollusca (B) Protozoa (C) Coelenterata (D) Porifera
2. **Assertion :** In *Pleurobrachia*, eight comb like ciliary plates called comb plates are present on the body that help in locomotion.
Reason : *Pleurobrachia* reproduces sexually and its life cycle includes cydippid larva.
(A) If both assertion and reason are true and reason is the correct explanation of assertion.
(B) If both assertion and reason are true but reason is not the correct explanation of assertion.
(C) If assertion is true but reason is false.
(D) If both assertion and reason are false.
3. Match the following list of animals with their level of organisation and choose the correct sequence.
Column-I
A. Organ level
B. Cellular aggregate level
C. Tissue level
D. Organ system level
(A) A-iv, B-iii, C-i, D-ii
(C) A-ii, B-iv, C-iii, D-i
- Column-II**
i. *Pheretima*
ii. *Fasciola*
iii. *Spongilla*
iv. *Obelia*
(B) A-iv, B-ii, C-iii, D-i
(D) A-ii, B-iii, C-iv, D-i
4. One of these is not a feature of non-chordates.
(A) Absence of post anal tail (B) Ventrally located central nervous system
(C) Absence of notochord (D) Ventrally located heart
(E) Absence of gill slits
5. The cercarial stage of a liver fluke is produced by
(A) sexual multiplication (B) asexual multiplication
(C) binary fission (D) parthenogenesis
6. Flame cells of flatworms help in
(i) osmoregulation (ii) digestion (iii) reproduction (iv) excretion
(v) bioluminescence
(A) (ii) only is correct (B) (i) and (iv) are correct
(C) (iii) only is correct (D) (i) and (v) are correct
(E) (iv) and (v) are correct
7. Which of the following phyla has members with a true coelom ?
(A) Aschelminthes (B) Platyhelminthes (C) Arthropoda (D) Coelenterata
8. Match the following list of animals with their level of organisation and choose the correct sequence.
Column I
A. Organ level
B. Cellular aggregate level
C. Tissue level
D. Organ system level
(A) A-(s), B-(r), C-(p), D-(q)
(C) A-(q), B-(s), C-(r), D-(p)
- Column II**
(p) *Pheretima*
(q) *Fasciola*
(r) *Spongilla*
(s) *Obelia*
(B) A-(s), B-(q), C-(r), D-(p)
(D) A-(q), B-(r), C-(s), D-(p)

www.blog.neetnearme.com

CELL CYCLE AND CELL DIVISION

“ Belief begins where science leaves off and ends where science begins. “

“ RUDOLF VIRCHOW (1821-1902)”

INTRODUCTION

In ability to grow and reproduce is the fundamental property of all living organisms. These organism grow by addition of new cells which arise by division of pre-existing cells. Thus, cell division or cell reproduction maintains the continuity of life. Cell division is defined as the process in which a single parent cell divides into two daughter cells. All cells reproduce by dividing into two, with each parental cell giving rise to two daughter cells each time they divide. These daughter cells grow and attain maturity and give rise to another two daughter cells. This process continues and a single cell divides into millions cells which form the body of organisms. This chapter will help us to understand the significance of cell division.

CELL DIVISION

INTRODUCTION

- **W.Flemming** at first studied mitotic division in **Salamander**.
- Strasburger discovered meiosis and gave name prophase, metaphase, anaphase, telophase.
- Meiosis name was given by **Farmer** and **Moore**.
- It is important for development, regeneration and reproduction.
- **Hormone cytokinin increases rate of cell division.**

TYPES OF DIVISION

- **AMITOSIS**
- **MITOSIS**
- **MEIOSIS**

AMITOSIS (No Spindle, No Chromosome)

- It is the simplest mode of cell division at first described by **REMAK** (1841).
- This type of division starts with elongation of nucleus.
- Nuclear division is followed by the division of cytoplasm its results in formation of two daughter cells.
- Nucleus becomes dumbbell shaped, and get divided into two daughter nucleus.
- In this division, **no spindle formation** and **no distinct chromosome** formation occurs. Nuclear envelope remains intact. The daughter cells are approximately the two equal halves of a parental cell.
e.g. PPLO, Blue-green algae, Bacteria and Eukaryotic cells. Examples are yeast-budding occurs by amitosis.
- Amoeba multiple fission occurs by amitosis.
- Mammals-growth of foetal membranes (amnion, chorion, allantois, yolk sac).
- Paramecium division of meganucleus.
- Division of mitochondria and chloroplasts.

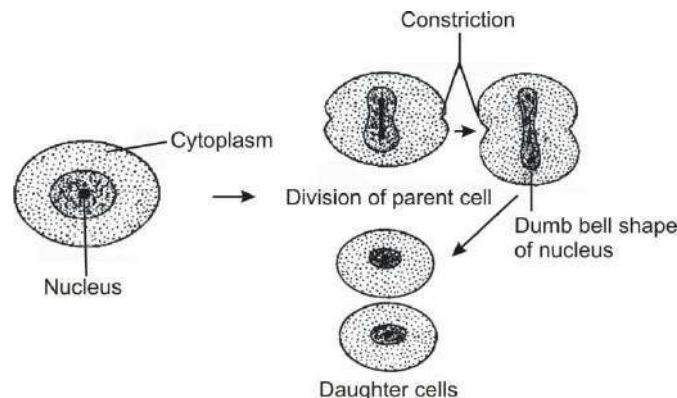


Fig. Amitosis

MITOSIS

- Mitosis was discovered by **Flemming** in 1879 in animal cell and in plants cells by **Strasburger** in 1875.
- Mitosis is a cell division in which parent cell divide to form two daughter cell, in which **number of chromosome, amount of DNA**, number and types of gene are equal to parent cell.
- It occurs in **somatic cell (n, 2n, polyploid any)**.
- It is called **indirect division**.

1. Significance of mitosis:

- Mitosis or the equational division is usually restricted to the diploid cell. Where as some lower plants and some insects haploid cells mitotically divide.
- Mitosis results in the production of daughter cell with identical genetical complement usually.
- The growth of multicellular organism is due to mitosis.
- Cell growth results in disturbing the ratio between the nucleus and cytoplasm, which is restored by mitosis.
- The cells of the upper layer of the epidermis, cells of the lining of the gut, and blood cells are being constantly replaced by mitosis.
- Mitosis in the meristematic tissue - the apical and the lateral meristem (cambium), results in a continuous growth of plants throughout their life.

2. Significance of meiosis:

- Conservation of specific chromosome number of each species is achieved across generation in sexually reproducing organism.
- Increases the genetic variability in the population of organisms from the one generation to the next.
- Variations are very important for the process of evolution.

SOLVED EXAMPLE

- Ex.1** Which of the following events are not characteristic features of telophase.
- A. Chromosome material condenses to form compact mitotic chromosomes
 B. Nucleolus, Golgi complex and ER reform
 C. Nuclear envelope assembles around the chromosome clusters
 D. Centromeres split and chromatids separate
 E. Chromosomes cluster are opposite, spindle poles and their identify as discrete elements is lost
- (A) A, B and D only (B) A and D only
 (C) B and C only (D) C, D and E only
 (E) A and B only
- Sol.** (B)
- Ex.2** The terms synaptonemal complex refers to site of
- (A) Chromatids separation
 (B) Spindle attachment
 (C) Replication
 (D) Chromosome alignment and recombination
- Sol.** (D)
- Ex.3** A stage in mitosis that starts towards the middle of anaphase and is completed with the telophase is
- Or**
- Division of cytoplasm after completion of nuclear division is called
- (A) Cytokinesis (B) Karyokinesis
 (C) Crossing over (D) Interkinesis
- Sol.** (A)
- Ex.4** Which of the following statements is incorrect about G_0 phase
- (A) Mitosis occurs after G_0 phase
 (B) Biocatalysts can be used to exit G_0 phase
 (C) Cell volume keeps on increasing during this phase
 (D) Cell metabolism occurs continuously in G_0 phase
- Sol.** (A)
- Ex.5** Arrange the following events of meiosis in correct sequence
- (A) Crossing over
 (B) Synapsis
 (C) Terminalisation of chiasmata
 (D) Disappearance of nucleolus
- (A) (B), (A), (C), (D) (B) (A), (B), (C), (D)
 (C) (B), (C), (D), (A) (D) (B), (A), (D), (C)
- Sol.** (A) : In prophase I of meiosis I, the correct sequence of events are
 B - synapsis in Zygotene
 C - crossing over in pachytene in diakinesis
 D - disappearance of nucleolus in diakinesis
- Ex.6** The best stage to count the number of chromosomes during mitosis is or structure of chromosomes can be best seen at
- Or**
- In which phase of mitosis the chromosomes are arranged around the equator of the spindle
- (A) Prophase
 (B) Metaphase
 (C) Anaphase
 (D) Telophase
- Sol.** (B) : Because in metaphase, chromosomes are present in bivalent form on equator. Chromosomes are much condense and well visible.
- Ex.7** Identify the meiotic stage in which the homologous chromosomes separate while the sister chromatids remain associated at their centromeres
- (A) Metaphase I (B) Metaphase II
 (C) Anaphase I (D) Anaphase II
- Sol.** (C)
- Ex.8** Chromosome number is halved in meiosis during
- (A) Metaphase - I (B) Anaphase - I
 (C) Metaphase - II (D) Anaphase - II
- Sol.** (B)
- Ex.9** Yeast cell can progress through the cell cycle in about
- (A) 30 minutes (B) 60minutes
 (C) 90 minutes (D) 120minutes
- Sol.** (C)
- Ex.10** The process of mitosis can be studies in
- (A) Onion root tip (B) Garlic root tip
 (C) Tendril tip (D) All of the above
- Sol.** (D)
- Ex.11** What is not seen during mitosis in somatic cells
- (A) Spindle fibres
 (B) Chromosome movement
 (C) Disappearance of nucleolus
 (D) Synapsis

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. The main difference between a dividing animals and plant cell lies in-
(A) Cell plate formation
(B) Coiling of chromosome
(C) Chromosome movement
(D) Types of spindle fibres
2. Cytoplasmic structures involved in cell division are-
(A) Mitochondria (B) Ribosomes
(C) Lysosomes (D) Centrioles
3. Cell division is not present in the cells of-
(A) Skin (B) Gonads
(C) Brain (D) Bone marrow
4. Tetrad is made of-
(A) Four non homologous chromatids
(B) Four homologous chromosomes with four chromatids
(C) Four non homologous chromosomes
(D) Two homologous chromosomes each with two chromatids
5. During meiotic cells division, genetic recombinations between two homologous chromosomes are facilitate by-
(A) Movement of centromeres
(B) Extrusion of polar bodies
(C) Movement of centrioles
(D) Formation of synaptonemal complex
6. In the somatic cell cycle-
(A) In G_1 phase DNA content is double the amount of DNA present in the original cell
(B) DNA replication takes place in S-phase
(C) A short interphase is followed by a long mitotic phase
(D) G_2 phase is followed by mitotic phase
7. Mitosis is not found in -
(A) Cartilage cells (B) Bone cells
(C) Nerve cells (D) All of the above
8. At which stage during meiotic prophase I the synaptic forces, between homologous chromosomes, are the maximum ?
(A) Leptotene (B) Zygotene
(C) Pachytene (D) Diplotene
9. The number of chromatids in a chromosome at metaphase is -
(A) Two each in meiosis and mitosis
(B) Two in mitosis and one in meiosis
(C) Two in mitosis and four in meiosis
(D) One in mitosis and two in meiosis
10. Decondensation of chromosome occurs in -
(A) Prophase (B) Metaphase
(C) Anaphase (D) Telophase
11. A red blood cell was kept in a solution for a few minutes, where it got burst. The solution taken was-
(A) Hypotonic
(B) Concentrated sugar solution
(C) Isotonic
(D) Hypertonic
12. Function of telomeres in nucleus is-
(A) Poleward movement
(B) To initiate the RNA synthesis
(C) To seal the ends of chromosome
(D) To recognise the homologous chromosome
13. When pairing occurs in chromosomes (meiosis) -
(A) Leptotene (B) Zygotene
(C) Pachytene (D) Diakinesis

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Meiosis not occurs in -
(A) Ovule (B) Anther
(C) Microsporangia (D) Shoot tip
2. Which of the two events restore the normal number of chromosomes in life cycle -
(A) Mitosis and Meiosis
(B) Meiosis and fertilisation
(C) Fertilisation and mitosis
(D) Only meiosis
3. Number of meiosis required to produce 100 ovules in angiosperms -
(A) 125 (B) 100
(C) 25 (D) 75
4. Amitosis is characteristic of -
(A) Higher plants (B) Higher animals
(C) Bryophyta (D) Lower organisms
5. Slipping of chiasmata towards the ends of bivalent is called -
(A) Terminalisation (B) Diakinesis
(C) Interkinesis (D) Heteropycnosis
6. Which does not occurs in prophase -
(A) Hydration of chromatin
(B) Dehydration of chromatin
(C) Appearance of chromosome
(D) Disappearance of nuclear memb. and nucleolus
7. During cell cycle, RNA and protein synthesis takes place during -
(A) G_1 and G_2 - phase (B) S - Phase
(C) M - phase (D) Cytokinesis
8. In which stage of cell division, number of chromosomes best counted -
(A) Prophase (B) Metaphase
(C) Telophase (D) Interphase
9. The synaptonemal complex was first observed by
(A) Moore (1905)
(B) Farmer and moore (1905)
(C) Mosses (1956)
(D) Flemming (1882)
10. How many Chromosome shall be present in a diploid cell at mitotic anaphase if its egg cell has ten chromosome -
(A) 10 (Ten) (B) 20 (Twenty)
(C) 30 (Thirty) (D) 40 (Forty)
11. If crossing-over occur at two strand stage then percentage of crossing over is -
(A) 50% (B) 60%
(D) 70% (D) 100%
12. Meiosis which occur at the time of spore formation is called -
(A) Zygotic meiosis
(B) Haplontic meiosis
(C) Terminal meiosis
(D) Intermediate meiosis
13. Chromosome exhibit high level of coiling at which phase of karyokinesis -
(A) Prophase (B) Metaphase
(C) Telophase (D) Interphase
14. The synaptonemal complex appears -
(A) Between homologous chromosomes
(B) In zygotene stage
(C) Composed of DNA + protein
(D) All the above
15. At anaphase - II of meiosis each chromosome contains
(A) 4 DNA (B) 3 - DNA
(C) 2 - DNA (D) 1 - DNA
16. During cell division chromosome move towards different poles due to -
(A) Centriole (B) Vacuole formation
(C) Microtubules (D) Cytokinesis

BIOLOGY FOR NEET & AIIMS

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match Column - I with Column - II and select the correct option from the codes given below.
- | Column - I | Column - II |
|---|------------------|
| A. Division of nucleus | i. Interphase |
| B. Division of cytoplasm | ii. Cytokinesis |
| C. DNA replication | iii. Syncytium |
| D. Karyokinesis not followed by cytokinesis | iv. Karyokinesis |
- (A) A-ii, B-iv, C-i, D-iii (B) A-iv, B-ii, C-i, D-iii (C) A-iv, B-ii, C-iii, D-i (D) A-iii, B-ii, C-iv, D-i
2. Match Column - I with Column - II and select the correct option from the codes given below.
- | Column - I | Column - II |
|-------------------------|--------------------------------|
| A. V-shaped at anaphase | i. Acrocentric chromosome |
| B. L-shaped at anaphase | ii. Metacentric chromosome |
| C. J-shaped at anaphase | iii. Telocentric chromosome |
| D. I-shaped at anaphase | iv. Sub-metacentric chromosome |
- (A) A-iv, B-ii, C-i, D-iii (B) A-ii, B-iv, C-i, D-iii (C) A-ii, B-iv, C-iii, D-i (D) A-iv, B-iii, C-ii, D-i
3. Match Column - I with Column - II and select the correct option from the codes given below.
- | Column - I | Column - II |
|---------------------------------------|----------------|
| A. Disintegration of nuclear membrane | i. Anaphase |
| B. Appearance of nucleolus | ii. Prophase |
| C. Division of centromere | iii. Telophase |
| D. Replication of DNA | iv. S-phase |
- (A) A-ii, B-iii, C-i, D-iv (B) A-ii, B-iii, C-iv, D-i (C) A-iii, B-ii, C-i, D-iv (D) A-iii, B-ii, C-iv, D-i
4. Match Column - I with Column - II and select the correct option from the codes given below.
- | Column - I | Column - II |
|---|---------------|
| A. Chromosomes move to spindle equator | i. Pachytene |
| B. Centromere splits and chromatids apart | ii. Zygotene |
| C. Pairing between homologous chromosomes | iii. Anaphase |
| D. Crossing over between homologous chromosomes | iv. Metaphase |
- (A) A-i, B-ii, C-iii, D-iv (B) A-ii, B-iii, C-iv, D-i (C) A-iv, B-iii, C-ii, D-i (D) A-iii, B-i, C-iv, D-ii
5. Select the incorrectly matched pair.
- | | |
|--------------------------|------------------------------|
| (A) Phragmoplast | – Persistent spindle |
| (B) Reductional division | – Meiosis - I |
| (C) Equational division | – Meiosis - II |
| (D) Crossing over | – Non-homologous chromosomes |
6. Find the correctly matched pairs and choose the correct option
- | | |
|---------------|---|
| A. Leptotene | – The chromosomes become invisible |
| B. Zygotene | – Pairing of homologous chromosomes |
| C. Pachytene | – Dissolution of the synaptonemal complex takes place |
| D. Diplotene | – Bivalent chromosomes appear as tetrads |
| E. Diakinesis | – Terminalization of chiasmata takes place |
- (A) A and B are correct (B) B and D are correct (C) B and E are correct (D) B and C are correct
(E) C and D are correct

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. During cell division, the spindle fibres attach to the chromosomes at a region called :
[CBSE AIPMT 2000]
(A) Chromocentre (B) Kinetochore
(C) Centriole (D) Chromomere
2. If a diploid cell is treated with colchicine then it becomes :-
[CBSE AIPMT 2002]
(A) Triploid (B) Tetraploid
(C) Diploid (D) Monoploid
3. Which of the following occurs more than one and less than five in a chromosome :-
[CBSE AIPMT 2002]
(A) Chromatid (B) Chromomere
(C) Centromere (D) Telomere
4. Best material for the study of mitosis in laboratory :
- [CBSE AIPMT 2002]
(A) Anther (B) Root tip
(C) Leaf tip (D) Ovary
5. Mitotic spindle is mainly composed of which protein :-
(A) Actin (B) Tubulin
(C) Actomyosin (D) Myoglobin
6. Crossing over that results in genetic recombination in higher organisms occurs between :-
[CBSE AIPMT 2004]
(A) Sister chromatids of a bivalents
(B) Non-sister chromatids of a bivalent
(C) Two daughter nuclei
(D) Two different bivalents
7. In the somatic cell cycle :- [CBSE AIPMT 2004]
(A) In G_1 phase DNA content is double the amount of DNA present in the original cell
(B) DNA replication takes place in S-phase
(C) A short interphase is followed by a long mitotic phase
(D) G_2 phase follows mitotic phase
8. Which one of the following precedes reformation of the nuclear envelope during M- phase of the cell cycle :-
[CBSE AIPMT 2004]
(A) Decondensation from chromosomes and reassembly of the nuclear lamina
(B) Transcription from chromosomes and reassembly of the nuclear lamina
(C) Formation of the contractile ring and formation of the phragmoplast
(D) Formation of the contractile ring and transcription from chromosomes
9. If you are provided with root-tips of onion in your class and are asked to count the chromosomes which of the following stages can you most conveniently look into :-
[CBSE AIPMT 2004]
(A) Metaphase (B) Telophase
(C) Anaphase (D) Prophase
10. At what stage of the cell cycle are histone proteins synthesized in a eukaryotic cell -
[CBSE AIPMT 2005]
(A) During G-2 stage of prophase
(B) During S-phase
(C) During entire prophase
(D) During telophase
11. Centromere is required for - [CBSE AIPMT 2005]
(A) Movement of chromosomes towards poles
(B) Cytoplasmic cleavage
(C) Crossing over
(D) Transcription
12. The salivary gland chromosomes in the dipteran larva, are useful in gene mapping because -
[CBSE AIPMT 2005]
(A) These are much longer in size
(B) These are easy to stain
(C) These are fused
(D) They have endoreduplicated chromosomes

- During cell growth, DNA synthesis takes place in
(A) S-phase (B) G₁-phase (C) G₂-phase (D) M phase
- When cell has stalled DNA replication fork, which checkpoint should be predominantly activated?
(A) G₁/S (B) G₂/M (C) M (D) Both G₂/M and M
- Which of the following phases correspond to the interval between mitosis and initiation of DNA replication?
(A) S phase (B) G₁ phase (C) G₂ phase (D) M phase
(E) Telophase
- The checkpoint in cell cycle plays important role in
(A) repair DNA damage (B) apoptosis initiation
(C) assess DNA damage (D) inhibit cell damage
- In a typical eukaryotic cell cycle, Gap 1, Synthesis and Gap 2 are the three phases included in the
(A) prophase (B) metaphase (C) anaphase (D) interphase
(E) telophase
- Compare the statements A and B.
Statement A : Synthesis of DNA takes place in the S-phase of interphase.
Statement B : Every chromosome, during metaphase, has two chromatids.
Choose the correct description.
(A) Statement A is wrong and B is correct.
(B) Statement A is correct and B is wrong.
(C) Both the statements A and B are correct and A is the reason for B.
(D) Both the statements A and B are correct and A is not the reason for B.
- Amitosis is shown by
(A) bacteria (B) *Euglena* (C) *Syllis* (D) *Hydra*
- Which of the following is not a characteristic feature during mitosis in somatic cells?
(A) Chromosome movement (B) Synapsis
(C) Spindle fibres (D) Disappearance of nucleolus
- Find out the correct statement.
(A) During mitosis endoplasmic reticulum and nucleolus disappear completely at early prophase.
(B) Chromosomes are arranged along the equator during prophase of mitosis.
(C) Chromosome is made up of two sister chromatids at anaphase of mitosis.
(D) A cell plate is laid down during interphase.
(E) Small disc shaped structures at the surface of the centromeres that appear during metaphase are kinetochores.
- Select the correct statement related to mitosis.
(A) Amount of DNA in the parent cell is first halved and then distributed into two daughter cells.
(B) Amount of DNA in the parent cell is first doubled and then distributed into two daughter cells.
(C) Amount of DNA in the parent cell is first halved and then distributed into four daughter cells.
(D) Amount of DNA in the parent cell is first doubled and then distributed into four daughter cells.

www.blog.neetnearme.com

PLANT KINGDOM

“The “cure,” it seemed, had once again been proven to be “worse than the disease.”

“ R.H. WHITTAKER (1920-1980)”

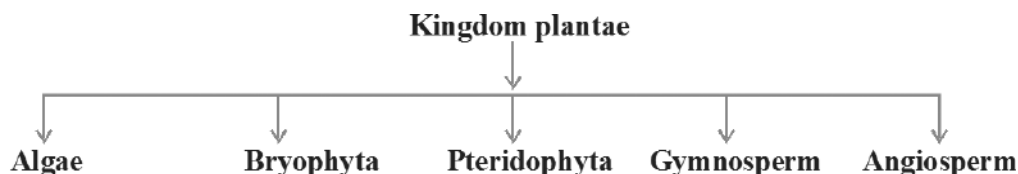
INTRODUCTION

In this chapter we will discuss about the classification of Plant kingdom. The broad classification of living organisms was given by Whittaker (1969) where in he suggested five kingdom classification i.e. Monera, Protista, Fungi, Animalia and Plantae.

Fungi and members of Monera and Protista having cell walls have now been excluded from Plant though earlier classification placed them in same kingdom. So, the cyanobacteria that are also referred to as blue green algae are not ‘algae’ any more. This chapter will also include Plantae under Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.

PLANT KINGDOM

All the multicellular eukaryotic plants are placed in Kingdom-Plantae. They are autotrophic i.e. they manufacture their food by photosynthesis.

**ALGAE**

Term "Algae" was given by **Linnaeus**.

Phycology - Study of algae.

Father of Phycology - **Fristch** → Book → "Structure & Reproduction of algae"

Father of Indian phycology - **M.O.P. Iyengar**

NATURE

- (1) Algae are found in both fresh and marine water.
- (2) Algae are found in many forms like filamentous, colonial.
- (3) Algae are surrounded by mucilagenous sheath and below the sheath cell wall is present which is made up of cellulose and pectin but mainly made up of cellulose, galactans, mannans and mineral like calcium carbonate.
- (4) On the basis of structure, algae are thalloid i.e. plant body is not differentiated into root, stem and leaves. **Tissue system** is also absent in algae.
- (5) On the basis of nutrition, algae are photoautotrophic. They have chloroplast in which photosynthetic pigments are present. Classification of algae is mainly based on pigments. **Chl-a** and **β carotene** are **universal pigment** of algae.

REPRODUCTION**(1) Vegetative****Vegetative reproduction:**

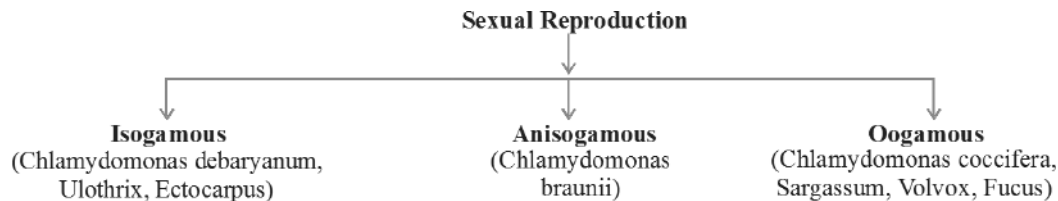
- (i) **Binary fission** - Cell is divided into two parts and nucleus is also divided into two parts by mitosis.
eg. Found only in unicellular algae
- (ii) **Fragmentation** - Filaments break down into small pieces & form new filaments.
eg. All filamentous algae

(2) Asexual**(3) Sexual**

Asexual reproduction : It is a method of protection in all unfavourable conditions.

Sexual reproduction :

- (i) Male sex organ is called **antheridium** and female is called **oogonium**. The sex organs of algae are **unicellular & jacketless**. But exceptionally sex organs of green algae **Chara** (Chara - green algae - known as stone wort) are multicellular and Jacketed. The male sex organ of **Chara** is known as **globule** and female is known as **nucule**.
- (ii) Plant body of algae is haploid so sexual reproduction take place through **zygotic meiosis**. So their life cycle is **haplontic**. But exceptionally brown algae are diploid so that sexual reproduction takes place through gametic meiosis in them. So their life cycle is **diplo haplontic** .
- (iii) Algae reproduce by **zygotic meiosis** i.e. first division in zygote is meiosis so embryo is not formed. Sexual reproduction is of three types



Check Point :

- (1) *Chlamydomonas* exhibits complete evolution of sexual reproduction.
- (2) *Ulothrix* exhibits origin of sexual reproduction

The classification of algae is mainly based on the photosynthetic pigments. In addition to this, cell wall composition and stored food are also the base of classification.

Algae is divided into following divisions

- | | | |
|------------------------|---|-----------------------------|
| (1) Chlorophyta | - | Green Algae |
| (2) Phaeophyta | - | Brown Algae |
| (3) Xanthophyta | - | Yellow - Green Algae |
| (4) Rhodophyta | - | Red Algae |

CHOLOROPHYTA GREENALGAE

Green algae are the **most advanced** algae. It is believed that green algae are the ancestors of the higher plants.

Habitat : Green algae are cosmopolitan in nature.

Different forms of Green algae (Structure) :

Green algae are found in many forms

(1) **Unicellular :-**

- (i) **Chlamydomonas** - Motile unicellular algae. This algae moves with the help of flagella.
- (ii) **Chlorella** - Non motile unicellular alga.
Calvin discovered "Calvin Cycle" by experimenting on *Chlorella*.
- (iii) **Acetabularia** - Umbrella plant - It is the largest unicellular plant. The diameter of its cell is 10 cm.
Hammerling experimented on *Acetabularia*.

(2) **Coenocytic** - Some green algae are coenocytic i.e. multinucleated.

eg. Caulerpa

Check Point : According to five kingdom system the algae described above should be placed in Protista but exceptionally due to their life cycle is similar to green algae. they are placed in Plantae. But now modern scientist place above algae in protista.

(3) **Colonial** - Some green algae are found in colonies. They form colony of cells. The number of cells in a colony is fixed. Colony with fixed number of cells called coenobium.

eg. Volvox - Motile colony

Hydrodictyon - Non motile colony (called as water net)

(4) **Multicellular filamentous** - Mostly algae are multicellular filamentous.

eg. Ulothrix - (pond wool), *Spirogyra* - (pond silk)

Check Point : some green algae are heterotrichous i.e. two types of branches prostrate and erect - *Fritschiella*, *Stigeoclonium*, *Coleochaete* (*Fritschiella tuberosa* has approach to the early land plants).

(5) **Multicellular thalloid or Parenchymatous** - Some algae are multicellular in length & width.

eg. Ulva - it is also known as sea lettuce.

BRYOPHYTA

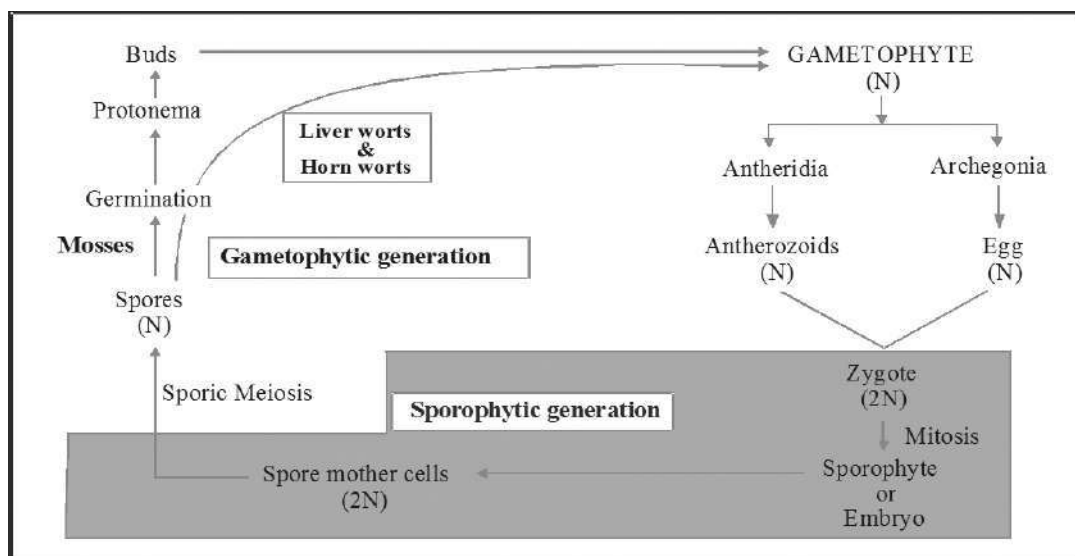
- The term "Bryophyta" was proposed by "Robert Braun".
- The study of Bryophytes is known as **Bryology**.
- **Hedwig** is considered to be the father of Bryology. But according to some scientist it is believed that **Cavers** is the father of Bryology.
- Father of Indian Bryology is **Prof. Shiv Ram Kashyap**.

GENERAL CHARACTERISTICS :

1. Bryophytes are the first land plant. It is believed that, they **originated from aquatic plant** and they come on land through water. Because some bryophytes have characters similar to aquatic plants (eg. presence of air canal)
2. Bryophytes are not considered as the successful land plants because *vascular tissue* is absent and they need water for fertilization. Due to the absence of vascular tissue bryophytes cannot grow very tall. The process of water conduction in bryophytes takes place with the help of **parenchyma**. Parenchyma is a living tissue.
3. Bryophytes are known as *amphibians* of the plant kingdom, because they need water to complete their life cycle. Mostly bryophytes are found on land.
4. Bryophytes are sciophytes, i.e. bryophytes prefer to grow in moist (wet) and shady places.
5. Roots are absent in bryophytes. Stem and leaves of bryophytes are functionally similar to the stem and leaves of higher plants.

Life cycle of Bryophytes :

1. The plant in bryophyte is gametophyte. It is haploid.
2. Sex organs are formed on gametophyte. Sex organs are multicellular and jacketed in bryophytes. Male sex organs are called as antheridium and female sex organs are called as archegonium.
3. The male gametes of bryophytes are motile. These motile male gametes are called as *antherozoids*. Antherozoids are comma shaped and biflagellate. Female gamete is called egg.



PTERIDOPHYTA

Term pteridophyta was proposed by Haeckel

The study of pteridophytes is known as pteridology.

Pteridophytes are known as reptiles of plant kingdom.

1. Pteridophytes are also called as **vascular cryptogames**. Pteridophytes are **vascular plants** i.e. xylem and phloem are present in it. In pteridophytes, vessels in xylem and companion cells in phloem are absent. But exceptionally xylem of **Pteridium, Selaginella** and **Marsilea** contains false vessels. These false vessels, are formed by the modification of tracheids, so false vessels are tracheids.
Type of vascular bundle - Concentric, Amphicribal, mesarch condition and closed.
Note :- Secondary growth is absent (due to absence of cambium) in pteridophytes but exceptionally secondary growth is present in stem of Isoetes.
2. Pteridophytes are called as the first successful terrestrial plants i.e. they are more adapted terrestrial plants as compared to bryophytes. It is because vascular tissue is present in pteridophyta and they have roots.
3. Pteridophytes are **not completely successful** terrestrial plants because they need water for fertilization, so pteridophytes grow in shady and moist places.
4. In pteridophyta, the plant body is completely differentiated in to **root, stem and leaves** hence their body is called as cormophyte.
 - The primary root remains alive for short period. After some time it is replaced by *adventitious* roots.
 - Stem is erect or prostrate. In some pteridophytes stem is underground, which is known as *rhizome*.
 - On the basis of leaves, pteridophytes are of two types -
First in which stem is smaller while leaves are larger. They are known as *macrophyllous* Pteridophytes.
eg. Pteridium, Pteris, Marsilea
Second, in which stem is larger and leaves are smaller. They are called as *microphyllous* Pteridophytes.
*eg. Equisetum, Lycopodium, Selaginella***Note : Differentiation in plant body starts from bryophytes.**

LIFE CYCLE OF PTERIDOPHYTES

1. Plant is **sporophyte**. i.e. diploid.
Most of the pteridophytes are **homosporus** i.e. only one type of spores are formed during reproduction.
eg. Lycopodium, Pteridium, Equisetum, Dryopteris
Exception - Some pteridophytes are **heterosporus** i.e. two types of spores **microspores** and **megaspores**.
eg. Selaginella, Isoetes, Marsilea, Salvinia, Azolla, Stylites, Pillularia, Regellidium

eg. of Ferns :

Pteridium

Pteris

Dryopteris

Dryopteris

Adiantum

They are called "Braken fern" or "Sun fern"

- Also called as Brook shield fern'

- **Walking fern** or Maiden hair fern

This name is given to them due to rapid vegetative reproduction. Vegetative reproduction in Adiantum takes place by means of leaf tip. It spreads very fast.

Osmunda - Royal fern or flowering fern

Ophioglossum - *Adder's tongue fern*

Marsilea - *Pepper wort fern*

Azolla - Aquatic fern (Smallest pteridophyte and biofertilizer)

Onychium - Golden fern

Cyathea - Lofty tree fern

Alsophila - Tree fern (Largest pteridophyte)

Chielanthus - Silver fern

Botrychium - Moon wort fern



ED OS KEY POINTS

(1) **Selaginella** – Vivipary is present in it i.e. **partial endosporic** germination. Seed habit was originated in *Selaginella* like pteridophytes.

- Ligulate leaves (tongue shaped) are present in it

Function - Ligule is secretory structure, which secretes water and keeps the sporangium and the young leaf moist.

(2) In some pteridophytes sporangia are not formed on lower surface of sporophylls -

- In some pteridophytes sporangia are formed at the axil of leaf.

eg. **Selaginella**

- In some pteridophytes sporangia are formed in spike.

eg. **Ophioglossum**

- In some pteridophytes sporangia are formed in sporocarp.

eg. **Marsilea, Azolla**

Habitat of some important pteridophytes - Most of the pteridophytes are found in moist soil and shady places.

(1) **Aquatic** - Some pteridophytes are found in water.

eg. *Marsilea, Salvinia, Azolla, Isoetes*

(2) **Epiphytes** - Some pteridophytes grow on other plants.

eg. *Lycopodium phlegmeria, Ophioglossum pendulum, Pleopeltis*

(3) **Xerophytes** - Some pteridophytes are found in deserts.

eg. *Selaginella rupestris, Selaginella bryopteris*

Selaginella lepidophylla

GYMNOSPERM

1. Term Gymnosperm was given by Theophrastus.
2. Study of Gymnosperm known as Gymnospermology.
3. Gymnosperm & Angiosperm are collectively included under spermatophyta i.e. seed bearing plants.
4. Gymnosperms are naked seeded plant i.e. no fruit formation takes place in these plant.
i.e. in gymnosperm embryo & seed formation takes place but no fruit formation occur.
5. Gymnosperms are very limited in distribution. They are mainly found in cold regions. In India Gymnosperms are found on Himalayan mountains. They occur on slopes of mountain in cold region therefore gymnosperms are **xerophyte**.
6. All gymnosperm are vascular plants. Therefore vascular tissue present i.e. xylem & phloem. Xylem lack **vessels** & phloem lacks **companion cells**.

Note :

- Exceptionally in xylem of **Gnetum, Ephedra, Welwitschia** true vessels are present.
 - In gymnosperms vascular bundle is **Conjoint-Collateral-Endarch-Open**.
 - In the vascular bundle cambium is present therefore secondary growth takes place in gymnosperms, so that Gymnosperms are woody plants.
7. Most of the gymnosperms are arborescent (woody and tree habit) - but some are present as shrub.
eg. Ephedra
Some Gymnosperm are liana or woody climbers.
eg. Gnetumula

LIFECYCLE OF GYMNASPERM

1. In Gymnosperms main plant body is **sporophyte** (diploid). All Gymnosperm are **dioecious**. i.e. male & female plants are separate, but exceptionally Pinus is monoecious.
2. All Gymnosperms are **heterosporus**. At the time of reproduction two types of spores are formed.
 - Microspores form – Male gametophyte
 - Megaspores form – Female gametophyte
3. These two types of spores are formed in different sporangia.
 - Microspores are formed in Microsporangia. Microsporangia are also termed as pollen sac.
 - Megaspores are formed in Megasporangia. Megasporangia are also termed as ovule.
4. Both type of sporangia are formed on different sporophylls.
 - Microsporangia are formed on Microsporophyll. It is known as stamen.
 - Megasporangia are formed on Megasporophylls. It is known as carpel.
5. Both types of sporophylls are found in groups & form male cone (strobilus) & female cone.
 - **Gymnosperm's cone are just like flower or inflorescence of angiosperm.**
 - **Carpels of Angiosperm & Gymnosperm are different to each other.**

BIOLOGY FOR NEET & AIIMS

- Kingdom plantae includes all eukaryotic chlorophyllous autotrophic organisms. A few members
- The gametes of these algae are pyriform (pear shaped) and bear two laterally attached flagella.
- Common members of phaeophyceae are - Ectocarpus, Dictyota, Laminaria, Sargassum & Fucus.

1. RHODOPHYCEAE (Red algae)

- Majority of red algae are found in marine water with greater concentrations in warmer areas.
- The reserve food in red algae is floridean starch which is very similar to amylopectin and glycogen.
- Sexual reproduction in red algae is Oogamous and accompanied by complex post fertilisation developments.
- Examples of red algae are Polysiphonia, Porphyra, Gracillaria, Gelidium.

2. BRYOPHYTA

- Bryophytes lack true roots, stem or leaves. They may possess root like, stem like or leaf like structures.
- Main body of bryophytes is made of haploids cells and it produces gametes hence is called as gametophyte.
- Sporophyte in them is not free living, but attached to the photosynthetic gametophyte and derives nourishment from it.
- Sphagnum provides peat that have long been used as fuel and also used as packing material for trans-shipment of living material because of its high water holding capacity.
- Mosses along with lichens are the first organisms to colonise rocks and hence are of great ecological importance.
- Mosses form dense mats on the soil, they reduce the impact of falling rain and prevent soil erosion. LIVER WORTS
- The plant body of liver wort is thalloid and the thallus is dorsiventral and closely appressed to the substratum.
- The leafy members of liverworts have tiny leaf like appendages in two rows on the stem like structures.
- Asexual reproduction in liverworts takes place by fragmentation of thalli or by the formation of specialised structures called gemmae (gemma-singular). Gemmae are green multicellular, asexual buds, which develop in small receptacles called gemma cups.
- The sporophyte is differentiated into a Foot, Seta and Capsule (Marchantia). After meiosis spores are produced within the capsule. "MOSS
- The gametophyte body of moss is made up of two stages.
 - (i) Protonema - first stage produced from spore.
 - (ii) Leafy stage - The second stage produced from buds of protonema.
- Vegetative reproduction in mosses is by fragmentation and budding in the secondary protonema.
- Common example of mosses are Funaria, Polytrichum and Sphagnum.

3. PTERIDOPHYTA

- In pteridophytes the main plant body is sporophyte which is differentiated into root, stem & leaves. They have well differentiated vascular tissues.
- The leaves in pteridophyta are small (microphylls) as in Selaginella or large (macrophylls) as in ferns.
- Only few genera of pteridophytes show heterospory; they produce two types of spores, Macrospores (large) and Microspores (small).
- In heterosporous pteridophytes the female gametophytes are retained on the parent sporophyte for variable period. The development of zygote into young embryo takes place within the female gametophytes. This is precursor to the seed habit, considered as an important step in evolution.

4. GYMNOSPERMS

- In gymnosperms ovules are not enclosed in ovary walls and remain exposed both before and after fertilisation, so they produce naked seeds.
- Gymnosperms are medium sized trees or tall trees and shrubs .
- The giant redwood tree Sequoia is one of the tallest tree species .
- In gymnosperms the stem may be unbranched (Cycas) or branched (Pinus, Cedrus)
- The leaves may be simple or pinnately compound.
- The leaves in gymnosperms are well adapted to withstand extremes of temperature, humidity and wind. In conifers,

SOLVED EXAMPLE

Ex.1 Fusion of two motile gametes which are dissimilar in size is termed as

- (A) oogamy (B) isogamy
(C) anisogamy (D) zoogamy.

Sol. (C) : Anisogamy is fusion of two motile gametes dissimilar in size. It is observed in some species of *Chlamydomonas*. Oogamy is also fusion of two dissimilar sized gametes in which female gamete is larger but non-motile.

Ex.2 Cyanobacteria are classified under

- (A) Protista (B) Plantae
(C) Monera (D) Algae.

Sol. (C) : Cyanobacteria are classified under Kingdom Monera as they are prokaryotes. They are generally photosynthetic in nature and contain pigments, chlorophyll a, and carotenoids, etc. *Nostoc* and *Oscillatoria* are examples of this category.

Ex.3 If the diploid number of a flowering plant is 36, what would be the chromosome number in its endosperm?

- (A) 36 (B) 18
(C) 54 (D) 72

Sol. (C): Endosperm of flowering plants is a triploid structure. As $2n = 36$, then $n = 18$, therefore $3n = 54$.

Ex.4 A plant shows thallus level of organisation. It shows rhizoids and is haploid. It needs water to complete its life cycle because the male gametes are motile. It may belong to

- (A) pteridophytes (B) gymnosperms
(C) monocots (D) bryophytes.

Sol. (D) : Bryophytes are non-vascular terrestrial plants of moist habitat in which a multicellular diploid sporophyte lives as a parasite on an independent multicellular haploid gametophyte that develops multi-cellular jacketed sex organs. True roots are absent, instead rhizoids occur, which may be unicellular or multicellular. An external layer of water is essential for the swimming of male gametes to the archegonia.

Ex.5 Plants of this group are diploid and well adapted to extreme conditions. They grow bearing sporophylls in compact structures called cones. The group in reference is

- (A) monocots (B) dicots
(C) pteridophytes (D) gymnosperms.

Sol. (D) : Gymnosperms are those seed plants in which the seeds remain exposed over the surface of the megasporophylls because the latter are not folded to form pistils. Flowers are absent. Two types of sporophylls, microsporophylls and megasporophylls are usually aggregated to form distinct cones or strobili, pollen cones (male cones) and seed cones (female cones) respectively.

Ex.6 The embryo sac of an angiosperm is made up of

- (A) 8 cells (B) 7 cells and 8 nuclei
(C) 8 nuclei (D) 7 cells and 7 nuclei.

Sol. (B) : Female gametophyte or embryo sac of angiosperms develops upto 8-nucleate, 7-celled state prior to fertilisation. There is a three celled apparatus (one egg cell or oosphere and two synergids), three antipodal cells and two polar nuclei. The two polar nuclei fuse to form a diploid secondary nucleus.

Ex.7 Protonema is

- (A) haploid and is found in mosses
(B) diploid and is found in liverworts
(C) diploid and is found in pteridophytes
(D) haploid and is found in pteridophytes.

Sol. (A): The predominant stage in the life cycle of a moss (bryophyte) is the gametophyte which consists of two stages. The first stage is the protonema stage, which develops directly from a spore. It is a creeping, green, branched and frequently filamentous stage. The second stage is the leafy stage, which develops from the secondary protonema as a lateral bud. It consists of upright, slender axes bearing spirally arranged leaves attached to the soil through multicellular and branched rhizoids. This stage bears the sex organs.

Ex.8 Holdfast, stipe and frond constitute the plant body in case of

- (A) Rhodophyceae (B) Chlorophyceae
(C) Phaeophyceae (D) all of these.

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Which algal groups have similarity in pigment composition :-
(A) Red algae and brown algae
(B) Green algae and blue green algae
(C) Kelps and diatoms
(D) Diatoms and euglenoids
2. Autotrophic thallophytes are called as :-
(A) Fungi (B) Lichens
(C) Algae (D) Microbes
3. Which of the following is parasitic algae :-
(A) Cephaleuros (B) Harveyella
(C) Both (A) and (B) (D) None of the above
4. Red algae is red due to the presence of :-
(A) R-Phycocyanin (B) R-Phycoerythrin
(C) C-Phycocyanin (D) C-Phycoerythrin
5. Sea lettuce is the name given to :-
(A) Laminaria (B) Fucus
(C) Sargassum (D) Ulva
6. Fertile cells are not enclosed by sterile cells in the group :-
(A) Thallophyta (B) Spermatophyta
(C) Pteridophyta (D) Bryophyta
7. "Red rust of tea" is caused by parasitic :-
(A) Algae (B) Fungi
(C) Bacteria (D) Bryophyta
8. No Zoospore formation has been observed in the Algal members belonging to :-
(A) Chlorophyceae (B) Xanthophyceae
(C) Phaeophyceae (D) Cyanophyceae
9. Which pigment is found in phaeophyceae :-
(A) Chl. a, c and fucoxanthin
(B) Chl. a, d and violaxanthin
(C) γ Carotene and phycocyanin
(D) None of these
10. Food reserve in Rhodophyta is :-
(A) Floridean starch (B) Mannitol
(C) Leucosin (D) All of the above
11. Zygotic meiosis is characteristic of :-
(A) Prokaryotes (B) Thallophyta
(C) Bryophyta (D) Spermatophyta
12. Photosynthetic pigments common to all algae :-
(A) Chlorophyll 'b' and carotene
(B) Chlorophyll 'a' and 'b'
(C) Chlorophyll 'a' and carotene
(D) Chlorophyll and xanthophyll
13. *Acetabularia*, a largest unicellular plant, belongs to
(A) Chlorophyta (B) Rhodophyta
(C) Pyrrophyta (D) Phaeophyta
14. Deepest algae in sea are :-
(A) Red Algae (B) Brown Algae
(C) Green Algae (D) Golden Algae
15. Phycobilins are characteristic pigments of :-
(A) Rhodophyta and Xanthophyta
(B) Rhodophyta and Pyrrophyta
(C) Pyrrophyta and Cyanophyta
(D) Rhodophyta and Cyanophyta
16. Which of the following plant groups have similar pigment composition :-
(A) Rhodophyta and phaeophyta
(B) Chlorophyta and phaeophyta
(C) Rhodophyta and cyanophyta
(D) Xanthophyta and euglenophyta
17. Polyuronic acid and polysulphate esters are characteristic in cell wall of :-
(A) Brown Algae (B) Red Algae
(C) Dinoflagellates (D) Diatoms
18. Stone wort is common name of :-
(A) *Chara* (B) *Chlorella*
(C) *Laminaria* (D) *Polysiphonia*

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. Blue - green Algae resembles more closely to:-
 (A) Green Algae
 (B) Brown Algae
 (C) Red Algae and bacteria
 (D) Slime molds
2. Which of the following statement is true for algae :-
 (A) Algae have root, stem and leaves
 (B) Algae have true roots but lack leaves
 (C) Algae have rhizoides and leaves
 (D) Body of algae is thallus
3. In which plant group reproductive organs are not enclosed in a layer of sterile cells:-
 (A) Pteridophyta (B) Thallophyta
 (C) Angiosperm (D) Gymnosperm
4. Classification of algae is mainly based up on :-
 (A) Reproductive organs
 (B) Structure of spores
 (C) Pigments
 (D) Stored food
5. "Carrageenin" is obtained from :-
 (A) *Chondrus crispus* (B) *Laminaria*
 (C) *Gelidium* (D) *Macrocystis*
6. Female sex organ of algae is called :-
 (A) Carpel (B) Oogonium
 (C) Archegonia (D) Oosphere
7. Change in colour of algae according to depth in sea is called :-
 (A) Bohr's effect (B) Gaudikov's effect
 (C) Fogg's effect (D) Pasteur effect
8. In some algae two entire individual fuse with each other. Such a type of sexual reproduction is called—
 (A) Isogamy
 (B) Anisogamy
 (C) Hologamy
 (D) Gametangial contact
9. Which of the following is not correctly matched :
 (A) Heterocyst = N₂-fixation structure of B.G.A.
 (B) Hormogonia = Reproductive structure of B.G.A.
 (C) Floridean starch = Stored food of brown algae
 (D) Cyanophycean starch = Stored food of B.G.A.
10. Cilia & flagella are absent in life cycle of:—
 (A) Red algae (B) Brown algae
 (C) Green algae (D) Red algae & B.G.A.
11. Which algae best explains the evolution of sexual reproduction :—
 (A) Green algae (B) Red algae
 (C) Brown algae (D) B. G. Algae
12. Spermatia are male gametes of:—
 (A) Red algae (B) Diatoms
 (C) Spermatophyta (D) Euglena
13. Cap cells occur in :-
 (A) *Oedogonium* (B) Diatoms
 (C) Dinoflagellates (D) *Euglena*
14. Algae which have food conducting tubes similar to phloem in vascular plants are :-
 (A) Red algae (B) Brown algae
 (C) Blue green algae (D) Green algae
15. Chlorophyll 'c', 'd' and 'e' are characteristic pigments of respectively :-
 (A) Red algae, brown algae and yellow green algae
 (B) Brown algae, Red algae and yellow green algae
 (C) Diatoms, Dinoflagellates, Euglena
 (D) High plants, Red algae, Diatoms
16. Which of the following algae produces synzoospores :-
 (A) *Chlamydomonas* (B) *Polysiphonia*
 (C) *Chlorella* (D) *Vaucheria*
17. Reserve food of algae and fungi are :-
 (A) Starch and soluble floridoside
 (B) Oil droplets and fats
 (C) Starch and glycogen
 (D) Starch and Glycerol

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

- Select the correct match from the options given in all algae

(A) Phaeophyceae	-	Mannitol
(B) Rhodophyceae	-	Dictyota
(C) Chlorophyceae	-	Non- motile gametes
(D) Rhodophyceae	-	r-Phycoerythrin

(A) A, B and C (B) B, C and D (C) A and C (D) C and D
(E) A and D
- Observe the diagram A, B, C, and D. In which one of the four options all the items are correct

A	B	C	D
(A) Chlamydomonas	Chara	Laminaria	Volvox
(B) Laminaria	Volvox	Chlamydomonas	Chara
(C) Chara	Laminaria	Volvox	Chlamydomonas
(D) Volvox	Chlamydomonas	Laminaria	Chara
- Which of these is mismatched

(A) Phaneros	- Visible
(B) Kryptos	- Concealed
(C) Gymmo	- Naked
(D) Bryon	- Liverworts
(E) Trachea	- Windpipe
- Choose the wrong pair.

(A) Hepaticopsida	- Marchantia
(B) Lycopsida	- Selaginella
(C) Bryopsida	- Anthoceros
(D) Pteropsida	- Dryopteris
(E) Sphenopsida	- Equisetum
- Observe the diagrams (A-D) given below and select the right option in which all the four items A - D are correctly identified.

A	B	C	D
(A) Antheridia	Archegonia	Gemma cup	Sphagnum
(B) Archegonia	Antheridia	Gemma cup	Sphagnum
(C) Archegoniophore	Gemma cup	Gametophyte	Sphagnum
(D) Gemma cup	Archegoniophore	Sporophyte	Sphagnum
- Match the following with correct combination

Column - I	Column - II
A. Anthoceros	i. Walking fern
B. Adiantum	ii. Alga
C. Sargassum	iii. Inferae
D. Asterales	iv. Gametophyte
	v. Hornwort
	vi. Liverwort

(A) A - vi, B - v, C - i, D - iii
(B) A - v, B - iv, C - iii, D - ii
(C) A - v, B - i, C - ii, D - iv
(D) A - iii, B - ii, C - i, D - v
(E) A - i, B - iv, C - iii, D - v

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. The largest ovules, largest male and female gametes and largest plants are found among
[CBSE AIPMT-2000]
(A) angiosperms
(B) tree ferns and some monocots
(C) gymnosperms
(D) dicotyledonous plants
2. In ferns meiosis occurs when
[CBSE AIPMT-2000]
(A) spore germinates
(B) gametes are formed
(C) spores are formed
(D) antheridia and archegonia are formed
3. A research student collected certain alga and found that its cells contained both chlorophyll-*a, b, c*, and chlorophyll-*d* as well as phycoerythrin. The alga belongs to [CBSE AIPMT-2000]
(A) Rhodophyceae (B) Bacillariophyceae
(C) Chlorophyceae (D) Phaeophyceae
4. *Cycas* has two cotyledons but not included in angiosperms because of [CBSE AIPMT-2001]
(A) naked ovules (B) seems like monocot
(C) circinate ptyxis (D) compound leaves
5. Which of the following plants produces seeds but not flowers ? [CBSE AIPMT-2002]
(A) Maiza (B) Mint
(C) Peepal (D) Pinus
6. Which of the following is without exception in angiosperms ? [CBSE AIPMT-2002]
(A) Presence of vessels
(B) Double fertilisation
(C) Secondary growth
(D) Autotrophic nutrition
7. Sexual reproduction in *Spirogyra* is an advanced feature because it shows [CBSE AIPMT-2003]
(A) physiologically differentiated sex organs
(B) different size of motile sex organs
(C) same size of motile sex organs
(D) morphologically different sex organs
8. Which one pair of examples will correctly represent the grouping spermatophyta according to one of the schemes of classifying plants ? [CBSE AIPMT-2003]
(A) *Rhizopus, Triticum* (B) *Ginkgo, Pisum*
(C) *Acacia, sugarcane* (D) *Pinus, Cycas*
9. Which one the following pairs of plants are not seed producers ? [CBSE AIPMT-2003]
(A) *Ficus* and *Chlamydomonas*
(B) *Punica* and *Pinus*
(C) *Fern* and *Funaria*
(D) *Funaria* and *Ficus*
10. Angiosperms have dominated the land flora primarily because of their [CBSE AIPMT-2004]
(A) power of adaptability in diverse habitat
(B) Property of producing largenumber of seeds
(C) nature of some pollination
(D) domestication by man
11. A free living nitrogen fixing cyanobacterium which can also form symbiotic association with the water fern *Azolla* is - [CBSE AIPMT-2004]
(A) *Tolypothrix* (B) *Chlorella*
(C) *Nostoc* (D) *Anabaena*
12. Which one of the following is a living fossil ? [CBSE AIPMT-2003]
(A) *Tolypothrix* (B) *Chlorella*
(C) *Nostoc* (D) *Anabaena*
13. Which of the following propagates through leaf-tip? [CBSE AIPMT-2004]
(A) Walking fern (B) Sproux - leaf plant
(C) *Marchantia* (D) Moss

- Which one of the following statements is wrong?
 - Algae increase the level of dissolved oxygen in the immediate environment.
 - Algin is obtained from the red algae, and carrageenan from brown algae.
 - Agar-agar is obtained from *Gelidium* and *Gracilaria*.
 - Laminaria* and *Sargassum* are used as food.
- Find out the wrong statements.
 - Ulothrix* and *Spirogyra* are filamentous forms.
 - Porphyra* and *Laminaria* are fresh water algae.
 - Stored food is in the form of mannitol in Rhodophycean members.
 - Chlorella* and *Spirulina* are unicellular algae.

(A) A and B (B) B and C (C) A and C (D) A and D
(E) b and D
- Which of the following groups of algae produces algin?
 - Phaeophyceae and Chlorophyceae
 - Rhodophyceae and Phaeophyceae
 - Chlorophyceae and Rhodophyceae
 - Phaeophyceae only
- Which out of the following is a mismatched pair?
 - Rhodophyceae – Floridean starch, phycoerythrin
 - Chlorophyceae – Laminarin, Mannitol
 - Rhodophyceae – Non-flagellated gametes
 - Phaeophyceae – Chlorophyll a and c, fucoxanthin
- Which one of the following shows isogamy with non-flagellated gametes?
 - Sargassum*
 - Ectocarpus*
 - Ulothrix*
 - Spirogyra*
- Which of the following groups of algae belongs to Class Rhodophyceae?
 - Laminaria*, *Fucus*, *Porphyra*, *Volvox*
 - Gelidium*, *Porphyra*, *Dictyota*, *Fucus*
 - Gracilaria*, *Gelidium*, *Porphyra*, *Polysiphonia*
 - Volvox*, *Spirogyra*, *Ulothrix*, *Sargassum*
 - Sargassum*, *Laminaria*, *Fucus*, *Dictyota*
- Match the following and choose the correct combination from the option given.

Column I	Column II
(Alga type)	(Example)
A. Green alga	i. <i>Dictyota</i>
B. Brown alga	ii. <i>Porphyra</i>
C. Red alga	iii. <i>Spirogyra</i>
(A) A-iii, B-ii, C-i	(B) A-iii, B-i, C-ii
(C) A-ii, B-iii, C-i	(D) A-(i), B-ii, C-iii
(E) A-i, B-iii, C-ii	

CHEMICAL CONTROL AND INTEGRATION

“Through art and science in their broadest senses it is possible to make a permanent contribution towards the improvement and enrichment of human life and it is these pursuits that we students are engaged in”.

“ **FREDRICK SANGER(1918-2013)**”

INTRODUCTION

As we have seen in earlier chapter the neural system provides a exact rapid coordination among organs. The neural coordination is fast but short-lived. It occurs for a short period of time. The nerve fibres are responsible for neural coordination do not innervate all cells of the body. hence, there is a need of another special kind of regulatory and coordinating system, so this regulation is carries out by chemical messengers called as **Hormones**, released by endocrine glands.

Therefore in this chapter, you will understand how different hormones regulate the cellular functions of the body and how these hormones help in coordination of different organs of the body.

CHEMICAL CONTROL AND INTEGRATION

INTRODUCTION:

- The branch of biology which deals with the study of endocrine system and its physiology is known as **Endocrinology**.
- **“Thomas Addison”** is known as father of Endocrinology.
Whereas the gland with duct is called exocrine gland which secretes enzyme etc. Endocrine glands pour their secretion directly into blood. These glands lack ducts, so these glands are called ductless glands.
- Where as, the work of co-ordination by endocrine system is slowly by secretion of some chemical substances.
- Co-ordination in the body of almost all the higher vertebrates is controlled by two systems **Nervous system** and **endocrine system**.

HORMONE:

- The term hormone was coined by **Starling**.
- First discovered hormone is **secretin**. It was discovered by **Bayliss & Starling in 1902**.
- Hormones are also called **“Primary messengers”** or chemical messengers.’

Chemical Nature of Hormone :

The animal hormones may be classified into 6 categories.

1. **Protein** : The gonadotropic, thyrotropic and somatotropic hormones from the anterior lobe of pituitary are protein with high molecular weights.
2. **Steroids (Fat soluble)** : The hormones like cortisol and aldosterone from adrenal cortex, testosterone from interstitial cells of testes, estrogen and progesterone from Graaffian follicles of ovary and placenta are the examples of steroid hormones. The hormones contain cholesterol and bile salts.
3. **Fatty acid derivative** : - Prostaglandin
4. **Amino acid derivatives** : The hormones epinephrine and norepinephrine from the adrenal medulla and thyroxine from the thyroid gland are derived from amino acid.
5. **Short peptides** : The hormones oxytocin and vasopressin from the posterior lobe of the pituitary gland are short peptides of 9 amino acid. The melanocyte stimulating hormone (MSH) from the intermediate lobe of the pituitary gland is also short peptide of 13 amino acids.
6. **Long peptides** : The hormones insulin from the pancreas, adrenocorticotropin (ACTH) from the anterior lobe of the pituitary gland, calcitonin from the parathyroid gland consists of 84 amino acids.

Physical & Chemical Specialities of Hormones : -

- Hormones are non-antigenic & non species specific substances.
- Hormones are soluble in water and are easily diffusible in tissues.
- The secretion of hormone is always in very small quantity because these are most reactive substances
- Hormones are destroyed after use.
- Hormones can not be stored in the body except Thyroxine.
- Hormones are soluble in water and blood.
- The molecules of most of the hormones are small, and their molecular weight is low.
- Liver and kidneys separate them from blood and decompose them. The waste product formed after decomposition, hormones are excreted with urine. It can not be reutilized.
- Usually, hormones do not participate in the metabolic activities of target cells but they affect and control the activity level of these target cells. Due to the effect of hormones, not only the rate of metabolic activities is effected but also the permeability of cell membrane is changed so the nature of reaction is also changed. so the nature of reaction is also changed.

INTEGRATIVE SYSTEMS

- Neural system and endocrine system jointly co-ordinate and regulate the physiological functions of the body.
- Note: Nervous system provides rapid co-ordination where endocrine system provides slow co-ordination with different body parts.
- Hormone :- Secretion of endocrine glands (Ductless glands) called as hormones. "Hormones are non-nutrient chemicals which act as intercellular messenger and are produced in trace amounts."
- Note: Intercellular messenger = Passes message from one cell to another cell by binding with membrane bound receptors or receptors located inside the cell.
- Receptors :- Protein molecules specific for particular hormone molecules. "Position of Receptors - Located on cell surface or intracellular."
- Organised endocrine Glands (Whole gland) : Pituitary gland, Pineal gland, Thyroid.gland, Adrenal Gland, Pancreas, Parathyroid gland, Thymus and Gonads.
- Other unorganised endocrine tissue (Diffused tissue) : GIT, Kidney, Heart etc.

HYPOTHALAMUS

- Basal part (ventral part) of Diencephalon.
- Group of neurosecretory cells known as nuclei (Nuclei = group of cyton in CNS) secrete 7 releasing hormones (which stimulate secretion) and 3 inhibiting (which inhibit secretion) hormones. These hormone regulate the synthesis and secretion of pituitary hormones.
- Hypothalamo hypophyseal portal system regulate functions of anterior pituitary.
- In this portal system releasing and inhibiting hormones are transfer to anterior pituitary by hypophyseal portal vein and stimulate hormone synthesis & secretion of anterior pituitary.
- Posterior pituitary is under the direct regulation of the hypothalamus.
- Hormones of posterior pituitary are synthesised into hypothalamic nuclei (Paraventricular nuclei and supra optic nuclei) and secreted into posterior pituitary through axons. So these are stores and again release into body via blood stream.

PINEAL GLAND (Dorsal side of forebrain)

- Hormone = Melatonin
- Melatonin regulate 24 hours diurnal rhythms of body.
- Melatonin maintain rhythms of body like - sleep wake cycle, body temperature.
- Melatonin also influence metabolism, pigmentation, menstrual cycle and defense capability.
- After 7 year of birth pineal gland undergo involution and crystal of CaCO_3 and Ca_3PO_4 are deposited in it called "Brain sand".

SOLVED EXAMPLE

- Ex.1** In mechanism of hormone action, which of the following is not a second messenger
(A) Cyclic AMP (B) IP3
(C) Ca⁺⁺ (D) Mg⁺⁺
Sol. (D)
- Ex.2**shows anti-allergic and anti-inflammatory effect
(A) Mineralocorticoids (B) Glucocorticoids
(C) Sexcorticoids (D) Noradrenaline
Sol. (B)
- Ex.3** Which is the inhibitory hormone of GH
(A) Insulin (B) Parathormone
(C) Somatostatin (D) Testosterone
Sol. (C)
- Ex.4** Endocrine glands
(A) Do not possess ducts
(B) Sometimes do not have ducts
(C) Pour their secretion into blood through ducts
(D) Always have ducts
Sol. (A) : Endocrine glands are ductless glands their secretion flows directly into the bloodstream.
- Ex.5** Select the mismatch pair from the following
(A) Oxytocin - Contraction of uterine muscles
(B) Insulin - Gluconeogenesis
(C) Prolactin - Milk production in mammary glands
(D) Glucagon - Glycogenolysis
Sol. (B)
- Ex.6** Which is a 32 amino acid water soluble peptide hormone
(A) Gastrin (B) Calcitonin
(C) Glucagon (D) Insulin
Sol. (B)
- Ex.7** One of the following cells secretes a hormone
(A) Cells of Leydig
(B) Cells of Sertoli
(C) Primary spermatocyte
(D) Secondary spermatocyte
Sol. (A)
- Ex.8** The blood calcium level is lowered by the deficiency of
Or
The hormone that increases the blood calcium level and decreases its excretion by kidney is
Or
Tetany (Irregular muscle contraction) and osteoporosis are caused due to the deficiency of
(A) Both calcitonin and parathormone
(B) Calcitonin
(C) Parathormone
(D) Thyroxine
Sol. (C) : Hypoparathyroidism results in hypocalcemia. Skeletal muscles fail to relax causing tetany and hyperparathyroidism result in osteoporosis i.e., dissolution of bone and hypercalcemia.
- Ex.9** Serotonin and Melatonin are hormones, secreted by
(A) Pancreas (B) Pineal body
(C) Pituitary gland (D) Thymus
Sol. (B)
- Ex.10** Endemic goiter is a state of
(A) Increased thyroid function
(B) Normal thyroid function
(C) Decreased thyroid function
(D) Moderate thyroid function
Sol. (C) : Endemic goitre is due to low iodine in soil and water in hilly areas.
- Ex.11** The co-ordinator between Nervous and endocrine system is
(A) Thalamus (B) Hypothalamus
(C) Epithalamus (D) Colliculus
Sol. (B)
- Ex.12** Adrenaline is equivalent to which neurotransmitter
(A) GABA (B) Serotonin
(C) Epinephrine (D) Norepinephrine
Sol. (C)
- Ex.13** Steroid hormones easily pass through the plasma membrane by simple diffusion because they
(A) Are water soluble
(B) Contain carbon and hydrogen
(C) Enter through pores
(D) Are lipid soluble
Sol. (D)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. The follicle stimulating hormone is secreted from
(A) Posterior lobe of pituitary gland
(B) Reproductive gland
(C) Thyroid gland
(D) Anterior lobe of pituitary gland
2. "Sella turcica" is a
(A) Depression in brain enclosing pituitary
(B) Cavity of skull enclosing ears
(C) Covering of testis
(D) Kind of endocrine gland
3. I.C.S.H. in male acts on
(A) Cells of Leydig (B) Sertoli cells
(C) Spermatids (D) Spermatogonia
4. Diabetes insipidus disease is caused due to the deficiency of hormone produced by
(A) Pituitary (B) Adrenal
(C) Pancreas (D) Thyroid
5. Growth hormone of pituitary is more effective in
(A) Presence of thyroxine
(B) Absence of thyroxine
(C) Absence of Insulin
(D) Presence of adrenaline
6. Median eminence is part of
(A) Anterior pituitary (B) Hypothalamus
(C) Neurohypophysis (D) None of these
7. The two lobes of thyroid gland are joined by horizontal connection called
(A) Inter thyroidal connective
(B) Inter thyroidal commissure
(C) Intermediary lobe
(D) Isthmus
8. Hyper secretion of Parathyroid hormone results in
(A) Stronger bones due to increased incorporation of calcium in them
(B) Deposition of calcium in various skeletal structure
(C) No effect on the constitution of bones
(D) Weaker bones due to increased removal of calcium from them
9. Hyposcretion of aldosterone causes
(A) Gull's disease (B) Grave's disease
(C) Cushing's disease (D) Addison's disease
10. The hormones that initiate ejection of milk stimulates milk production and growth of ovarian follicles are respectively known as
(A) PRL, OT and LH (B) OT, PRL and FSH
(C) LH, PRL and FSH (D) PRL, OT and LH
11. Mammalian thymus is mainly concerned with
(A) Regulation of body temperature
(B) Regulation of body growth
(C) Immunological functions
(D) Secretion of thyrotropin
12. A hormone is :-
(A) An enzyme (B) Chemical messenger
(C) Primary messenger (D) 2 and 3 both
13. The receptors for protein hormones are present on
(A) Nucleus
(B) Endoplasmic reticulum
(C) Cytoplasm
(D) Cell-surface
14. Hormones are :-
(A) Internal secretion mostly discharged in the blood by endocrine glands
(B) Secretion of exocrine glands
(C) Chemical substances secreted into the gut
(D) Inorganic catalysts
15. Hormones are :
(A) Produced in low amount
(B) Easily diffusible
(C) Non - antigenic
(D) All
16. Hormones are :-
(A) Destroyed after use
(B) Not destroyed after use
(C) Non antigenic
(D) 1 and 3 both

CHEMICAL COORDINATION & INTEGRATION

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

- A hormone is
 - An enzyme
 - Chemical messenger
 - Primary messenger
 - both 2 and 3
- Integrative system in the body are
 - Endocrine system
 - Nervous system
 - Blood vascular system
 - Both endocrine and nervous system
- Hormones are
 - Internal secretion mostly discharged in the blood by endocrine glands
 - Secretion of endocrine glands
 - Chemical substances secreted into the gut
 - Inorganic catalysis
- Term "Hormone" was coined by
 - W.M. Baylis
 - E.H. Schally
 - E.H. Starling
 - Harris
- Hormones are chemically
 - Amino acid
 - Protein
 - Steroid
 - All
- Pituitary gland does not control the secretory activity of
 - Thyroid
 - Adrenal cortex
 - Adrenal medulla
 - Testes
- Which of the following controls spermatogenesis
 - FSH
 - LTH
 - LH
 - Vasopressin
- Adrenaline increases
 - Heart beat
 - Blood pressure
 - Both (A) & (B)
 - None
- Immuno competent process of T-lymphocyte occur in
 - Bone marrow
 - Cortex part of thymus
 - Peyer's patches
 - Medulla part of thymus
- Norepinephrin hormone is secreted from
 - Zona glomerulosa
 - Zona fasciculata
 - Zona reticularis
 - Medulla of adrenal
- Which of the following is not paired correctly
 - Myxoedema - swollen facial tissues
 - Insulin - raises blood glucose
 - Parathyroid - tetany
 - Cretinism - mentally retarded
- A patient of diabetes mellitus excreted glucose in urine even when he kept in a carbohydrate free diet. It is because
 - Fats are catabolised to form glucose
 - Amino acids are catabolised in liver
 - Amino acids are discharged in blood stream from liver
 - Glycogen from muscles are discharged in blood stream from liver
- Match the list I with list II
 - Adenohypophysis
 - Adrenal medulla
 - Parathyroid gland
 - Thymus gland
 - Epinephrine
 - Somatotropin
 - Thymosin
 - Parathormone
 - A = 3, B = 1, C = 4, D = 2
 - A = 1, B = 2, C = 3, D = 4
 - A = 2, B = 1, C = 4, D = 3
 - A = 4, B = 3, C = 2, D = 1
- If receptor molecule is removed from target organ for hormone action, the target organ will
 - Continue to respond but require higher concentration of hormone
 - Continue to respond but in opposite way
 - Continue to respond without any difference
 - Not respond to hormone

Exercise # 3**PART - 1****MATRIX MATCH COLUMN**

1. Match Column-I with Column - II and select the correct option from the codes given below.

Column - I

- A. Testis
B. Ovaries
C. Thymus
D. Melanin

Column - II

- i. Pigmentation
ii. Atrophies in adult
iii. Estrogen
iv. Testosterone

- (A) A-iii, B-iv, C-i, D-ii (B) A-ii, B-iii, C-iv, D-i (C) A-iv, B-iii, C-ii, D-i (D) A-i, B-iv, C-ii, D-iii

2. Match Column - I with Column - II and select the correct option from codes given below.

Column - I

- A. Hypothalamus
B. Anterior pituitary
C. Testis
D. Ovary

Column - II

- i. Relaxin
ii. Estrogen
iii. FSH and LH
iv. Androgen
v. Gonadotropin releasing hormone

- (A) A-v, B-iii, C-iv, D-ii (B) A-v, B-iii, C-ii, D-iv (C) A-i, B-ii, C-iv, D-iii (D) A-iii, B-v, C-iv, D-iii

3. Match Column - I with Column - II and select the correct option from codes given below.

Column - I

- A. Oxytocin
B. Prolactin
C. Lutenising hormone
D. Progesterone

Column - II

- i. Stimulates ovulation
ii. Implantation and maintenance of pregnancy
iii. Lactation after childbirth
iv. Uterine contraction during labour
v. Reabsorption of water by nephrons

- (A) A-v, B-iv, C-i, D-ii (B) A-iv, B-i, C-ii, D-iii (C) A-iv, B-iii, C-i, D-ii (D) A-v, B-iii, C-ii, D-i

4. Match Column - I with Column -II and select the correct option from the codes given below.

Column - I

- A. Thyroid
B. Adrenal
C. Pituitary
D. Pineal

Column - II

- i. Acts on the renal tubules
ii. Regulates blood calcium levels
iii. Maintains diurnal rhythm of our body
iv. Acts on the melanocytes

- (A) A-iv, B-iii, C-ii, D-i (B) A-iii, B-iv, C-i, D-ii (C) A-iv, B-ii, C-iii, D-i (D) A-ii, B-i, C-iv, D-iii

5. Match Column-I with Column - II and select the correct option from the codes given below.

Column - I

- A. FSH
B. MSH
C. Vasopressin
D. Pars intermedia

Column - II

- i. Transported axonally to neurohypophysis from hypothalamus
ii. Acts on melanocytes and regulates pigmentation of skin
iii. Stimulates the growth and (ADH) development of ovarian follicles in female
iv. In human, it is almost merged with pars distalis

- (A) A-iii, B-ii, C-i, D-iv (B) A-i, B-ii, C-iii, D-iv
(C) A-iv, B-iii, C-ii, D-i (D) A-iii, B-ii, C-iv, D-i

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. A common scent - producing gland among mammals is [CBSE AIPMT-2000]
(A) anal gland (B) prostate
(C) adrenal gland (D) Bartholin's gland
2. Melanocyte stimulating Hormone (MSH) is produced by [CBSE AIPMT-2000]
(A) anterior pituitary
(B) posterior pituitary
(C) pars intermedia of pituitary
(D) parathyroid
3. Melatonin is secreted by [CBSE AIPMT-2000]
(A) skin (B) thymus
(C) pituitary (D) pineal gland
4. Which steroid is used for transformation ? [CBSE AIPMT-2002]
(A) Cortisol (B) Cholesterol
(C) Testosterone (D) Progesterone
5. Adrenaline directly affects [CBSE AIPMT-2002]
(A) SA node
(B) β -cells of Langerhans
(C) dorsal root of spinal cord
(D) epithelial cells of stomach
6. Melanin protects from [CBSE AIPMT-2002]
(A) UV-rays (B) visible rays
(C) infra-red rays (D) X-rays
7. When both ovaries are removed from rat which hormone is decreased in blood ? [CBSE AIPMT-2002]
(A) Oxytocin
(B) Prolactin
(C) Estrogen
(D) Gonadotropic releasing factor
8. Mainly which type of hormones control the menstrual cycle in human beings. [CBSE AIPMT-2002]
(A) FSH (B) LH
(C) FSH, LH estrogen (D) Progesterone
9. Acromegaly is caused by [CBSE AIPMT-2002]
(A) Epinephrine (B) Progesterone
(C) Prostaglandin (D) Oestrogen
10. Which one of the following hormones is a modified amino acid ? [CBSE AIPMT-2004]
(A) Epinephrine (B) Progesterone
(C) Prostaglandin (D) Oestrogen
11. Which of the following hormones is not a secretion product of human placenta ? [CBSE AIPMT-2004]
(A) Human chorionic gonadotropin
(B) Prolactin
(C) Oestrogen
(D) Progesterone
12. Which one of the following pairs correctly matches a hormone with a disease resulting from its deficiency ? [CBSE AIPMT-2004]
(A) Luteinising hormone - Failure of ovulation
(B) Insulin - Diabetes insipidus
(C) Thyroxine - Tetany
(D) Parathyroid hormone - Diabetes mellitus
13. Chemically hormones are [CBSE AIPMT-2004]
(A) biogenic amines only
(B) proteins, steroids and biogenic amines
(C) proteins only
(D) steroids only
14. Which of the following is an accumulation and release centre of neurohormones [CBSE AIPMT-2006]
(A) Posterior pituitary lobe
(B) Intermediate lobe of the pituitary
(C) Hypothalamus
(D) Anterior pituitary lobe
15. A steroid hormone which regulates glucose metabolism is [CBSE AIPMT-2006]
(A) cortisol (B) corticosterone
(C) 11-deoxycorticosterone
(D) cortisone
16. Sertoli cells are regulated by the pituitary hormone known as [CBSE AIPMT-2006]
(A) FSH (B) GH
(C) prolactin (D) LH
17. Which hormone causes dilation of blood vessels, increased oxygen consumption and gluconeogenesis ? [CBSE AIPMT-2006]
(A) ACTH (B) Insulin
(C) Adrenaline (D) Glucagon

1. Cells die at the time of release of secretory materials in
(A) holocrine gland (B) apocrine gland (C) merocrine gland (D) mixed gland
2. Gonadotropin releasing hormone is transferred to anterior pituitary by
(A) left coronary artery (B) hypophyseal portal veins
(C) axons of neurosecretory cells (D) nuclei of hypothalamus
3. Function of the somatostatin is to
(A) stimulate pituitary synthesis and release gonadotropins
(B) inhibit the release of gonadotropins from pituitary
(C) stimulate pituitary and promotes the secretion of growth hormone
(D) inhibit the release of growth hormone from the pituitary
(E) stimulate the secretion of thyrotropin from thyroid.
4. The posterior pituitary gland is not a 'true' endocrine gland because
(A) it is provided with a duct (B) it only stores and releases hormones
(C) it is under the regulation of hypothalamus (D) it secretes enzymes.
5. Secretion of which of the following hormones is not pituitary dependent?
(A) Triiodothyronine (B) Testosterone (C) Glucocorticoids (D) Parathyroid hormone
6. Diabetes insipidus is related to
(A) ADH (B) glucagon (C) insulin (D) TSH
7. The hormone 'melatonin' is secreted by the gland
(A) pineal (B) thyroid (C) pituitary (D) adrenal
8. Graves' disease is caused due to
(A) hyposecretion of thyroid gland (B) hypersecretion of thyroid gland
(C) hyposecretion of adrenal gland (D) hypersecretion of adrenal gland
9. Deficiency of thyroxine in an adult causes a disease characterised by low BMR, low body temperature, scaly skin etc. The disease is
(A) myxoedema (B) cretinism (C) Grave's disease (D) Basedow's disease
10. Which of the following statements is wrong?
(A) Sella turcica is a bony cavity where the pituitary gland is located
(B) Parathyroid hormone decreases the Ca^{2+} levels in blood.
(C) Thymosins play a major role in T cell differentiation.
(D) The middle layer of adrenal cortex is zona fasciculata.
(E) Insulin stimulates glycogenesis.
11. Match correctly.
(A) Thyroxine – tetanus
(B) Insulin – diabetes insipidus
(C) Adrenaline – hepatitis
(D) Parathyroid – tetany

www.blog.neetnearme.com

CELL : THE UNIT OF LIFE

“The cause of nutrition and growth resides not in the organism as a whole, but in the separate elementary parts — the cells.”

“THEODORE SCHWANN (1810-1882)”

INTRODUCTION

When you look around, you see the diversity of living world comprising of various organisms like microscopic bacteria to huge multicellular plants and animals. You must have also wondered and asked yourself several times - “What is it that makes an organism living, or what is it that an inanimate thing does not have which a living thing has?” The answer to this is the presence of the basic unit of life--the cell in all living organisms.

All living organisms possess life and are made up of basic unit structure called **Cell**. An organisms consists of one or more cells. Accordingly there are of two types of organisms:

(i) Unicellular organisms-e.g. Amoeba, Diatoms etc. (ii) Multicellular organisms e.g. Plants, Animals etc.

CELL : THE UNIT OF LIFE**What is Cytology?**

Cytology : Structural study of cell

What is Cell Biology?

Cell Biology : Structural & Functional study of cell.

HISTORY

Discovery of cell – In 1665 Robert Hooke examined thin slices of cork under his self made microscope (Magnification = 42 times). The cork seen was dead bark of spanish oak (*Quercus suber*). Robert Hooke coined the term "Cellula" for Honey comb like structure of bottle cork (Greek cellulae = Hollow space) which later modified to cell. Actually he saw only the dead cell walls of plant cells. He published his findings in his book 'Micrographia'.

Karl Nageli showed that cells in plants arises by the division of pre existing cell.

- Discovery of living cell by **Leeuwenhoek**–
- Leeuwenhoek examined mud, semen, saliva, blood, Insects etc. Under his self made microscope and observe protozoans, sperm, bacteria, RBC, muscle cells etc.
- He called these tiny creatures as "Animalcules" and published his finding in "Secrets of nature".
- He is known as father of microbiology, father of bacteriology, father of protozoology.

R. Virchow stated "Omnis cellula e cellula" which means all cells arises from pre existing cell. This is known as "**Law of Lineage**".

- Father of cytology is **Hertwig & R. Hooke**.
- Father of Indian cytology is **Dr. A.K. Sharma**.
- Father of modern cytology is **C.P. Swannson**.

General facts Related With cells

- **Longest cell** is nerve cell of Giraffe. (more than 1m) (90 cm in man).
- **Largest cell** is egg of ostrich (17cm x 13.5 cm dimension).
- Smallest cell is PPLO (Pleuro Pneumonia Like Organism).
- Smallest plant cell mycoplasma *Laidlawii* 0.1 μ .
- Largest plant cell – *Acetabularia* (10cm)
- Longest plant cell – Remy fibre (*Boehmerianevia*)
- Centre for cellular and molecular biology is at **Hyderabad**.

Cell Theory

Cell theory → 

- Cell theory was proposed by **Schleiden** and **Schwann**.
- According to cell theory, all living things are made up of cells.
- Cell is structural and functional unit of living being.
- They have power of Reproduction.

- Apposition

Intussusception

- When the particles are deposited between the substance which are already present then this types of growth is called **Intussusception Growth**
- This types of growth takes place in primary, secondary and tertiary cell wall.

Apposition (Accretion)

- When the **layers** are desposited on to the layers which are present already , then this types of growth is called apposition growth
- This types of growth takes place in **secondary cell wall**.

Functions

- Cell wall protects the protoplasm.
- Cell wall gives a particular size & shape to cell & functions in form of exoskeleton of cell.
- It gives a mechanical support to cell.
- Cell wall is permeable so it helps in transport of water & mineral substances
- Cell wall plays an important role in absorption, transpiration, transport and secretion etc.



ED OS KEY POINTS

1. The middle lamella can be dissolved by strong acid only.
2. Bacterial cell without cell wall is called **Lister-Form** (L-form)
3. **Mucopeptide** is a polymer of two amino-sugar, N-acetyl Glucosamine (NAG) and N-acetyl muramic acid (NAM).
4. In **cellulose**, a polymer of **unbranched chain of glucose** molecule linked by **-1-4 glycosidic bond**.
5. The cellulose formation is takes place in presence of **cellulose synthetase** enzymes which is present in membrane.

Cell Coat (Glycocalyx)

Position –

It is found outside the plasma membrane in many **protistants** and animals cell. Made by **sialic acid** mucin & Hyaluronic acid

Function –

- It protects the underlying plasma membrane.
- It provides definite shape to the cell.
- It helps in recognition of microbes for defence.

PLASMA MEMBRANE

- Term **plasma lemma** was given by **J.Q. Plover (1885)**.
- Term cell membrane or **plasma membrane** was given by **Nagelli**.
- Term **unit membrane** was given by **Robertson**.
- At first, structure of cell membrane was studied by **Overton** and postulated that cell membrane is composed of a continuous layer of lipid material.
- It is outermost boundary of animal cell.

ED

TS

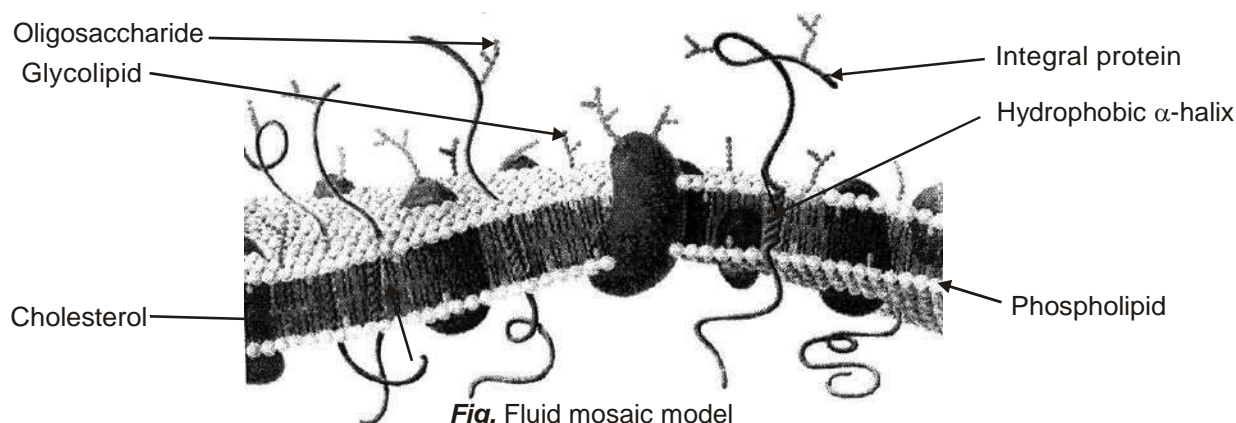
1. Plasma membrane is a thin selective permeable & living membrane.
2. It is flexible and porous membrane.
3. Plasmalemma of animal cells is elastic due to the presence of **lipids**.

Model of cell membrane

To describe structure of plasma membrane numerous models have been proposed but the important model are as follow :-

Fluid mosaic model (1973)

- This model was proposed by **Singer and Nicholson**.
- It described protein as ice bergs in a sea of lipids.
- It is the most accepted model.
- There is a central bilipid layer (2 layer) composed of phospholipids arranged in a specific manner.
- Hydrophilic polar head constitute top and bottom surfaces.
- Hydrophobic non polar tail end-are buried in the membrane.
- Within phospholipid, bilayer, proteins are arranged in (2) forms
 - Intrinsic proteins
 - Extrinsic proteins



Intrinsic proteins (70%)

- Such protein partially or wholly remain embedded in phospholipid.

- The cell is the basic structural, functional and biological unit of all known living organisms,
- Robert Hooke (1665) observedd honey-comb like dead cells in a thin slice of cork and named them 'cell'. Anton van
- Leeuwenhoek (1667) was the first to describe a living cell.
- The properties of a living organism depend on those of its individual and RNA found in the cell nucleus and cytoplasm.
- All cells are basically the same in chemical composition in organisms of similar species. Energy flow (metabolism and biochemistry) occurs within cells.)

CELL THEORY (Magna Carta of Cell Study)

- MJ Schleiden ; 1838 and Theodor Schwann; 1839.
 - The postulates are:
 - (a) All living beings are made up of cells (cell is the basic unit of life).
 - (b) All cells arise from pre-existing cells (Omnis cellula e cellula - Rudolf Virchow).
 - (c) Cell is the smallest independent unit of life.
 - Size of biological cell is generally too small to be seen without a microscope. There are exceptions as well as considerable range in the sizes of various cell types.
 - Growth of Cell Wall
- The growth and formation of cell wall occurs by two ways:
- (i) By intussusception : It is the deposition of wall material in the form of fine grains.
 - (ii) By apposition : In this method, the new cell wall material secreted by protoplasm is deposited by definite thin plates one after other.
- Function of the cell wall :
 - (i) It maintains the shape of plant cell and protects it from mechanical injury.
 - (ii) It wards off the effect of pathogens.

→ Plasma Membrane

Plasmalemma contains about 58 - 59 % proteins, 40 % lipids and 1-2 % carbohydrates.

- Autosomes: These are the somatic chromosomes which do not take part in fertilisation process. These are also called allosomes and they are 44 in number in human body.

MITOCHONDRIA

- Visible under the microscope only after specific staining.
- Number per cell is variable, depending on the physiological activity of the cells.

SOLVED EXAMPLE

Ex.1 Who invented the "electron microscope"

- (A) Knoll and Ruska
- (B) Robert Brown
- (C) Correns
- (D) Janssen and Janssen

Sol. (A)

Ex.2 With the increase in diameter of the rotor, the effective RCF (relative centrifugal force) at a fixed RPM (revolutions per minute) will

- (A) Remain unaffected
- (B) Increase
- (C) Decrease
- (D) Be lower at the bottom of centrifugal tube

Sol. (B)

Ex.3 Detailed structure of the membrane was studied after the advent of electron microscope during

- (A) 1930's
- (B) 1950's
- (C) 1970's
- (D) 1990's

Sol. (B)

Ex.4 Which of the following is used for observing spindle fibres

Or

The microscope usually used for seeing living cells or tissues

- (A) Dark field microscope
- (B) Phase contrast microscope
- (C) Polarisation microscope
- (D) Scanning transmission electron microscope

Sol. (B) : Phase contrast microscope is used to observe living cells and cell organs i.e., spindle fibres, pinocytosis, karyokinesis, cytokinesis etc.

Ex.5 Who proposed the "Cell theory"

- (A) Schleiden (botanist) and Schwann (zoologist)
- (B) Watson and Crick
- (C) Mendel and Morgan
- (D) Robert Hooke

Sol. (A) : M. J. Schleiden and T. Schwann (1838 - 39) proposed cell theory

Ex.6 Which of the following is absent in prokaryotes

- (A) Nuclear membrane
- (B) Golgi bodies
- (C) Endoplasmic reticulum
- (D) All the above

Sol. (D)

Ex.7 Middle lamella is made up of

- (A) Cellulose
- (B) Suberin
- (C) Calcium and magnesium pectate
- (D) Lignin

Sol. (C)

Ex.8 Plant cell wall consists of

- (A) Lignin + hemicellulose + pectin + lipid
- (B) Lignin + protein + hemicellulose + pectin
- (C) Lignin + hemicellulose + pectin + cellulose
- (D) Lignin + hemicellulose + tubulin + lipid

Sol. (C)

Ex.9 Cell wall is absent in

- (A) Gametes
- (B) Amoeba
- (C) Mycoplasma
- (D) All of these

Sol. (D)

Ex.10 The type of cell junction which facilitates cell to cell communication is

- (A) Tight junction
- (B) Adhering junction
- (C) Gap junction
- (D) Desmosomes
- (E) Brush borders

Sol. (C)

Ex.11 According to widely accepted "Fluid mosaic model" cell membranes are semi-fluid, where lipids and integral proteins can diffuse randomly. In recent years, this model has been modified in several respects. In this regard, which of the following statements is incorrect

- (A) Proteins in cell membranes can travel within the lipid bilayer
- (B) Proteins can also undergo flip-flop movements in the lipid bilayer.
- (C) proteins can remain confined within certain domains of the membrane
- (D) Many proteins remain completely embedded within the lipid bilayer

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Which of the following is the smallest cell-
(A) Human nerve cells (B) Chlamydomonas
(C) Virus (D) PPLO
2. Which of the following is true of the carbohydrate portion of the cell membrane-
(A) It contributes to the polycationic charge on the extracellular surface
(B) It is 1% of plasma membrane
(C) It is found primarily in the form of free saccharide groups
(D) It has a symmetric distributions
3. Plasmalemma of animal cells is elastic due to the presence of-
(A) Proteins (B) Lipids
(C) Carbohydrates (D) Microfilaments
4. The most abundant substance of middle lamella is-
(A) Lignin (B) Suberin
(C) Pectin (D) Cutin
5. Cell wall is the secretory product of-
(A) Lysosomes (B) Cytoplasm
(C) Plasmodesmata (D) Middlelamella
6. The size of the nucleolus is large where-
(A) Protein synthesis is active
(B) Protein synthesis is less
(C) No protein synthesis occurs
(D) None of the above
7. Aerobic respiration is performed by-
(A) Iyosomes (B) Chloroplast
(C) Mitochondria (D) Glyoxysomes
8. Mitochondria are most abundant in-
(A) Heart muscle (B) Muscles of thigh
(C) Wings of birds (D) None
9. Cytochrome oxidases are found-
(A) On outer wall of mitochondria
(B) In the matrix of mitochondria
(C) In the lysosomes
(D) On cristae of mitochondria
10. Small particles present on inner mitochondrial membrane are called-
(A) Cristae (B) Ergatosomes
(C) Elementary particles (D) Quantasome
11. Lysosomes are called "suicide bags" because they have-
(A) Catabolic enzymes (B) Food vacuole
(C) Hydrolytic enzymes (D) Parasitic activity
12. In which of the following cells the endoplasmic reticulum is absent-
(A) Kidney cells
(B) Liver cells
(C) Mammalian mature erythrocytes
(D) Mammalian eye cells
13. If cells are broken up and sedimented by centrifugation, the new structures formed in one of the fraction is-
(A) Centrosomes (B) Microsomes
(C) Peroxisomes (D) Lysosomes
14. The endoskeleton of the cell is made up of-
(A) Cell wall (B) Cytoplasm
(C) E.R. (D) Mitochondria
15. Match the following
(A) Microtubules - Structural component of cilia
(B) Centrioles - Store hydrolases
(C) Peroxisomes - Stores carbohydrate, fats and proteins in plants
(A) 1 correct, 2 and 3 false
(B) 1 and 3 correct, 2 false
(C) 1 and 2 correct, 3 false
(D) All are false
16. The carbohydrates which project out of the lipid bilayer in animal cell membrane are linked to -
(A) Lipids only (B) Proteins only
(C) Peptidoglycan (D) Both lipid & protein

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. Butter Sandwich model of plasma membrane was proposed by -
 (A) Davson and Danielli
 (B) Robertson
 (C) Singer and Nicolson
 (D) Benson
2. Ingestion of solid food by plasma membranes is called -
 (A) Endosmosis (B) Pinocytosis
 (C) Cytokinesis (D) Phagocytosis
3. In order to find out quickly whether the cells are living one must observe -
 (A) Cell sap
 (B) Tonoplast
 (C) Movement of Cytoplasm
 (D) Starch granules
4. Maximum enzymes are found in -
 (A) Lysosomes (B) Mitochondria
 (C) Nucleus (D) E.R.
5. Rough E.R. mainly responsible for -
 (A) Protein synthesis
 (B) Cell wall formation
 (C) Lipid synthesis
 (D) Cholesterol synthesis
6. Mitochondria supply most of the necessary biological energy through -
 (A) Breaking down sugars
 (B) Reducing NADP
 (C) Oxidising substrates of TCA cycle
 (D) Breaking down proteins
7. Enzymes for ETS occurs in (mitochondria)-
 (A) Matrix
 (B) Outer wall
 (C) Inner membrane
 (D) Between inner & outer wall
- 8.
9. Mitochondrial DNA is -
 (A) Naked (B) Circular
 (C) Double stranded (D) All the above
10. Lysosomes are not helpful in -
 (A) Osteogenesis
 (B) Cellular digestion
 (C) Metamorphosis in frog
 (D) Lipogenesis
11. Digestion of hormonal vesicle by lysosome is called -
 (A) Crinophagy (B) Heterophagy
 (C) Autophagy (D) Autolysis
12. In mammals, the mitochondrial ribosomes are
 (A) 55s (B) 70s
 (C) 80s (D) 100s
13. Mitochondria are site of respiration first reported by Kingsbury and supported by Hogeboom. Mitochondria are related with the oxidation of -
 (A) Carbohydrates (B) Fats
 (C) Proteins (D) All the above
14. Peptidyl transferase enzyme found on -
 (A) Cytoplasm (B) E.R.
 (C) Golgibody (D) Ribosomes
15. Which of the following is absent in an intact cell :-
 (A) Microsomes (B) Golgibody
 (C) Glyoxysomes (D) Microtubules
16. Which microscope is best study cell division in functional state -
 (A) EM
 (B) SEM
 (C) Phase contrast microscope
 (D) Simple microscope

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match Column-I with Column-II and select the correct option from the codes given below

Column - I

- A. Leeuwenhoek
- B. Robert Brown
- C. Schleiden
- D. Schwann

- (A) A-i, B-iii, C-iv, D-ii
- (C) A-iii, B-i, C-iv, D-ii

Column - II

- i. First saw and described a living cell
- ii. Presence of cell wall is unique to plant cells
- iii. Discovered the nucleus
- iv. All plants are composed of different kind of cells

- (B) A-i, B-iii, C-ii, D-iv
- (D) A-i, B-iv, C-ii, D-iii

2. Which one is the mis-matched pair?

- A. Largest isolated single cell
- B. Golgi apparatus
- C. Mitochondria
- D. Lysosomes

- Egg of an ostrich
- Discovered by Altman
- Name was given by Benda
- Discovered by de Duve

3. Match Column-I with Column-II and select the correct option from the codes given below.

Column - I

- A. Mitochondria
- B. Lysosomes
- C. Ribosomes
- D. Nucleus

Column - II

- i. Without membrane
- ii. Single membrane
- iii. Double membrane

- | A | B | C | D |
|---------|-----|-----|-----|
| (A) i | ii | iii | iii |
| (B) iii | i | i | ii |
| (C) iii | ii | i | iii |
| (D) ii | iii | i | iii |

4. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Dictyosomes
- B. Mitochondria
- C. Vacuoles
- D. Grana

Column - II

- i. Storage
- ii. Photosynthesis
- iii. Transport
- iv. Secretion
- v. Respiration

- | A | B | C | D |
|--------|----|-----|-----|
| (A) iv | v | i | ii |
| (B) i | ii | iv | iii |
| (C) iv | i | ii | iii |
| (D) i | ii | iii | iv |

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. The cell organelle involved in glycosylation of protein [CBSE AIPMT-2000]
 - (A) ribosome
 - (B) peroxisome
 - (C) endoplasmic
 - (D) mitochondria
2. Lysosomes are reservoirs of [CBSE AIPMT-2000]
 - (A) RNA and protein
 - (B) fats
 - (C) secretory glycoproteins
 - (D) hydrolytic enzymes
3. Microtubules are absent in [CBSE AIPMT-2001]
 - (A) mitochondria
 - (B) centriole
 - (C) flagella
 - (D) spindle fibres
4. In 'fluid mosaic model of plasm [CBSE AIPMT-2002]
 - (A) upper layer is non-polar and hydrophilic
 - (B) upper layer is polar and hydrophobic
 - (C) phospholipids form a bimolecular layer in middle part
 - (D) proteins form a middle layer
5. Ribosomes are produced in [CBSE AIPMT-2002]
 - (A) nucleolus
 - (B) cytoplasm
 - (C) mitochondria
 - (D) golgi body
6. Flagella of prokaryotic and eukaryotic cells differ in [CBSE AIPMT-2004]
 - (A) type of movement and placement in cell
 - (B) location in cell and mode of functioning
 - (C) microtubular organisation and type of movement
 - (D) microtubular organisation and function
7. In chloroplasts, chlorophyll is present in the [CBSE AIPMT-2004]
 - (A) outer membrane
 - (B) inner membrane
 - (C) thylakoids
 - (D) stroma
8. Extra nuclear inheritance is a consequence of presence of genes in [CBSE AIPMT-2004]
 - (A) mitochondria and chloroplasts
 - (B) endoplasmic reticulum and mitochondria
 - (C) ribosomes and chloroplast
 - (D) lysosomes and ribosomes
9. A student wishes to study the cell structure under a light microscope cell structure under a light microscope having 10X eyepiece and 45X objective. he should illuminate the object by which one of the following colours of light so as to get the best possible resolution ? [CBSE AIPMT-2004]
 - (A) Blue
 - (B) Green
 - (C) Yellow
 - (D) Red
10. Chlorophyll in chloroplast is located in [CBSE AIPMT-2005]
 - (A) grana
 - (B) pyrenoid
 - (C) stroma
 - (D) Both (A) and (C)
11. Protein synthesis in an animal cell occurs [CBSE AIPMT-2000,05]
 - (A) only on the ribosomes present in cytosol
 - (B) only on ribosomes attached to the nuclear envelope and endoplasmic reticulum
 - (C) on ribosomes present in the nucleolus as well as in cytoplasm
 - (D) on ribosomes present in cytoplasm as well as in mitochondria
12. According to widely accepted 'fluid mosaic model', cell membranes are semifluid, where lipids and integral proteins can diffuse randomly. In recent years, this model has been modified in several respects. In this regard, which of the following statements is incorrect? [CBSE AIPMT-2005]
 - (A) Proteins in cell membranes can travel within the lipid bilayer
 - (B) Proteins can also undergo flip-flop movements in the lipid bilayer
 - (C) Proteins can remain confined within certain domains of the membrane
 - (D) many proteins remain completely embedded within the lipid bilayer
13. The main organelle involved in modification and routing of newly synthesised proteins to their destinations is [CBSE AIPMT-2005]
 - (A) chloroplast
 - (B) mitochondria
 - (C) lysosome
 - (D) endoplasmic reticulum

MOCK TEST

1. A nanometre is
(A) 10^{-9} m (B) 10^{-4} m (C) 10^{-6} m (D) 10^{-12} m
(E) 10^9 m
2. Objects less than $0.2 \mu\text{m}$ in size cannot be seen under light microscope because
(A) the wavelength of visible light is 3900 \AA to 7800 \AA
(B) only two types of lenses are used
(C) maximum magnifying power of ocular lens is 20 X
(D) maximum magnifying power of objective lens is 100 X.
3. The microscope usually used for seeing living cells or tissues is
(A) compound microscope (B) electron microscope
(C) phase contrast microscope (D) light microscope
4. Numerical aperture of microscope lens is expressed by
(A) angular aperture only (B) refractive index only
(C) both angular aperture and refractive index (D) wave length of the light used
5. “*Omnis cellula-e cellula*” was stated by
(A) Schwann (B) Schleiden (C) Purkinje (D) Virchow
6. Cells divide and new cells are formed from pre-existing cells. This concept was given by
(A) Matthias Schleiden
(B) Theodore Schwann
(C) Matthias Schleiden and Theodore Schwann
(D) Rudolf Virchow
7. **Assertion :** Pili are tubular structures present in bacteria which help in conjugation.
Reason : Formation of pili is controlled by F^+ or fertility factor.
(A) If both assertion and reason are true and reason is the correct explanation of assertion.
(B) If both assertion and reason are true but reason is not the correct explanation of assertion.
(C) If assertion is true but reason is false.
(D) If both assertion and reason are false.
8. Which of the following structures is not found in a prokaryotic cell?
(A) Mesosome (B) Plasma membrane (C) Nuclear envelope (D) Ribosome
9. Select the mismatch.
(A) Gas vacuoles – Green bacteria (B) Large central vacuoles – Animal cells
(C) Protists – Eukaryotes (D) Methanogens – Prokaryotes
10. Mitochondria and chloroplast are
(A) semi-autonomous organelles
(B) formed by division of pre-existing organelles and they contain DNA but lack protein synthesising machinery.
Which one of the following options is correct?
(A) (A) is true but (B) is false (B) Both (A) and (B) are false
(C) Both (A) and (B) are correct (D) (B) is true but (A) is false

www.blog.neetnearme.com

ANATOMY OF FLOWERING PLANTS

[We need not think] that there is any Contradiction, when Philosophy teaches that to be done by Nature; which religion, and the Sacred Scriptures, teach us to be done by God: no more, than to say, That the balance of a Watch is moved by the next Wheel, is to deny that Wheel, and the rest, to be moved by the Spring; and that both the Spring, and all the other Parts, are caused to move together by the Maker of them. So God may be truly the Cause of This Effect, although a Thousand other Causes should be supposed to intervene: For all Nature is as one Great Engine, made by, and held in His Hand.

“NEHEMIAH GREW (1641-1712)”

INTRODUCTION

The study of internal structures of organisms is called Anatomy. You can also see the structural similarities and variations in the external morphology of the larger living organism, both plants and animals. This topic will help you to understand the internal structures and functional organisation of higher plants. It also includes the study of type of cells present in the body; whether eukaryotic and prokaryotic, approximate number of cells in the body, their organisation into tissues and in turn, the tissues are organised into organs, etc.

Through this topic, you will be able to answer the questions like how the plants survive in aquatic conditions, carry out their life processes.

PLANT ANATOMY

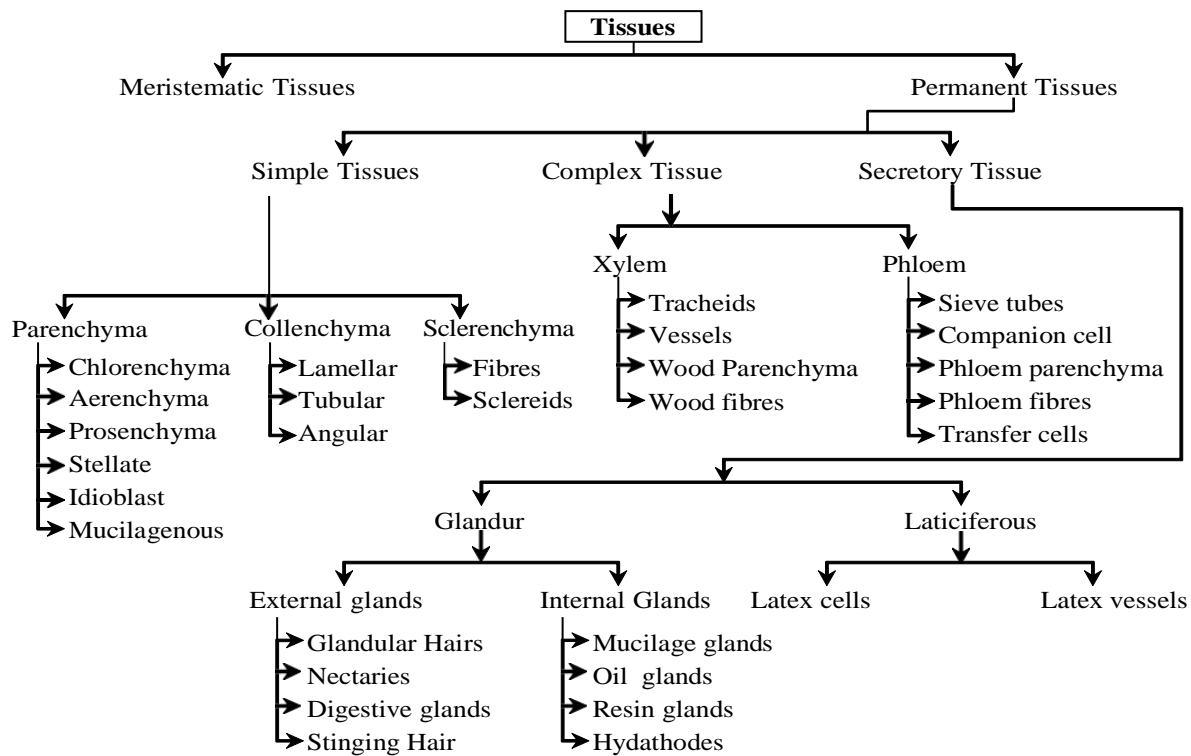
PRIMARY STRUCTURE OF PLANTS

PLANT ANATOMY

- It is the branch of Botany which deals with study of internal structures and organization of plants by the section cutting is called **Plant anatomy**.
- Anatomy is a Greek Word. Ana → asunder & temnein → to cut. Plant anatomy is also called as **Internal Morphology**.
- **N.Grew** is known as father of plant anatomy.
- **K.A. Chaudhary** is known as father of Indian plant Anatomy.

PLANT TISSUE

- An organized group of cells which is having similar or dissimilar in shape, having a common origin and usually performing a common function is called **tissue**.
- The term tissue was coined by **Nehemiah Grew**.



MERISTEMATIC TISSUE :

- Term given by Nageli.
- **Meristem** : A meristem is a localized region in which actual cell division occurs. Growth in plants is largely restricted to specialised regions of active cell division called meristem.

CHARACTERISTICS OF MERISTEMATIC TISSUE :

- It is an **undifferentiated tissue**.
- They have **prominent** and large nucleus.
- They do not have **intercellular** spaces. Cells are closely fitted (Packed) together. So it is a **compact tissue**.
- Meristematic cells have only primary cell wall which is thin and flexible (elastic) and made up of cellulose. Secondary cell wall is absent.
- They have **dense cytoplasm**.
- Cell cycle of meristem is in **continuous** state of division. It means they have the capacity to divide. So meristematic tissue is composed of **immature cells**.
- Cells of meristem are small and isodiametric.
- Normally vacuoles are absent in meristematic cells but if present they are small.
- Meristematic cells are **metabolically** highly active so lack of reserve food occurs in these cells.
- **Plastids** are **absent** in meristems. If they are present, then only in the **proplastid stage** ER is poorly developed.

CLASSIFICATION OF MERISTEMATIC TISSUE :

MERISTEMATIC TISSUE BASED ON ORIGIN AND DEVELOPMENT

On the basis of origin and development meristems can be divided into following three types :

- Promeristem/Embryonic Meristem/Primordial Meristem :**
 - This meristem develops in beginning during embryonic stage.
 - They divide and give rise to primary meristem.
- Primary meristem :**
 - Meristematic cell developed from promeristem are known as **primary meristem**.
 - These cells are always in division phase and form primary permanent tissue.
 - They are present below the promeristem at shoot and root apices, at the apex of leaves and in intercalary parts.
- Secondary meristem :**
 - These are the meristems developed from primary permanent tissues. They are not present in the embryonic stage of the plant. These are present in mature region of root and stem of many plants particularly those that produce woody axis.

- Axillary bud is derived from shoot apical meristem .
- Both apical meristem and intercalary meristem are primary meristem, because they appear early in life of a plant and contribute to the formation of the primary plant body.
- Lateral meristems are cylindrical.
- Intrafascicular cambium is an example of primary lateral meristem .
- Interfascicular cambium and cork cambium (phellogen) are examples of secondary lateral meristem .
- In the dicot stem, vascular cambium is partly primary and partly secondary in origin .
- In the dicot root, vascular cambium is completely secondary in origin . “Parenchymatous cells are generally isodiametric .
- Collenchymatous cells are much thickened at the corners, due to deposition of pectin, cellulose and hemicellulose. Collechyma is present below epidermis either as a homogenous layer or in patches in herbaceous dicotyledonae stem.
- Cell walls of sclerenchymatous cells are thick and lignified .
- Sclereids are commonly found in the fruit wall of nuts, pulp of fruits like guava, pear & sapota, seed coats of legumes and leaves of tea.
- Tracheids are unicellular, whereas vessels are multicellular .
- Vessel is a long cylindrical tube-like structure made up of many cells called vessel elements .
- Xylem fibres have highly thickened walls and obliterated central lumens .
- The radial conduction of water takes place by the ray parenchymatous cells .
- In stems, the primary xylem is endarch, whereas in roots, the primary xylem is exarch .
- Gymnosperms have albuminous cells and sieve cells. They lack sieve tube and companion cells .
- The companion cells are specialised parenchymatous cells, which are closely associated with sieve tube elements The companion cells help in maintaining the pressure gradient in the sieve tubes .
- Phloem parenchyma is absent in most of the monocotyledonae .
- Phloem fibres (Bast fibres) are generally absent in primary phloem .
- Eucleate condition is found in mature sieve tube element and in mature vessel element.
- Protophloem has narrow sieve tubes, whereas metaphloem has bigger sieve tubes .
Jute, flax and hemp fibres are used commercially .
- Tissue systems are of three types on the basis of their structure, location and function .
- Epidermal cells are parenchymatous .
- Cuticle is absent in roots .
- The stomatal aperture, guard cells and surrounding subsidiary cells are together called stomatal apparatus . The root hairs are unicellular elongations of epidermal cells .
- The trichomes in the shoot system are usually multicellular .
- The ground tissue system consists of parenchyma, collenchyma and sclerenchyma .
- Radial vascular bundles are found in roots.
- Endodermal cells of roots are barrel-shaped having Casparian strips on radial and tangential walls. These are of a waxy-material-suberin.
- In dicot root, pith is small or inconspicuous, whereas in monocots roots pith is large and well developed .
- In roots conjunctive tissue is present between the xylem and the phloem. It is made up of parenchyma .
- Dicot roots are usually diarch to Tetrarch (Rarely hexarch), whereas monocot roots are usually polyarc

SOLVED EXAMPLE

Ex.1 A group of cell alike in form, function and origin is called

- (A) Organ (B) Organella
(C) Tissue (D) None of these

Sol. (C)

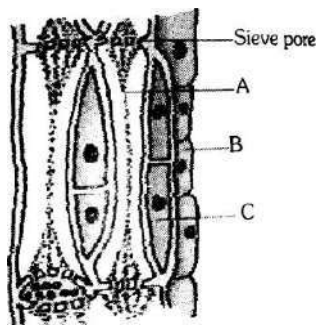
Ex.2 Companion cells are closely associated with
Or

Transport of food material in higher plants takes place through

- (A) Sieve elements (B) Vessel elements
(C) Trichomes (D) Guard cells

Sol. (A) : Companion cells are connected with sieve elements by complex plasmadesmata

Ex.3 See the following figures and identify the types of simple tissue marked by alphabets



- (A) A - Sieve tube, B - Companion cell, C - Phloem fibre
(B) A - Sieve tube, B - Phloem parenchyma, C - Phloem fibre
(C) A - Vessel, B - Xylem parenchyma, C - Companion cell
(D) A - Sieve tube, B - Phloem parenchyma, C - Companion cell

Sol. (D)

Ex.4 Interfascicular cambium develops from the cells of

- (A) Pericycle (B) Medullary rays
(C) Xylem parenchyma (D) Endodermis

Sol. (B)

Ex.5 The only plant cells without nuclei among the following are

Or

The tissue which is living but does not possess nucleus in mature state is

- (A) Cambium cells (B) Cells of pericycle
(C) Xylem parenchyma (D) Sieve tube

Sol. (D) : In sieve tubes, nucleus is present only in young stage and without nuclei at maturity

Ex.6 Sieve tubes are better suited for translocation, because

- (A) Possess broader lumen and perforated cross walls
(B) Are broader than long
(C) Possess bordered pits
(D) Possess no end walls

Sol. (A)

Ex.7 The root apex is subterminal because it

- (A) Is covered by tunica cells
(B) Is covered by root hairs
(C) Has many corpus cells
(D) Is covered by root cap

Sol. (D) A group of initial cells, present at the subterminal region of the growing root tip, which is protected by a root cap is called root apical meristem or root apex.

Ex.8 P – protein is found in

- (A) Collenchyma (B) Parenchyma
(C) Xylem (D) Sieve tube

Sol. (D) : A sieve tube is analogous to RBC, both being living but enucleated at maturity. A network of fibres of P₁ and P₂ protein is present in the central part of lumen of sieve tube which controls movement of materials and with callose, the sealing of pores after injury.

Ex.9 Function of companion cells is

- (A) Loading of sucrose into sieve elements by passive transport
(B) Loading of sucrose into sieve elements
(C) Providing energy to sieve elements for active transport
(D) Providing water to phloem

Sol. (B)

Ex.10 Casparian strips are present in the _____ of the root

- (A) Epiblema (B) Cortex
(C) Pericycle (D) Endodermis

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Bamboo, grass and mint stem elongate by the activity of -
(A) Primary meristem (B) Secondary meristem
(C) Intercalary meristems (D) Apical meristems
2. Maximum growth in root occurs –
(A) At its tip (B) Towards light
(C) Behind the apex (D) Towards apex
3. Periclinal division in a cell takes place by -
(A) Vertical cleavage
(B) Transverse cleavage
(C) Perpendicular cleavage
(D) Tangential cleavage
4. Monocot leaves grow by -
(A) Apical meristem (B) Lateral meristem
(C) Intercalary meristem (D) Dermatogen
5. Which of the following is a primary meristem -
(A) Intra fascicular cambium
(B) Cork cambium
(C) Vascular cambium in roots
(D) None of the above
6. In plants, during embryonic condition –
(A) All cells of the embryo divide
(B) Meristematic activity is confined to single apical cell
(C) Meristematic activity is confined to a group of apical cells
(D) Apical & lateral cells only divide
7. Which of the following plants grow by a single “apical cell” -
(A) Monocots (B) Dicots
(C) Gymnosperms (D) Bryophyta
8. Which of the following is secondary meristem
(A) Protoderm (B) Procambium
(C) Cork cambium (D) All of the above
9. The function of root cap is -
(A) Protection of root tip and control of geotropic movement
(B) Storage of food products
(C) Absorption of nutrients
(D) None of the above
10. Tunica is a rib meristem because it divides in -
(A) Anticlinal plane only
(B) Periclinal plane only
(C) Both 1 & 2
(D) Several different planes
11. The cells of a permanent tissue do not divide because these are -
(A) Dead (B) Enucleate
(C) Arrested at G-1 stage (D) Arrested at prophase
12. Plate meristem shows -
(A) Anticlinal divisions in two planes to right angle to each other
(B) Anticlinal divisions in one plane
(C) Both periclinal & anticlinal divisions in one plane
(D) Three dimensional divisions
13. Plastochron is -
(A) Period between initiation of two successive leaf primordia
(B) Distance between two successive leaf primordia
(C) Region of origin of root branch
(D) Region of origin of stem branch
14. A parenchyma cell which stores ergastic materials or waste substance is -
(A) Phragmoblast (B) Conidioblast
(C) Idioblast (D) Blastomere
15. The tissue not having specifically thickened walls are -
(A) Parenchyma (B) Collenchyma
(C) Fibres (D) Sclereids
16. According to histogen concept of apical meristem, three histogens are present. Which of the following is differentiated from perome
(A) Cortex (B) Xylem & Phloem
(C) Ground tissue system (D) Stele
17. Who differentiated tissue system in epidermal tissue system, ground tissue system and vascular tissue system -
(A) Hanstein (B) Buvet
(C) Sachs (D) Nageli

Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. Laticiferous vessels are found in -
 (A) Xylem tissue
 (B) Phloem tissue
 (C) Cortex
 (D) None of the above
2. When phloem is completely surrounded by xylem, the vascular bundle is called -
 (A) Concentric, leptocentric/amphivasal
 (B) Concentric, hadrocentric/amphicribal
 (C) Conjoint, Collateral
 (D) Conjoint, bicollateral
3. Amphivasal or leptocentric vascular bundles are found in -
 (A) *Cycas* and *Dryopteris*
 (B) *Dracaena*
 (C) *Helianthus* and *Cucurbita*
 (D) Maize and Wheat
4. Callose can occur in -
 (A) Phloem parenchyma
 (B) Companion cells
 (C) Sieve tubes
 (D) Tracheids
5. A narrow thin-walled cell with large nucleus and lying on the side of sieve tube is absent in
 (A) Angiosperms (B) Pteridophytes
 (C) Gymnosperms (D) Both (B) and (C)
6. An open collateral bundle is one in which -
 (A) Xylem and phloem are separated by cambium
 (B) Xylem and phloem lie side by side
 (C) Cambium occurs on the outside of bundle
 (D) Cambium does not occur in the bundle
7. Which is enucleate at maturity
 (A) Sieve cell (B) Companion cell
 (C) Cortical cell (D) Palisade cell
8. Longest fibres are found in -
 (A) Jute (B) Cotton
 (C) Sunn Hemp (D) Coir
9. Phloem tissue of angiosperms differs from that of gymnosperms in having -
 (A) Companion cells
 (B) Sieve cells
 (C) Sieve plates
 (D) None of the above
10. A bundle with xylem and phloem separated by a strip of cambium is -
 (A) Collateral and closed
 (B) Collateral and open
 (C) Concentric and closed
 (D) Bicollateral and open
11. Transport of water and dissolved minerals occurs through -
 (A) Phloem (B) Xylem
 (C) Sieve tubes (D) Sclerenchyma
12. Which one of the following comprises only simple tissues -
 (A) Parenchyma, Collenchyma and Sclerenchyma
 (B) Parenchyma, Xylem and Collenchyma
 (C) Parenchyma, Xylem and Sclerenchyma
 (D) Parenchyma, Xylem and Phloem
13. Vessel elements differ from other elements of xylem in having -
 (A) Simple and bordered pits on end walls
 (B) Simple perforation on their end walls
 (C) Simple pits on their radial walls
 (D) Bordered pits on their lateral walls
14. Function of vessels is -
 (A) Conduction of water and minerals
 (B) Conduction of food
 (C) Mechanical strength
 (D) All of the above

Exercise # 3**PART - 1****MATRIX MATCH COLUMN**

1. Match the following

Column-I

- A. Hypodermis in dicot stem
- B. Pericycle in dicot stem
- C. Ground tissue in monocot stem
- D. Phloem parenchyma in monocot stem

(A) A-iv., B-i., C-ii., D-ii.

(C) A-iii., B-iv., C-ii., D-i.

Column-II

- i. Absent
- ii. Parenchymatous
- iii. Collenchymatous
- iv. Sclerenchymatous

(B) A-i., B-ii., C-iv., D-iii.

(D) A-ii., B-iii., C-i., D-iv.

2. Select a set having correct match

Dicot stem

- A. Sclerenchymatous hypodermis
- B. Parenchymatous pericycle
- C. Epidermis with trichomes
- D. Oval bundles

Monocot stem

- Collenchymatous hypodermis
- Sclerenchymatous pericycle
- Water containing cavities in vascular bundles
- Wedge shaped bundles

3. Match the followings in column I with column II and choose the correct combination

Column-I

- A. Xylem vessels
- B. Xylem tracheids
- C. Xylem fibre
- D. Xylem parenchyma

(A) A-iv, B-iii, C-ii, D-i

(C) A-ii, B-i, C-iv, D-iii

(D) A-iii, B-iv, C-ii, D-i

Column-II

- i. Store food materials
- ii. Obliterated lumen
- iii. Perforated plates
- iv. Chisel like ends

(B) A-iii, B-ii, C-i, D-iv

(D) A-i, B-ii, C-iii, D-iv

4. Match the items in Column – I with Column – II and choose the correct option

Column-I

- A. Radial Vascular Bundle
- B. Collateral Vascular Bundle
- C. Bicollateral Vascular Bundle
- D. Amphicribal Bundle
- E. Amphivasal Vascular Bundle

Column-II

- i. Cucurbita pepo
- ii. Dracaena
- iii. Roots of angiosperms
- iv. Sunflower stem
- v. Fern

5. Match the following and choose the correct option from below

Column - I

- A. Meristem
- B. Parenchyma
- C. Collenchyma
- D. Sclerenchyma
- E. Epidermal tissue

Options :

(A) A-i, B-iii, C-v, D-ii, E-iv

(C) A-ii, B-iv, C-v, D-i, E-iii

Column-II

- i. Photosynthesis, storage
- ii. Mechanical support
- iii. Actively dividing cells
- iv. Stomata
- v. Sclereids

(B) A-iii, B-i, C-ii, D-v, E-iv

(D) A-v, B-iv, C-iii, D-ii, E-i

Exercise # 4

PART - 1

PREVIOUS YEAR (NEET/AIPMT)

1. What happens during vascularisation in plants ? [CBSE AIPMT-2000]
 - (A) Differentiation of procambium is immediately followed by the development of secondary xylem and phloem
 - (B) Differentiation of procambium followed by the development of xylem and phloem
 - (C) Differentiation of procambium, xylem and phloem is simultaneous
 - (D) Differentiation of procambium followed by the development of primary phloem and then by primary xylem
2. Loading of phloem is related to - [CBSE AIPMT-2001]
 - (A) increases of sugar in phloem
 - (B) Tracheids are multicellular with narrow lumen
 - (C) Vessels are unicellular with wide lumen
 - (D) Tracheids are unicellular with wide lumen
3. Which of the following statements is true ? [CBSE AIPMT-2002]
 - (A) Vessels are multicellular with narrow lumen
 - (B) Tracheids are multicellular with narrow lumen
 - (C) Vessels are unicellular with wide lumen
 - (D) Tracheids are unicellular with wide lumen
4. Axillary bud and terminal bud are derived from the activity of [CBSE AIPMT-2002]
 - (A) lateral meristem
 - (B) intercalary meristem
 - (C) apical meristem
 - (D) parenchyma
5. Four radial vacular bundles are found in [CBSE AIPMT-2002]
 - (A) dicot root
 - (B) monocot root
 - (C) dicot stem
 - (D) monocot stem
6. Vessels are found in [CBSE AIPMT-2002]
 - (A) all angiosperms and some gymnosperms
 - (B) most of angiosperms and few gymnosperms
 - (C) all angiosperms and few gymnosperms and some pteridophytes
 - (D) all pteridophytes
7. Main function of lenticel is [CBSE AIPMT-2002]
 - (A) transpiration
 - (B) guttation
 - (C) gaseous exchange
 - (D) bleeding
8. The cells of the quiescent centre are characterised by [CBSE AIPMT-2003]
 - (A) dividing regularly to add to tunica
 - (B) having dense cytoplasm and prominent nuclei
 - (C) having light cytoplasm and small nuclei
 - (D) dividing regularly to add to the corpus
9. The apical meristem of the root is present [CBSE AIPMT-2003]
 - (A) in all the roots
 - (B) only in radicals
 - (C) only in tap roots
 - (D) spore capsule of a moss
10. Chlorenchyma is known to develop in the [CBSE AIPMT-2003]
 - (A) Pollen tube of *Pinus*
 - (B) cytoplasm of *Chlorella*
 - (C) mycelium of a green mould such as *Aspergillus*
 - (D) spore capsule of a moss
11. In a longitudinal section of root, starting from the tip upward, the four zones occur in the following order. [CBSE AIPMT-2004]
 - (A) root cap, cell division, cell enlargement, cell maturation
 - (B) root cap, cell division, cell maturation, cell enlargement
 - (C) cell division, cell enlargement, cell maturation, root cap
 - (D) cell division, cell maturation, cell enlargement, root cap
12. In a woody dicotyledonous tree which of the following parts will mainly consist of primary tissues? [CBSE AIPMT-2005]
 - (A) All parts
 - (B) Stem and root
 - (C) Flowers, fruits and leaves
 - (D) Shoot tips and root tips
13. A common structural feature of vessel elements and sieve tube elements are [CBSE AIPMT-2006]
 - (A) pores on lateral walls
 - (B) presence of p-protein
 - (C) enucleate condition
 - (D) thick secondary walls

- Which of the following meristems are lateral meristems?
(A) Apical meristem, interfascicular cambium and cork cambium
(B) Fascicular vascular cambium, interfascicular cambium and cork cambium
(C) Apical meristem, intercalary meristem and cork cambium
(D) Intercalary meristem, interfascicular cambium and cork cambium
(E) Fascicular cambium, apical meristem and cork cambium
- The increase in length of petiole results from the division of
(A) apical meristem (B) lateral meristem (C) intercalary meristem (D) phellogen
- The girth or diameter of the stem increases due to the activity of the following.
(A) Apical meristems (B) Intercalary meristems (C) Lateral meristems (D) Parenchyma cells
- Which one of the following is not a lateral meristem?
(A) Intrafascicular cambium (B) Interfascicular cambium
(C) Phellogen (D) Intercalary meristem
- Which one of the following pairs is an example for lateral meristem?
(A) Procambium and phellogen (B) Interfascicular cambium and phellogen
(C) Phellogen and phellogen (D) Phellogen and fascicular cambium
- Which among these statements about collenchyma is true?
(A) Collenchyma cells are usually dead without protoplasts.
(B) The cells are long and narrow with thick lignified walls
(C) Collenchyma occurs in layers below the epidermis in dicotyledonous plants.
(D) These cells are found in the pulp of fruits like guava, pear and sapota.
(E) Collenchyma may be either fibres or sclereids.
- Oval, spherical or polygonal cells, thickening at the corners due to deposition of cellulose, hemicellulose and pectin, often containing chloroplasts and having or not having inter-cellular spaces are called
(A) parenchyma (B) chlorenchyma (C) sclerenchyma (D) collenchyma
- Aerenchyma is found in
(A) epiphytes (B) hydrophytes (C) halophytes (D) xerophytes
- Pick out the wrong statement.
(A) Gymnosperms lack vessels in their xylem.
(B) The cell wall of parenchyma is made up of pectin.
(C) The first formed primary xylem elements are called protoxylem.
(D) Gymnosperms have albuminous cells and have sieve cells in their phloem.
(E) Intercellular spaces are absent in collenchyma.

www.blog.neetnearme.com

BODY FLUIDS AND ITS CIRCULATION

“ Owing to the difficulty of dealing with substances of high molecular weight we are still a long way from having determined the chemical characteristics and the constitution of proteins, which are regarded as the principal constituents of living organisms.”

“ KARL LANDSTEINER (1868-1943)”

INTRODUCTION

All living cells have to be provided with nutrients and other essential substances. Some waste or harmful substance produced, have to be removed continuously to carry proper and healthy functioning of tissues. Therefore, it is essential to have efficient mechanisms for the movement for these substances to the cells and from the cells. In complex organisms, special fluids are present within their bodies for the transportation of such materials. As in simple organisms like sponges and coelenterates circulate water from their surroundings through their body cavities to facilitate the cells to exchange these substances.

Blood is commonly used body fluid to transport materials within body by higher organisms including humans. Another body fluid is Lymph, which help in transport of certain substances.

BODY FLUIDS & ITS CIRCULATION

INTRODUCTION

Each and every cell of the body requires consistent supply of O₂, food etc. for energy. Similarly toxic substances like CO₂, ammonia, urea, uric acid are needed to get removed from the body. In lower organism cell is in direct contact of surrounding medium and there is direct exchange of material in between cell and the medium so, circulatory system is not needed. In higher and multicellular organism due to its complex form a specialized system is needed to supply useful, substance to the body cell and to remove, harmful substance out of the body. This specialized, system is called **circulatory system**. Components involved in circulatory system originate from **mesoderm** of embryo. Except the inner lining of blood vessels and capillaries which are endodermal in origin.

TYPES OF CIRCULATION

Numerous types of fluid circulation are found in animals which are as follows-

1. Intracellular circulation

- (i) It also plays important role in amoeboid locomotion found in certain protozoans like *Amoeba* and WBC.
- (ii) Streaming movement of the cytoplasm which is called cyclosis is the **intracellular circulation**.
- (iii) Cyclosis helps in uniform distribution of material like O₂, food within the cell.
- (iv) In all living cells and unicellular organism intracellular circulation is found.

2. Extracellular circulation

- (i) Circulation which occurs outside of the cell is called extracellular circulation.
- (ii) Such type of circulation is found in **multicellular organism**.

It is of numerous types which are as follows-

Water circulation : Such type of circulation is found in **sponges** and **Hydra**.

Pseudocoelomic fluid circulation : Such type of circulation is found in **roundworm**.

Parenchymal circulation : Such type of circulation is found in **flatworm**.

Blood vascular system

- (i) Blood vascular system is present in higher invertebrates from the **Annelida** to the **Echinodermata** and all the **Chordates**.

Note :

- (i) Annelida are the 1st metazoans to have a well developed circulatory system.
- (ii) **Nereis** among Annelida and **Amphioxus** among the **Chordata** have well developed circulatory system but lacks heart.

The blood vascular system may be **open or closed circulatory system**.

I- Open circulatory system

- (i) When the circulating fluid is present in a central cavity called Haemocoel or it flows into spaces called sinuses in the tissue, it is termed as the **open circulatory system**.
- (ii) Animals in which circulatory system is open are Arthropoda (Prawn, lobsters, crabs, insects and spiders) and Mollusca (snails, oysters).

II- Closed circulatory system

- (i) When the blood remains confined to the blood vessel it is called **closed circulatory system**.
- (ii) In invertebrate, closed circulatory system is found in some annelida like earthworm and some mollusca like, squid.
- (iii) In all vertebrate animals closed circulatory system is found.
- (iv) The circulation of blood in the closed circulatory system was at first discovered and demonstrated by William Harvey who is known as father of angiology. He called heart as the "Pumping station of body"

REGULATION OF HEART BEAT

The rate of heart beat is regulated by two mechanism.

- Nervous regulation
- Hormonal regulation

NERVOUS REGULATION

The cardiac centre lies in the upper part of ventral wall of the medulla oblongata.

Cardiac centre is composed of-

- Cardioinhibitory centre (CIC)
- Cardioacceleratory centre (CAC)

Cardioinhibitory centre

- (i) It decreases rate of heart beat.
- (ii) The cardio-inhibitor is connected with SA node through vagus nerve or parasympathetic nerve fibre.
- (iii) It decreases the rate of heart beat (about 20 to 30 times/minute) as well as strength of heartbeat (by 20 to 30 percent).

Cardioacceleratory centre

- (i) It accelerates the rate of heart beat.
- (ii) Cardio acceleratory centre is associated with SA node through sympathetic nerve fibre.
- (iii) It increase rate of heart beat.

HORMONAL REGULATION

- (i) Heart beat is mainly regulated by **adrenaline** (epinephrine) and **non adrenaline** (nor epinephrine). Both hormones are secreted by medulla of adrenal gland.
- (ii) **Nor adrenaline** and **adrenaline** both accelerate the rate of heart beat but operate in different conditions. Adrenaline increase the heart beat during emergency conditions, whereas non adrenaline increase the heart beat during normal conditions.

CHECKPOINT:Thyroxine hormone indirectly increase the heart beat because thyroxine increases oxidative metabolism of the body cell, so body cells require more oxygen.



ETD OS KEY POINTS

Hormonal control

Adrenaline	–	↑ Rate
Nor adrenaline	–	↑ Rate
Vagal stimulation releases Acetyl choline	–	↓ Rate

Tachycardia. It is the condition where heart rate exceeds 90 per minute for an average adult.

Common causes of tachycardia :

- (i) **Tachycardia.** Rate of heart beat increases. Fever causes tachycardia because increased body temperature increases the rate of metabolism of the sinus node, which in turn directly increases its excitability and rhythm.
- (vi) **Sinus tachycardia.** Increased frequency of impulse discharges from the SA node will in run increase the heart rate.
- (ii) **Stimulation by sympathetic nerves.** Stimulation of the sympathetic nerves releases the hormone norepinephrine at the sympathetic nerve endings. Therefore this leads to increase in the heart rate.

→ Two types of circulatory patterns are :

- | Open | Closed |
|---|--|
| (a) Blood flows through open spaces called sinuses. | (a) Blood flows through closed network of blood vessels. |
| (b) e.g. Arthropods, Molluscs | (b) e.g. Annelids Vertebrates |

→ All vertebrates possess a muscular chambered heart :

	Fishes	Amphibians	Reptiles	Crocodile	Birds	Mammals
Number of chambers	2	3	3	4	4	4
Atria	1	2	2	2	2	2
Ventricles	1	1	1	2	2	2

→ Human circulatory system = heart + blood vessels + blood

→ Human heart:

- (a) Origin : mesodermal
- (b) Position : Situated in the thoracic cavity, in between the two lungs, slightly tilted to the left.
- (c) Covering : double walled pericardium.

→ Cardiac cycle : Sequential events in the heart which is cyclically repeated called cardiac cycle. Time of cardiac cycle = 0.8 second.

→ Disorders of circulatory system :

- (a) High blood pressure (Hypertension) :
Normal BP is 120/80 mm of Hg
120 is systolic pressure.
80 is diastolic pressure.
If BP increases more than 140/90 mm of Hg than called hypertension.
- (b) Coronary heart disease: often referred to as atherosclerosis. Caused by deposition of Ca^{+2} , Fats, cholesterol and fibrous tissues in arteries.
- (c) Angina pectoris is pain in heart muscles.
- (d) Heart failure is the condition when heart is not pumping blood effectively to meet the needs of the body. (e) Cardiac arrest : Heart stops beating.
- (f) Heart attack : Death of heart muscles due to an inadequate blood supply.

SOLVED EXAMPLE

Ex.1 Systemic heart refer to

- (A) The two ventricles together in humans
- (B) The heart that contracts under stimulation from nervous system
- (C) Left auricle and left ventricle in higher vertebrates
- (D) Entire heart in lower vertebrates

Sol. (C)

Ex.2 The problem of electrical discontinuity caused in the normal heart by the connective tissue separating the atria from the ventricles is solved by

- (A) Coordinating electrical activity in the atria with electrical activity in the ventricles by connecting them via the Bundle of His
- (B) Having the A-V node function as a secondary pacemaker
- (C) Having an ectopic pacemaker
- (D) Coordinating electrical activity in the atria with electrical activity in the ventricles by connecting them via the vagus nerve

Sol. (A)

Ex.3 What is total diastolic time of ventricle in cardiac cycle

- (A) 0.30 second
- (B) 0.40 second
- (C) 0.50 second
- (D) 0.10 second

Sol. (B)

Ex.4 In the heart of mammals the bicuspid valve (mitral valve) is situated between

- (A) Left auricle and left ventricle
- (B) Post caval and right caval
- (C) Right auricle and left auricle
- (D) Right ventricle and pulmonary aorta

Sol. (D) : The bicuspid valve is a valve consisting of two membranous flap or cusps situated between the atrium and ventricle of the left side of the heart in mammals.

Ex.5 The T-wave in an ECG represents

- (A) Depolarisation of ventricles
- (B) Electrical excitation of atria
- (C) Beginning of systole
- (D) Return of the ventricles from excited state

Sol. (D)

Ex.6 Heart beat can be initiated by

Or

The cardiac pacemaker in a patient fails to function normally. The doctors find that an artificial pacemaker is to be grafted in him. It is likely that it will be grafted at the site of

- (A) Sino-auricular node
- (B) Atrio-ventricular node
- (C) Sodium ion
- (D) Purkinje's fibres

Sol. (A)

Ex.7 Read the statements regarding the cardiac system and choose the right option

- A. Human heart is an ectodermal derivative
- B. Mitral valve guards the opening between the right atrium and left ventricle
- C. SAN is located on the left upper corner of the right atrium
- D. Stroke volume \times Heart rate = Cardiac output

- (A) A alone is correct
- (B) A and B alone are correct
- (C) B and C alone are correct
- (D) D alone is correct

Sol. (D) : The amount of blood flowing from the heart over a given period of time is known as the cardiac output. It depends upon the heart rate and stroke volume.

Cardiac output = stroke volume \times heart rate

Ex.8 Circulatory system does not help in

- (A) Transport in respiratory gases
- (B) Transport of hormones
- (C) Transport of food materials
- (D) Transfer of impulses

Sol. (D)

Ex.9 The increase in blood flow to heart stimulates secretion of

- (A) Renin
- (B) Oxytocin
- (C) Antidiuretic hormone
- (D) Atrial natriuretic factor

Sol. (D)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Systolic pressure is higher than diastolic pressure due to :-
(A) Volume of blood in the heart is greater during systole
(B) Arteries contract during systole
(C) Blood vessels offer resistance to flowing blood during systole
(D) Blood is forced into arteries during systole.
2. First heart transplant was performed by :-
(A) William Harvey (B) Watson
(C) Christian Bernard (D) Khorana
3. When heart beat is decreased than normal is called
(A) Bradycardia (B) Tachycardia
(C) Hypocardia (D) Nicocardia
4. Which artery supplies blood to the diaphragm :-
(A) Phrenic (B) Splenic
(C) Renal (D) Caudal
5. Which one of the following organ can be called a sort of "blood bank" :-
(A) Heart (B) Liver
(C) Spleen (D) Lungs
6. Blood of which vessel in mammals carries least percentage of urea :-
(A) Dorsal aorta (B) Renal vein
(C) Renal artery (D) Posterior vena cava
7. All arteries carry oxygenated blood except :-
(A) Systemic (B) Hepatic
(C) Pulmonary (D) Cardiac
8. Heart beat in vertebrates is :-
(A) Neurogenic (B) Myogenic
(C) Both (D) None
9. Single heart circuit occurs in :-
(A) Fishes (B) Frog
(C) Reptiles (D) Man
10. Pain in heart muscle is :-
(A) Angina cardius (B) Angina pericardius
(C) Angina pectoris (D) None
11. Study of blood circulation system is called :-
(A) Angiology (B) Cardiology
(C) Haematology (D) Osteology
12. "Vasa Vasorum" refers to :-
(A) Jugular anastomosis
(B) A network of blood vessels in an organ
(C) "Vessels of vessels" nutritive in function
(D) Carotid labyrinth regulating pressure of blood vessels
13. Coronary artery supplies blood to :-
(A) Mammary glands (B) Rib muscles
(C) Skin (D) Heart
14. When there is a sudden loss of blood from the body the organ which supplies blood is :-
(A) Spleen (B) Heart
(C) Liver (D) Lung
15. Carotico - systemic arch arises from :-
(A) Right auricle (B) Right ventricle
(C) Left auricle (D) Left ventricle
16. The colour of lymph is :-
(A) White (B) Pale yellow
(C) Colourless (D) Milky
17. Coagulation of lymph is :-
(A) Faster than blood (B) Not possible
(C) Slower than blood (D) A passive process
18. The most important center of lymph formation is -
(A) Liver (B) Spleen
(C) Bone marrow (D) Mucosa of ileum
19. The spleen of Human serves to :-
(A) Generate all blood cells in early foetal life
(B) Produce lymphocytes, monocytes and antibodies in adult stage
(C) Acts as blood bank for the period of emergency and control blood volume in adults
(D) All of the above
20. Removal of which organ will have least effect in an adult Human :-
(A) Spleen (B) Liver
(C) Pancreas (D) Pituitary
21. Contraction of heart is called :-
(A) Peristalsis
(B) Systole
(C) Diastole
(D) Voluntary contraction
22. Mitral valve is the other name of :-

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Cells forming the wall of blood capillaries are called
(A) Oxyntic cells (B) Endothelium cells
(C) Parietal cells (D) Haemocytes
2. Blood pressure and heart beat is regulated by:-
(A) Insulin (B) Adrenalin
(C) Optic nerve (D) Growth hormone
3. Heart beat is controlled by which cranial nerve :-
(A) Xth (B) IXth
(C) IIIrd (D) Vth
4. Blood Capillaries are made of :-
(A) Endothelium and thin coat of connective tissue
(B) Endothelium and thin coat of muscle fibres
(C) Endothelium and thin coat of connective tissue and muscle fibres.
(D) Only endothelium
5. The heart sound "DUP" is produced when :-
(A) Mitral valve opens
(B) Mitral valve closes
(C) Semilunar valve at the base of aorta closes
(D) Tricuspid valve opens
6. Red pulp and white pulp are histological structure found in :-
(A) Tooth (B) Spleen
(C) Bone (D) Liver
7. Where is the pace maker situated :-
(A) In left auricle near opening of pulmonary vein
(B) In right auricle near eustachian valve
(C) On inter - auricular septum
(D) On inter-ventricular septum
8. Papillary muscles are found in :-
(A) Haemocoel of cockroach
(B) Auricles of heart
(C) Ventricles of heart
(D) Arm
9. In mammalian embryo the pulmonary aorta communicates with carotico-systemic aorta by a narrow ductus arteriosus, in the adult this connection closes leaving :-
(A) Fossa - ovalis
(B) Carotico pulmonary aperture
(C) Ligamentum arteriosus
(D) None of these
10. Blood circulation take following course in heart of man
(A) Left auricle - left ventricle - body - right auricle - right ventricle
(B) Right auricle - left ventricle
(C) Left auricle - left ventricle - lungs - right auricle - right ventricle
(D) None of them
11. Pulmonary veins are those which :-
(A) Carry impure blood from lungs to heart
(B) Carrying pure blood from lungs to heart
(C) Carry impure blood from heart to lung
(D) Carry pure blood from heart to lungs
12. How many contraction nodes are found in heart of Human :-
(A) One (B) Two
(C) Many (D) None
13. Characteristics of cardiac muscles are that they :-
(A) Contract quickly and get fatigued
(B) Contract quickly and do not get fatigued
(C) Contract slowly and get fatigued
(D) Contract slowly and do not get fatigued
14. Largest amount of urea in blood is found in:-
(A) Hepatic portal vein (B) Hepatic Artery
(C) Coeliac artery (D) Renal Artery
15. Lymph can be defined as :-
(A) Blood minus corpuscles
(B) Blood minus Plasma
(C) Blood minus WBC
(D) Blood minus RBC & Platelets
16. Sphygmomanometer measures :-
(A) Blood pressure (B) Pulse rate
(C) Rate of heart beat (D) All
17. Chordae tendinae are found in :-
(A) Ventricles of brain
(B) Ventricles of heart
(C) Auricles of heart
(D) Connection between bone
18. A Pace maker or S.A. Node is found in :-
(A) Lungs (B) Brain
(C) Spleen (D) Heart

Exercise # 3**PART - 1****MATRIX MATCH COLUMN**

1. Match Column - I with Column - II and select the correct option from the codes give below.

Column - I

- A. Factor II
B. Factor III
C. Factor VIII
D. Factor XII
(A) A-iii, B-iv, C-ii, D-i
(C) A-ii, B-i, C-iv, D-iii

Column - II

- i. Thromboplastin
ii. Prothrombin
iii. Hageman factor
iv. Antihæmophilic globulin
(B) A-iv, B-iii, C-ii, D-i
(D) A-i, B-ii, C-iii, D-iv

2. Match the types of WBC listed under Column - I with the shape of nucleus given under column - II and select the correct option from codes given below.

Column - I

- A. Neutrophils
B. Eosinophils
C. Basophils
D. Monocytes
(A) A-iii, B-v, C-i, D-ii
(C) A-ii, B-i, C-v, D-iii

Column - II

- i. Kidney-shaped
ii. S-shaped
iii. 3 to 5 lobes
iv. 2 lobes
v. Disc-shaped
(B) A-v, B-iii, C-i, D-iv
(D) A-iii, B-iv, C-ii, D-i

3. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Fibrinogen
B. Globulins
C. Albumins
(A) A-iii, B-i, C-ii
(C) A-iii, B-ii, C-i

Column - II

- i. Defence mechanism
ii. Osmotic balance
iii. Coagulation of blood
(B) A-i, B-iii, C-ii
(D) A-ii, B-i, C-iii

4. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I

- A. Superior vena cava
B. Inferior vena cava
C. Pulmonary artery
D. Pulmonary vein
(A) A-ii, B-iv, C-iii, D-i
(C) A-iv, B-iii, C-i, D-ii

Column - II

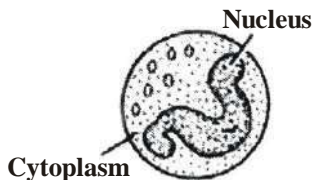
- i. Carries deoxygenated blood to lungs
ii. Carries oxygenated blood from lungs
iii. Brings deoxygenated blood from lower part of body to right atrium
iv. Bring deoxygenated blood from upper part of body to right atrium
(B) A-iv, B-i, C-ii, D-iii
(D) A-iv, B-i, C-iii, D-ii

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. Pulmonary artery is different from pulmonary vein because it has [CBSE AIPMT 2000]
(A) large lumen
(B) thick muscular walls
(C) no endothelium
(D) valves
2. What is correct regarding leucocytes ? [CBSE AIPMT 2000]
(A) These can squeeze out through (can cross) thin capillary walls
(B) These are enucleate
(C) Sudden fall in their number indicates cancer
(D) These are produced in thymus
3. What is correct for Blood group 'O' : - [CBSE AIPMT 2001]
(A) No antigens but both a and b antibodies are present
(B) A antigen and b antibody
(C) Antigen and Antibody both absent
(D) A and B antigens and a, b, antibodies
4. Continuous bleeding from an injured part of body is due to deficiency of : - [CBSE AIPMT 2001]
(A) Vitamin -A (B) Vitamin -B
(C) Vitamin -K (D) Vitamin -E
5. Which of the following statement is true for Lymph : - [CBSE AIPMT 2002]
(A) WBC and serum
(B) All components of blood except RBCs and some proteins
(C) RBCs, WBCs and Plasma
(D) RBCs, Proteins and Platelets
6. Bundle of His is a network of : - [CBSE AIPMT 2003]
(A) Muscle fibres found only in the ventricle wall
(B) Nerve fibres distributed in ventricles
(C) Nerve fibres found throughout the heart
(D) Muscle fibres distributed throughout the heart walls
7. Systemic heart refers to : - [CBSE AIPMT 2003]
(A) Left auricle and left ventricle in higher vertebrates
(B) Entire heart in lower vertebrates
(C) The two ventricles together in humans
(D) The heart that contracts under stimulation from nervous system
8. You are required to draw blood from a patient and to keep it in a test tube for analysis of blood corpuscles and plasma. You are also provided with the following four types of test tubes. Which of them will you not use for the purpose? [CBSE AIPMT 2004]
(A) Test tube containing calcium bicarbonate
(B) Chilled test tube
(C) Test tube containing heparin
(D) Test tube containing sodium oxalate
9. In the ABO system of blood groups if both antigens are present but no antibody, the blood group of the individual would be :- [CBSE AIPMT 2004]
(A) B (B) O
(C) AB (D) A
10. Which of the following substances, if introduced into the blood stream, would cause coagulation of blood at the site of its introduction - [CBSE AIPMT 2005]
(A) Fibrinogen (B) Heparin
(C) Prothrombin (D) Thromboplastin
11. Antibodies in our body are complex- [CBSE AIPMT 2006]
(A) Lipoproteins (B) Steroids
(C) Prostaglandins (D) Glycoproteins
12. Examination of blood of a person suspected of having anemia, shows large, immature, nucleated erythrocytes without haemoglobin. Supplementing his diet with which of the following is likely to alleviate his symptoms ? [CBSE AIPMT 2006]
(A) Thiamine
(B) Folic acid and cobalamine
(C) Riboflavin
(D) Iron compounds





MOCK TEST

- Name the blood cells, whose reduction in number can cause clotting disorder, leading to excessive loss of blood from the body.
 (A) Erythrocytes (B) Leucocytes (C) Neutrophils (D) Thrombocytes
- Serum differs from blood in
 (A) lacking globulins (B) lacking albumins (C) lacking clotting factors (D) lacking antibodies
- The granulocytes which secretes histamine, serotonin and heparin are
 (A) neutrophils (B) basophils (C) eosinophils (D) lymphocytes
 (E) monocytes
- Mature RBCs lose their ability for
 (A) DNA replication
 (B) Anaerobic respiration
 (C) Aerobic respiration and DNA replication
 (D) Aerobic respiration, DNA replication and RNA synthesising machinery.
- The figure shows a human blood cell. Identify it and give its characteristics.



Blood cell	Characteristics
(A) Basophil	Secretes serotonin, inflammatory response
(B) B-lymphocyte	Forms about 20% of blood cells involved in immune response
(C) Neutrophil	Most abundant blood cells, phagocytic
(D) Monocyte	Life span of 3 days, produces antibodies

- Select the option having all the correct characteristics.

	Structure	Percentage	Function
(A)	d		0.3–0.5 Phagocytic
(B)	d		0.5–1.0 Secrete histamine and serotonin
(C)	d		30–40 Defence against parasites
(D)		30–40	Allergic reactions

www.blog.neetnearme.com

ORGANISMS AND POPULATIONS

“In nature nothing is created, nothing is lost, everything changes”.

“ANTOINE LAVOISIER (1743-1794)”

INTRODUCTION

At various level of biological organisation macromolecules, cells, tissues, organs, individual organisms, population, communities and ecosystems and biomes, complexity by investigating processes can be understood. Ecology deals with the study of interactions and interrelationships between organisms and their environment. It is concerned with the four level of biological organisations-organisms, populations, communities and biomes.

The essence of ecological understanding is to know how organisms interact with other organisms and physical environment as a group and hence behave like organised wholes i.e., population, community, ecosystem or even as the whole biosphere.

This topic emphasize more on organismic and population level.

Organisms and Populations

Introduction

- The term ecology was coined and described by **E.Haeckel**. The term ecology was first authentically used by **Reiter**.
 - Father of ecology – **Reiter**
 - The term Ethology for ecology was used by – **Geoffroy Hilaire**
 - The term Hexicology for ecology was used by – **G.H. Mivart**
 - Study of ecology was initiated in India by – **W. Dudgeon**
 - Father of Indian Ecology – **Prof. Ram Deo Misra**
 - First of all term ecology was employed for – **Warming**
for study of plants by
 - The study of interaction or inter-relationship of organism with their environment is called ecology.
Organism \rightleftharpoons Environment
 - Organism and environment are always interdependent, inter related or mutually reactive.
- Branches of Ecology** – It is based on organism level
1. **Autecology or species ecology** – Study of the relation of a species with its environment is known as autecology
 2. **Synecology or Biocoenology or Community ecology** – Study of the relation of the group of different species with their environment. Ex. Population, community, ecosystem, biome ecology.

Aims & Scope

- The main aim of ecology is to study the interrelationship between organisms. i.e., Plants, animals and environment..
- Studies like pollution, soil conservation, soil erosion, proper use of land, afforestation, control on deforestation, regulation of overgrazing, flood control, maintenance of soil fertility etc., are also done in the ecology.
- Thus, the scope of this science is very vast.
- The living world can be dealt at different level of complexities. A molecular biologist restricts itself to the level of genes & cells whereas a development biologist deals at the level of tissues, organs & organisms. Whereas an ecologist treats the living organisms largely at the level of population, community & ecosystem.
- A **population** is defined as a group of individuals of a species growing in a given area.
- A **community**, on the other hand, is collection of populations of different species growing in a given area.
- The transition zone between two different communities is known as **ecotone**.
- A species may be defined as a uniformly inbreeding population spread over a time. Ecologically, a species is sub-divided into **ecotype** and the ecotypes into **ecads**.

Ecotype/Ecological Race/Ecospecies :

- Formed due to genotypical response to a particular habitat.
- Genetically different but interfertile.
- Adaptations are genetically fixed and irreversible.
- Variations are not changed if different ecotypes are grown in same habitat
- Ecospecies with one or more ecotypes.

Psychrophytes :

- They are also known as **hekistotherms**. These plants are grown in cold soil (land). Psychrophytes are found in **north and south polar regions**. The plants grown at 11000 feet or above are only psychrophytes. They known as Alpines. Such plants are grown on Himalaya.
 - Cold lands are **physiologically dry**. Plants are unable to absorb water because temperature of soil is very less, reasons are as follows -
 - The viscosity of the water increase due to decrease in temperature.
 - Water potential of water decreases due to low temperature.
 - The permeability of plasma membrane decreases at low temperature.
 - The true characters of xerophytes are found in these plants, such as small leaves, thick cuticle and very deep root system.
- e.g. **Rhododendron, Delphinium, Anemone, Primula, Saxifraga.**

Adaptation against High pressure In hydrothermal vents :

- No excess body cavities (swim bladder) → provide bouyancy.
- Flesh and bones are Flubby
- T.M.O-Tri methyleneoxide. Binds with pressure sensitive protiens and protects their pressure inhibition.
- Serine phosphoethanol amine - protects protiens from pressure effect.

Adaptation of plants against predators :

Thorns, Hairs, Thick stem, Nectorless. Silica in grasses.

Chemicals : Caffein, Tannin, Quinin, Opium, Glycosides, Pyrethrin.

Adaptation of Animals against predators :

- (i) Cryptic appearance/Camouflage.
- Grass hopper-Look like green leaf.
- Preying Mantis-Look like dead leaf.



ED OS KEY POINTS

- **Best pH** of the soil for cultivation of plant is **5.5 - 6.5**
- Excess water produces **salinity** problem in soil.
- Calcifuge Plants → Those plants which can grow in little amount of calcium in soil (pH - 3.8 to 4.0) eg., Rhododendron, Rumax etc.
- Calcarious soil → Soil having excess of calcium carbonate.
- Alkaline soil can be corrected by adding gypsum (CaCO_3) and heavy irrigation whereas acidic soil can be corrected by adding lime Ca(OH)_2
- Availability of nutrients from the soil is related with pH of soil.

Literization :

In the **tropical area** due to high temperature, high rainfall, litter is decomposed very rapidly in A-layer. Due to mineralization of **Al** and **Fe** are liberated in the upper layer (A-layer) of soil, colour of this soil becomes **reddish-brown**, this process is known as laterization and soil is **literate**.

Podsolization :

In **temperate area** temperature is low and high humidity occurs. Humus and minerals contents dissolve and percolate with water and are leached from A layer to B layer. Due to loss of chemicals the colour of soil of A-layer (horizon) turns to **light ash** colour. This process is known as podsolization and soil is known as **podosols**.

Gleization :

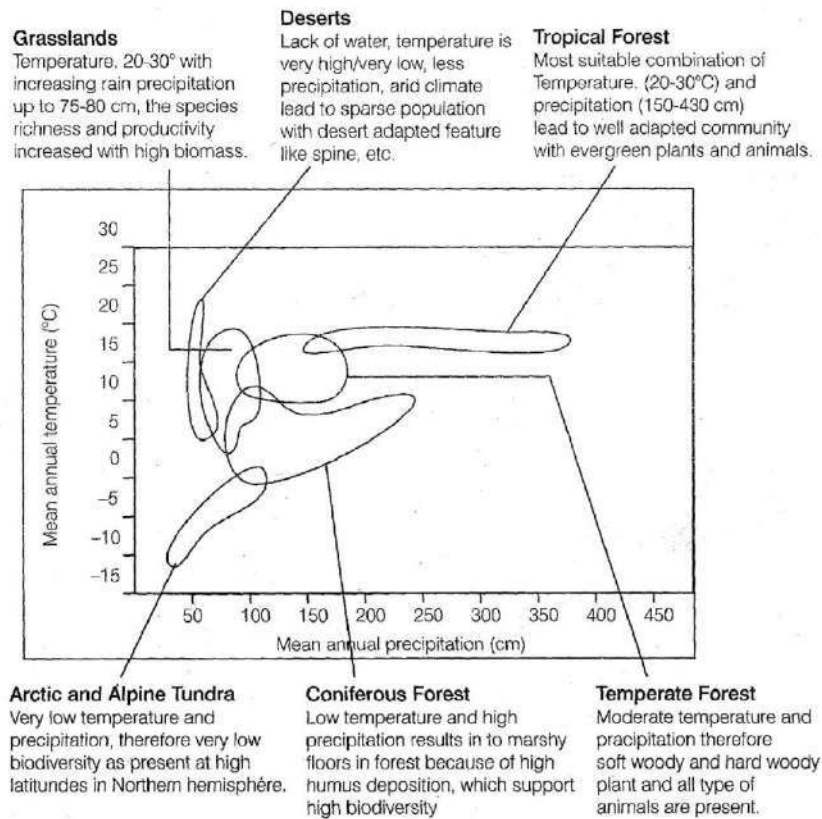
In **tundra** region due to low temperature and humid condition humus is formed in less quantity and moves slowly in B-layer. So colour of B-layer becomes **blue-grey** due to deposition of **Fe** salt. This process is known as gleization and soil is known as **gleys**.

BIOLOGY FOR NEET & AIIMS

→ An isolated, biological entity (e.g., unicellular or multicellular) which is able to perform biological process independently called as organism. Individual organism is the basic unit of ecological hierarchy.

Organism and its Environment

- Organism's life exists not just in a few, favourable habitats, but even in extreme and harsh conditions, e.g., desert, rainforests, deep ocean and other unique habitats.
- The suitability of environment directly affect the growth of residing population and manifested in form of various biological communities.
- Following diagrammatic representation clearly indicates the relationship between environmental conditions and its impact on population which ultimately results into different types of communities.



Climatic adaptation among floral and faunal communities

Responses to Abiotic Factors

→ Organism cope up with the stressful conditions or possibilities to manage with the adverse situation. With following set of modification, an organism can stabilised its relationship with environment.

Regulate

→ Some organisms are able to maintain a constant body temperature and constant osmotic concentration despite changes in the external environment. e.g., **Thermoregulation**, as human is an isothermic organism, it regulate the temperature, in summer by sweating and in winter by shivering. The proces of regulation mostly occurs in birds and higher animals.

Conform

→ It is the strategy to adjustment of organisms towards environmental conditions. In this an organism control their physiology in the tune of environmental conditions. e.g., poikilotherms (i.e., an organism which fails to maintain their body temperature constant) changes their body temperature with environment e.g., fishes.

SOLVED EXAMPLE

Ex.1 Plant species having a wide range of genetical distribution evolve into a local population known as

- (A) Ecotype
- (B) Biome
- (C) Ecosystem
- (D) Population
- (E) Ephemerals

Sol. (A)

Ex.2 Biogenetic law was put forward by

- Or
- The term ecology was coined by
- (A) E. Haeckel
 - (B) Charles Darwins
 - (C) Karl von Bear
 - (D) Lamarck

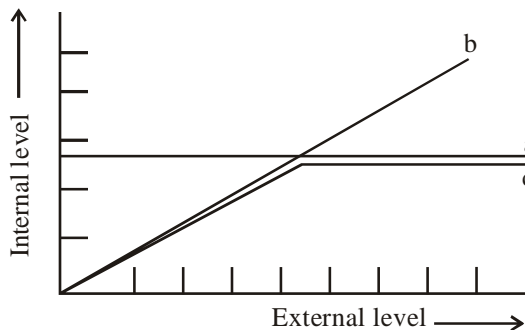
Sol. (A)

Ex.3 The term ‘niche’ of a species refers to

- (A) Specific and habitual function
- (B) Specific place where an organism lives and perform its duty
- (C) Competitive power of an organism
- (D) Specific function of organism

Sol. (B) : Ecological niche is specific habitat where a specific species lives.

Ex.4 The figure given below is a diagrammatic representation of response of organism to abiotic factors. What do a, b and c represent respectively.



(a)	(b)	(c)
(A) Regulator	Conformer	Partial regulator
(B) Conformer	Regulator	Partial regulator
(C) Regulator	Partial regulator	Conformer
(D) Partial regulator	Regulator	Conformer

Sol. (A)

Ex.5 The plant of this group are adapted to live partly in water and partly above substratum and free from water.

Or

- Pneumatophore roots are present in
- (A) Xerophytes
 - (B) Thalophytes
 - (C) Halophytes
 - (D) Hydrophytes

Sol. (C)

Ex.6 Population density of terrestrial organisms is measured in terms of individual per

- (A) Meter³
- (B) Meter⁴
- (C) Meter
- (D) Meter²

Sol. (D) : Population density is the total population within a geographic entity divided by the number of square miles of land area of that entity measured in square kilometers square meters or square miles.

Ex.7 The concept that “Population tends to increase geometrically while food supply increases arithmetically” was put forward by

- (A) Thomas Malthus
- (B) Adam Smith
- (C) Stuart Mill
- (D) Charles Darwin

Sol. (A) : It was an essay on the principles of population by R.T. Malthus which made Darwins realise that under intense competition, natural selection operates.

Ex.8 Autecology is the

- (A) Relation of heterogenous population to its environment
- (B) Relation of an individual to its environment
- (C) Relation of a community to its environment
- (D) Relation of a biome to its environment

Sol. (B)

Ex.9 Ecological niche is

- (A) The surface area of the ocean
- (B) Composed of the plants present in the soil
- (C) Life in the outer space
- (D) Formed of all plants and animals living at the bottom of a lake

Sol. (C)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. The term ecology was coined by
(A) Linnaeus (B) William
(C) Odum (D) Haeckel
2. Number of endangered species of angiosperms in India is
(A) 487 (B) 3000
(C) 5000 (D) 15,000
3. The carrying capacity of a population is determined by its
(A) Birth rate (B) Death rate
(C) Limiting resource (D) Reproductive status
4. Tectonic is the study of
(A) Earthquakes (B) Earth's crust
(C) Sand (D) None of these
5. A community is defined as
(A) A group of birds
(B) A collection of species
(C) Interacting populations
(D) An interactive ecosystem
6. Distribution of different plants geographically is called
(A) Allopatric (B) Sympatric
(C) Geopatric (D) Sibling
7. Group of two or more than two plant species is called as
(A) Plant community (B) Animal ecosystem
(C) Plant ecosystem (D) Ecological niche
8. Study of environment and animals relation
(A) Ecosystem (B) Phytosociology
(C) Biotic community (D) Ecology
9. Which of the following statements is true regarding individuals of same species
(A) They are interbreeding
(B) They live in same niche
(C) They live in different niche
(D) They live in different habitats
10. Which of the following isolation is important for speciation
(A) Seasonal (B) Tropical
(C) Behavioural (D) Reproductive
11. Species are considered as
(A) Real units of classification devised by taxonomists
(B) Real basic units of classification
(C) The lowest units of classification
(D) Artificial concept of human mind which cannot be defined in absolute terms
12. "Exobiology" refers to the study of
(A) Exodermis (B) Terrestrial organism
(C) Life in the air (D) Life on other planets
13. Y-shaped energy flow model was given by
(A) H.T. Odum (B) E.P. Odum
(C) Tensley (D) Both (A) and (B)
14. The ecological niche of population is a
(A) Geographical area that it covers
(B) Place where it lives
(C) Set of conditions and resource it uses
(D) None of these
15. Biological concept of species is mainly based on
(A) Reproductive isolation
(B) Morphological features only
(C) Methods of reproduction only
(D) Morphology and methods of reproduction
16. Territoriality occurs as a result of
(A) Parasitism (B) Predation
(C) Co-operation (D) Competition
17. In an aqueous environment, the microscopic animals are collectively called
(A) Herbivores (B) Carnivores
(C) Planktons (D) Fauna and flora
18. Soil is a mixture of
(A) Sand and clay
(B) Sand and humus
(C) Clay and humus
(D) Sand, clay and humus
19. Clay soil is obtained
(A) In desert (B) Around ponds
(C) On seashore (D) On rocks
20. A bird enters the mouth of crocodile and feeds on parasitic leeches. The bird gets food and crocodile gets rid of blood-sucking leeches. Both partners can live independently. Such an association is
(A) Mutualism (B) Amensalism
(C) Commensalism (D) Protocooperation

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Ruthless exploitation and pollution of the environment has increased the magnitude of waste materials which has disturbed the operations of all important
(A) Biomes
(B) Ecosystems
(C) Bio-geo-chemical cycles
(D) All above
2. The study of inter-relationship between living organisms and their environment is called
(A) Ecosystem (B) Phytogeography
(C) Ecology (D) Phytosociology
3. Term 'ecology' was proposed by
(A) William (B) Odum
(C) Reiter (D) Daubenmier
4. Biotic potential refers to
(A) Increase of population under optimum conditions
(B) Increase of population under given conditions
(C) Increase of population under natural conditions
(D) Increase of population under climatic conditions
5. E.P. Odum is a leading
(A) Bryologist (B) Physiologist
(C) Ecologist (D) Mycologist
6. The term 'biocoenosis' was proposed by
(A) Tansley (B) Carl Mobious
(C) Warming (D) None of the above
7. Ecology takes into account only
(A) Environmental factors only
(B) Plant adaptations only
(C) Effect of environment on plants
(D) All of the above
8. World environment day is celebrated on
(A) 15th March (B) 15th April
(C) 4th May (D) 5th June
9. Ecological factors which prevent a species from producing at its maximum rate is termed as
(A) Survival curve (B) Ecological drift
(C) Environmental resistance
(D) None of these
10. The ecologically fixed and genetically irreversed species are called
(A) Ecotone
(B) Ecological equivalents
(C) Ecotype
(D) None of these
11. Biogenetic law was putforward by
(A) E. Haeckel (B) Charles Darwins
(C) Karl von Bear (D) Lamarck
12. Agrostology is related with the study of
(A) Agricultural growth (B) Epiphytes
(C) Grasses (D) Nematode diseases
13. The plants and animals living in a given area form
(A) Biological community (B) Ecotone
(C) Biome (D) Consociation
14. Phytotron is a device by which
(A) Mutations are produced in plants
(B) Plants are grown in controlled environment
(C) Protons are liberated
(D) Leaf fall occurs on abscission layer
15. Name the famous plants ecologist
(A) Jagdish Chandra Bose (B) Birbal Sahani
(C) Ramdeva Misra (D) Charles Darwin
16. 'Eco' term refers as
(A) Biosphere (B) Environment
(C) Organisms (D) Plants
17. The major characteristics of the vegetation of a locality are controlled by
(A) Man only
(B) Mainly by climate
(C) Animals only
(D) Altitude of place only
18. Ozone layer depletion or hole in ozone layer is being found in
(A) North pole (B) South pole
(C) Russia (D) None of the above
19. The resource which regulates the flow of energy in desert ecosystem is the availability of
(A) Light (B) Water
(C) Minerals (D) Heat
20. Which of the following ecological factor exerts a direct effect
(A) pH (B) Topography
(C) Mineral elements (D) Humidity

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match the following with correct combination

Column - I

- (A) Mutualism
- (B) Commensalism
- (C) Parasitism
- (D) Predation
- (A) A- (i), B - (ii), C - (iii), D - (iv)
- (C) A- (i), B - (iii), C - (ii), D - (iv)
- (E) A- (iv), B - (ii), C - (iii), D - (i)

Column - II

- (i) Tiger and deer
- (ii) Cuscuta on Cissus
- (iii) Sucker fish and shark
- (iv) Crab and sea anemone
- (B) A- (iv), B - (iii), C - (ii), D - (i)
- (D) A- (ii), B - (iii), C - (i), D - (iv)

2. Match the following and choose the correct combination from the options given below.

Column - I

(Population interaction)

- (A) Mutualism
- (B) Commensalism
- (C) Parasitism
- (D) Competition
- (E) Predation
- (A) A-1, B-5, C-4, D-3, E-2
- (C) A-3, B-2, C-1, D-5, E-4
- (E) A-5, B-4, C-1, D-2, E-3

Column - II

(Examples)

- (1) Ticks on dogs
- (2) Balanus and Chathamalus
- (3) Sparrow and any seed
- (4) Epiphyte on a mango branch
- (5) Orchid Ophrys and bee
- (B) A-2, B-1, C-5, D-4, E-3
- (D) A-4, B-3, C-2, D-1, E-5

3. Column I represent the size of the soil particles and Column II represents type of solid components. Which of the following is correct match for the Column I and Column II.

Column - I

- (A) 0.2 to 2.00 mm
- (B) Less than 0.002 mm
- (C) 0.02 to 0.2 mm
- (D) 0.002 to 0.02 mm
- (A) A- (ii), B - (iii), C - (iv), D - (i)
- (B) A- (iv), B - (i), C - (iii), D - (ii)
- (C) A- (iii), B - (ii), C - (iv), D - (i)
- (D) None of the above

Column - II

- (i) Slit
- (ii) Clay
- (iii) Coarse sand particle
- (iv) Fine sand particle

4. Match list I with list II and choose the correct option

Column - I

- (A) Pacific salmon fish
- (B) $N_t = N_0 e^{rt}$
- (C) Oyster
- (D) $\frac{dN}{dt} = rN \left(\frac{K - N}{K} \right)$
- (A) A-4, B-3, C-1, D-2
- (C) A-3, B-1, C-4, D-2
- (E) A-2, B-4, C-3, D-1

Column - II

- (1) Verhulst-Pearl Logistic growth
- (2) Breeds only once in lifetime
- (3) Exponential growth
- (4) A large number of small sized offsprings
- (B) A-3, B-4, C-1, D-2
- (D) A-2, B-3, C-4, D-1

1. Special kinds of roots called pneumatophores are characteristics of the plants growing in
(A) sandy soils
(B) saline soils
(C) marshy places and salt lakes
(D) dryland regions
2. What is true for individuals of same species?
(A) Live in same niche
(B) Live in same habitat
(C) Interbreeding
(D) Live in different habitats
3. Two different species cannot live for long duration in the same niche or habitat. This law is
(A) Allen's law
(B) Mendel's law
(C) Gause's competitive exclusion principle
(D) Weismann's theory
4. Which of the following is a correct pair?
(A) *Cuscuta* - Parasite
(B) *Dischidia* - Insectivorous
(C) *Opuntia* - Predator
(D) *Capsella* - Hydrophyte
5. Which type of association is found in between entomophilous flower and pollinating agent
(A) Mutualism (B) Commensalism
(C) Cooperation (D) Co-evolution
6. Choose the correct sequence of stages of growth curve for bacteria
(A) lag, log, stationary, decline phase
(B) lag, log, stationary phase
(C) stationary, lag, log, phase
(D) decline, lag log phase
7. The semilog of per minute growing bacteria is plotted against time. What will be the shape of graph?
(A) Sigmoid
(B) Hyperbola
(C) Ascending straight line
(D) Descending straight line
8. Mycorrhiza is an example of
(A) endoparasitism (B) decomposers
(C) symbiotic relationship (D) ectoparasitism
9. Diffuse porous woods are characteristic of plants growing in
(A) temperate climate (B) tropics
(C) alpine region (D) cold winter regions
10. In which one of the following habitats does the diurnal temperature of soil surface vary most ?
(A) Shrubland (B) Forest
(C) Desert (D) Grassland
11. What is a keystone species?
(A) A species which makes up only a small proportion of the total biomass of a community, yet has a huge impact on the community's organisation and survival
(B) A common species that has plenty of biomass, yet has a fairly low impact on the community's organisation
(C) A rare species that has minimal impact on the biomass and on other species in the community
(D) A dominant species that constitutes a large proportion of the biomass and which affects many other species.
12. In which one of the following pair is the specific characteristic of soil not correctly matched ?
(A) Laterite - Contains aluminium compound
(B) Terra rossa - Most suitable for roses
(C) Chernozems - Richest soil in the world
(D) Black soil - Rich in calcium carbonate
13. Which one of the following pairs is mismatched ?
(A) Savanna - *Acacia trees*
(B) Prairie - Epiphytes
(C) Tundra - Permafrost
(D) Coniferous - Evergreen trees
14. Animals have the innate ability to escape from predation. Examples for the same are given below. Select the incorrect example
(A) enlargement of body size by swallowing air in puffer fish
(B) melanism in moths
(C) poison fangs in snakes
(D) colour change in *Chamaeleon*

MOCK TEST

1. Match mean annual precipitation in column I with the biome in column II and choose the right option.
- | Column I | Column II |
|------------------------------------|------------------------------------|
| (i) 0-50 cm | (A) Tropical forest |
| (ii) 50-100 cm | (B) Coniferous forest |
| (iii) 150-100 cm | (C) Grassland |
| (iv) 50-250 cm | (D) Desert |
| (A) (i)-D, (ii)-C, (iii)-A, (iv)-B | (B) (i)-C, (ii)-A, (iii)-B, (iv)-D |
| (C) (i)-C, (ii)-D, (iii)-A, (iv)-B | (D) (i)-B, (ii)-D, (iii)-A, (iv)-C |
| (E) (i)-D, (ii)-A, (iii)-C, (iv)-B | |
2. Benthic organisms are affected the most by
- (A) Light reaching the forest floor (B) Surface turbulence of water
(C) Sediment characteristics of aquatic ecosystems (D) Water-holding capacity of soil
3. Large woody vines are more commonly found in
- (A) Temperate forests (B) Mangroves (C) Tropical rainforests (D) Alpine forests
4. Major ecological community of plants and animals extending over large natural areas is known as
- (A) Bioregion (B) Biosphere (C) Biota (D) Biome
5. Which one of the following is not a method of soil conservation?
- (A) Mulching (B) Overgrazing (C) Strip cropping (D) Crop rotation
6. Many fresh water animals cannot live for long in sea water mainly because of the
- (A) Change in the atmosphere (B) Change in the levels of thermal tolerance
(C) Variations in light intensity (D) Osmotic problems they would face
(E) Change of temperature and light
7. Some desert beetles can survive on “metabolic water”, without ever drinking liquid water which
- (A) Is a breakdown product of pyruvate inside the mitochondria, along with carbon dioxide
(B) was produced as water in the organisms they eat
(C) is a breakdown product from glycolysis in the cytoplasm
(D) is absorbed from the air along with respiratory oxygen
8. Which of the following statements regarding responses of organisms to abiotic factors is false ?
- (A) All birds and mammals are capable of thermoregulation.
(B) Majority of animals and nearly all plants cannot maintain a constant internal environment.
(C) Shivering is a kind of exercise which produces heat and raises body temperature.
(D) Very small animals are commonly found in polar regions as they have to spend less energy to generate body heat.
(E) Diapause is a stage of suspended development seen in zooplanktons.
9. The animals that rely on the heat from environment than metabolism to raise their body temperature are, in strict sense, called
- (A) Ectothermic (B) Poikilothermic (C) Homeothermic (D) endothermic

www.blog.neetnearme.com

STRUCTURAL ORGANISATION IN ANIMALS

“Surgical Knowledge depends on long practice, not from speculations”.

“MARCELLO MALPIGHI (1628-1694)”

INTRODUCTION

In previous chapters you came know about various and large variety of organisms both unicellular and multicellular of the animal kingdom. In unicellular organisms, various functions are necessary to perform for life like digestion, respiration and reproduction. Even now, millions of unicellular organisms are present like Amoeba, Paramecium, Euglena etc. They are able to perform all activities not without much efficiency. The body of simple organism like Hydra is made of different type of cells and no. of cells in each type can be thousands. Therefore, in multicellular organisms or animals, a group of cells alongwith intercellular substances perform a specific function. Such organisation is called Tissue. This cell grouping has resulted in developing different structures for different functions like protective structures, reproductive cells, information conducting cells, etc.

Tissues are well organised in specific proportion and pattern to form an organ like stomach, lung, heart and kidney. So, when these organs perform a common function by their physical or by chemical interaction, they together form an organ system for e.g., digestive system, respiratory system, excretory system, etc.

ANIMAL TISSUE

Animal tissue term was given by Bichat (Father of Histology). Histology term was given by Mayer. Marcello malpighi (Father of Microscopic Anatomy) – Studied in detail.

Tissue is a group of cells which are similar in structure origin and function.

KINDS OF TISSUES : On the basis of function and location the tissues are of four types-

	Types	Origin	Function
1.	Epithelial tissue	Ectoderm, endoderm, mesoderm	Protection, secretion, absorption, excretion, reproduction.
2.	Connective tissue	Mesoderm	Attachment, support, storage
3.	Muscular tissue	Mesoderm	Movement of body part and locomotion
4.	Nervous tissue	Ectoderm	Control coordination by nerve impulse

EPITHELIAL TISSUE

Features : It has no blood supply & cells are closely packed. Intercellular space or matrix is absent. Epithelial Tissue are of two major categories. Types of epithelial tissues -

1. **Covering Epithelial Tissues** include simple and compound epithelium.

A. **Simple epithelium**- single layer of cell

(i) **Simple squamous Epithelium :** Thinnest epithelium. Simple squamous Epithelium is tiles like, so called pavement epithelium. Example - Alveoli of lungs, Bowman's capsule of Nephron, Loop of Henle (descending limb) and thin segment of ascending limb.

(ii) **Simple cuboidal epithelium :** Made up of cuboidal cells. Example - Vesicles of thyroid, Acini of Pancreas, Distal convoluted tubule of nephron, Germinal epithelium of seminiferous tubules of testes (They form gametes), Inner most layer of ovary, Proximal convoluted tubule of nephron. Microvilli are present on cuboidal cells of PCT.

(iii) **Simple Columnar Epithelium :** Cell are long and Pillar like. At the base of cells elongated nucleus is present. It is present in Bile duct.

B. **Compound epithelium** - Multiple cell layer. It is divided into transitional and stratified epithelium. It is of two type-

(i) **Transitional Epithelium (Plastic epithelium) :** Stretchable and Water proof epithelium. Only epithelium in which basement membrane absent. Ex. Renal pelvis, Urinary Bladder, Ureter, Proximal Part of Urethra etc.

(ii) **Stratified Epithelium :** Non Elastic. Basement membrane present. On the basis of shape of outer most layer, it is divided into three.

(a) **Stratified Squamous Epithelium** - Outer layer of cells are flat and innermost cuboidal.

(i) Keratinized Eg. Epidermis of skin.

(ii) Non Keratinised Eg. Buccopharyngeal cavity, Oesophagus, Vagina, Cornea of eye.

(b) **Stratified cuboidal epithelium** - Inner most layer cuboidal and Outer most layer cuboidal e.g. Conjunctiva, Duct of sweat gland, Female urethra.

STRUCTURAL ORGANIZATION IN ANIMALS

(c) **Stratified columnar epithelium** – Two types-

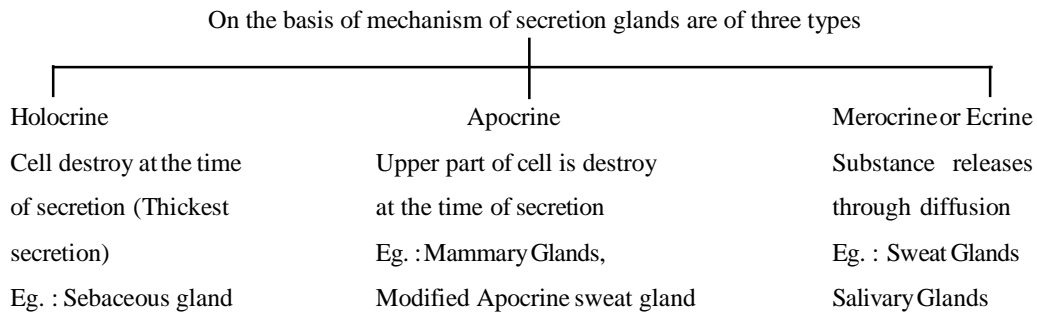
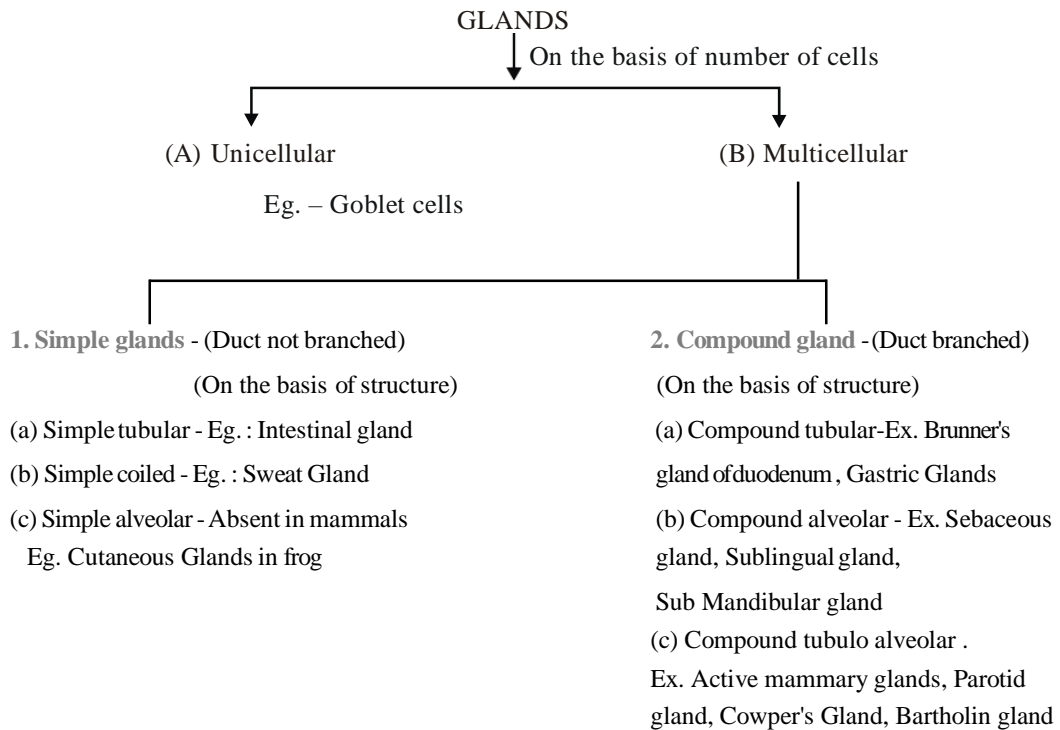
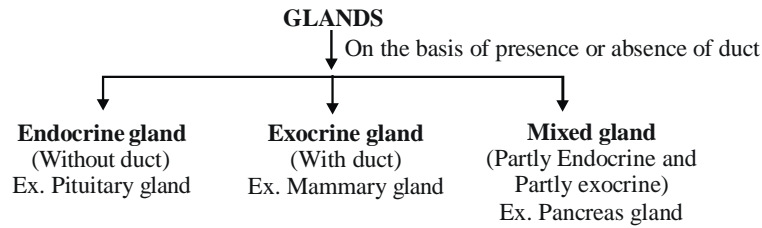
(i) **Ciliated** stratified columnar epithelium - Outer most layer columnar and cilia is present. Eg. Epithelium of larynx, Upper part of soft palate, Ciliated epithelium is present in buccal cavity of frog.

(ii) **Non ciliated** stratified columnar epithelium e.g. Male urethra & epiglottis.

2. **Glandular Epithelial Tissues** - include glands.

GLANDULAR TISSUE (EXOCRINE GLANDS)

Gland – Group of Cells which secrete specific chemical is called as gland.



STRUCTURAL ORGANIZATION IN ANIMALS

A tissue is defined as group of cells along with intercellular substance having similar a origin and performing similar function.

EPITHELIUM TISSUE

- (i) Epithelium tissue has a free surface, which faces either a body fluid or the out side environment.
- (ii) Epithelium is of two type : simple and compound epithelium .
- (iii) Simple epithelium is made up of a single layer of cells and functions as a lining for body cavities, ducts and tubes. The compound epithelium consists of two or more cell layers and has protective function.
- (iv) Simple squamous epithelium is made of a single layer of flattened cell with irregular boundaries. Found in blood vessel and inner lining of lungs and are involved in forming a diffusion boundary.
- (v) The cuboidal epithelium is commonly found in ducts of glands and tubular part of nephrons and its main function is secretion and absorption.
- (vi) The columnar epithelium is made up of pillar shaped cells in which nucleus is located at the base. When free surface has microvilli, found in the lining of stomach and intestine.
- (vii) When their free surface has cilia they are called as ciliated epithelium, found in the lining of bronchioles and fallopian tubes.
- (viii) Compound epithelium has a limited role in secretion and absorption. Their main function is to provide protection against chemical and mechanical stresses. They cover the moist surface of buccal cavity, pharynx, inner lining of ducts of salivary gland and of pancreatic ducts.
- (ix) Some of columnar or cuboidal cells get specialised for secretion and are called as glandular epithelium. They are mainly of two types, unicellular (goblet cells) and multicellular (salivary glands)
- (x) On the basis of mode of pouring their secretion glands are exocrine and endocrine.

Three types of cell junctions are found in epithelium :

- (1) Tight junction (help to stop substances from leaking across a tissue)
- (2) Adhering junctions (perform cementing - to keep neighbouring cells together)
- (3) Gap junction (for rapid transfer of ions, small molecules and some times big molecules)

CONNECTIVE TISSUE

- (i) Connective tissue are most abundant and widely distributed in the body .
- (ii) Their special function are linking and supporting other tissues/organs of the body .
- (iii) In all connective tissues except blood the cells secrete fibres like collagen, elastic and reticular .
- (iv) These cells also secrete modified polysaccharides which accumulate between cells and fibres which acts as matrix (ground substance).

Connective tissues are classified into three types

- (1) Loose connective tissue.
- (2) Dense connective tissue.
- (3) Specialised connective tissue.
 - (a) Loose connective tissue consists of Areolar and Adipose tissue, present beneath the skin.
 - (b) In Dense connective tissue fibres and fibroblasts are compactly packed.
 - (c) Dense connective can be regular namely Tendon and Ligament where as irregular are oriented differently in the skin.
- (v) In cartilage intercellular material is solid and pliable e.g.- tip of nose, ear pinna etc.
- (vi) Bone have a hard and non-pliable ground substance rich in calcium salt. Bone cells (osteocytes) are present in the Lacunae. The bone marrow in some bone is the site of production of blood cells.
- (vii) Blood is fluid connective tissue containing plasma, RBC, WBC and platelets. It is main circulating fluid that helps in the transport of various substances.

SOLVED EXAMPLE

Ex.1 Name the type of tissue that form gland
 (A) Epithelial (B) Muscular
 (C) Squamous (D) Cuboidal

Sol. (A)

Ex.2 The cell junctions called tight, adhering and gap junctions are found in
 (A) Muscular tissue (B) Connective tissue
 (C) Epithelial tissue (D) Neural tissue

Sol. (C)

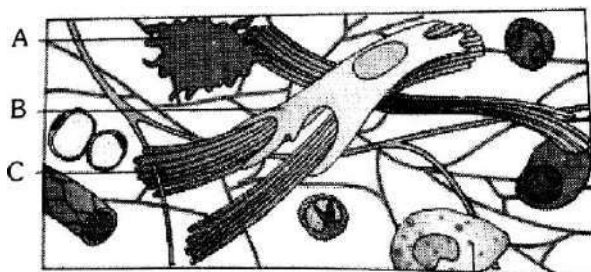
Ex.3 The cells lining the blood vessels belongs to the category of
 (A) Columnar epithelium
 (B) Connective tissue
 (C) Smooth muscle tissue
 (D) Squamous epithelium

Sol. (D)

Ex.4 The ciliated columnar epithelium cells in humans are known to occur in
 (A) Fallopian tubes and urethra
 (B) Eustachian tube and stomach lining
 (C) Bronchioles and Fallopian tubes
 (D) Bile duct and oesophagus

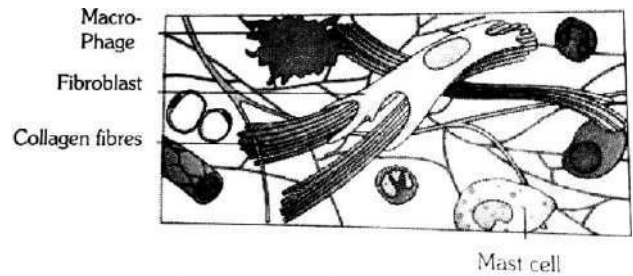
Sol. (C) : Ciliated columnar epithelium lines bronchioles and fallopian tubes.

Ex.5 Given below is the diagrammatic sketch of a certain type of connective tissue. Identify the parts labelled A, B, C and D and select the right option about them



- Part - A Part - B Part - C Part - D
- (A) Macro-phage, Fibroblast, Collagen fibres, Mast cells
 (B) Mast cell, Macro-phage, Fibroblast, Collagen, fibres
 (C) Macro-phage, Collagen fibres, Fibroblast, Mastcell
 (D) Mast cell, Collagen fibres, Fibroblast, Macro-phage

Sol. (A) Correct labeling as follows :



Ex.6 Haversian system is a diagnostic feature of
 (A) Avian bones
 (B) All animals
 (C) Mammalian bones only
 (D) Reptilian bones

Sol. (C) : Mammalian bone is characterized by the presence of haversian system or osteon. Osteon is a basic structural unit of mammalian bone consisting of the haversian canal, lamellae and lacunae.

Ex.7 The supportive skeletal structures in the human external ears and in the nose tip are examples of
 (A) Ligament (B) Areolar tissue
 (C) Bone (D) Cartilage

Sol. (D) : Cartilage is a type of connective tissue which is present in human external ears and in the nose tip.

Ex.8 Bone-forming cells are known as :
 (A) Chondroclasts (B) Osteoblasts
 (C) Chondroblasts (D) Osteoclasts

Sol. (B)

Ex.9 A matured mammalian (RBC) is unusual because
 (A) It exhibits diapedesis
 (B) It is colourless
 (C) It has no nucleus
 (D) It can change its shape

Sol. (C)

Ex.10 Which of the following is not phagocytic in nature
 (A) Monocyte
 (B) Lymphocyte
 (C) Mast cell
 (D) Neutrophil

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. Human RBCs in 1.5% salt solution will :
(A) burst (B) shrink
(C) seal up (D) remains unaffected
2. Volkmann's canals are found in-
(A) bones of birds (B) bones of mammals
(C) bones of amphibians (D) cartilage of mammals
3. Ends of long bone are covered with :
(A) muscles (B) ligaments
(C) cartilage (D) blood cells
4. Sarcomere is a segment of striated muscle fibre between :
(A) M-lines (B) Z-lines
(C) H-zones (D) I-bands
5. This one is the characteristic of epithelial tissue-
(A) Tissue are highly vascularized
(B) These cells never produce glands
(C) The cells will have a rapid rate of cell division
(D) Large intercellular spaces are seen between cells
6. The joint between axon of a neuron and the dendrite of the next is called-
(A) Synapse (B) Bridge
(C) Junction (D) Joint
7. Bones joints are made up of-
(A) Cardiac muscles (B) Elastin fibres
(C) Skeletal muscle fibres (D) Collagen fibres
8. In *Pheretima* blood glands are found in which of the following segments ?
(A) 1,2,3 (B) 7,8,9
(C) 4,5,6 (D) 10,11,12
9. How many lateral hearts are in *Pheretima*?
(A) 12 (B) 16
(C) 8 (D) 4
10. In *Pheretima* mouth develops from which of the following ?
(A) Ectoderm (B) Mesoderm
(C) Blastopore (D) Endoderm
11. The animal which respire without respiratory organs is-
(A) Frog (B) Fish
(C) Earthworm (D) Cockroach
12. Neurons of *Pheretima* are-
(A) Only motor (B) Only adjustor
(C) Only Sensory (D) All
13. In *Pheretima*, locomotion occurs with the help of :
(A) circular muscles
(B) longitudinal muscles and setae
(C) circular, longitudinal muscles and setae
(D) parapodia
14. Earthworm takes food by which method-
(A) Ciliary feeding (B) Detritus feeding
(C) Liquid feeding (D) None of these
15. Mandibles are present in the mouth parts of -
(A) locust (B) cockroach
(C) bedbug (D) housefly
16. The palpiger of cockroach bears-
(A) lingula (B) submentum
(C) labrum (D) labial palp
17. Which one of the following mouth parts are found in Cockroach ?
(A) Cutting and chewing (B) Piercing
(C) Sucking (D) Drilling
18. Basic unit of compound eyes of Cockroach is:
(A) ocelli (B) ommatidia
(C) ratinule (D) crystalline cone

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Which one of the following anticoagulant is added in blood during storage-
(A) Sodium carbonate (B) Sodium oxalate
(C) Sodium chloride (D) Sodium hydroxide
2. Haversian canals are interconnected by-
(A) Hyloid canal (B) Volkmann's canale
(C) Clockwatt's canal (D) Schliman's canal
3. White adipose tissue contains-
(A) Multilocular fat cells (B) Bilocular fat cells
(C) Unilocular fat cells (D) Alocular fat cells
4. Haversian canal is found in the bone of-
(A) Mammals (B) Reptiles
(C) Aves (D) Pices
5. Most radiosensitive tissue of body is-
(A) Bone marrow (B) Platelet
(C) Nervous tissue (D) Lymphocyte
6. Which one of the following contain the largest quantity of extra cellular material -
(A) Striated muscle
(B) Areolar Tissue
(C) Stratified layer
(D) Myelinated nerve fibre
7. Ventricles of brain are lined by the cells called-
(A) Ependymal (B) Neuron cells
(C) Neuroglea (D) Schwann's cells
8. In earthworm gizzard is found in which segment-
(A) 7 (B) 8
(C) 9 (D) 10
9. Cocoon is formed in earthworms in-
(A) Chitinous setae (B) Cuticle
(C) Clitellum (D) Epidermal muscles
10. Chloragogen cells are found in :-
(A) Blood of cockroach
(B) Blood of earthworm
(C) Coelomic fluid of earthworm
(D) body wall of *Leucosolenia*
11. Main function of porphyrin pigment present in earthworm:-
(A) Help in respiration
(B) Helps in reproduction
(C) Makes the worm beautiful
(D) Protection from adverse effects of sun
12. Type of body cavity (Coelom) in earthworm is :-
(A) Acoelomic (B) Schizocoel
(C) Haemocoelic (D) Enterocoelic
13. The enormous amount in saliva of cockroach-
(A) Amylase (B) Protease
(C) Lipase (D) None
14. In cockroach number of segments in muscle abdomen are-
(A) 10 (B) 12
(C) 14 (D) 16
15. Most swollen segment in leg cockroach is :
(A) Tarsus (B) Coxa
(C) Femur (D) Trochanter
16. Main character for the distinction between male and female cockroach :
(A) Antennae (B) Mandibles
(C) Anal cerci (D) Anal style
17. Anal styles are found in :
(A) Housefly
(B) Female cockroach
(C) Male cockroach
(D) Both male & female cockroach
18. Head of frog is and its anterior conical part is called :-
(A) circular, snout (B) triangular, snout
(C) rectangular, snout (D) pentagonal, snout
19. Select the true statement regarding frog (*Rana tigrina*):-
(A) Frog is a homeothermal animal
(B) Frog drinks about 5 litres H₂O per day
(C) poisonous glands are not found on the body of frog.
(D) A very long tail is present in posterior part of frog's body.

Exercise # 3**PART - 1****MATRIX MATCH COLUMN**

1. Which one of the following is correct pairing of a body part and the kind of muscle tissue that moves it?
(A) Biceps of upper arm – Smooth muscle fibres
(B) Abdominal wall – Voluntary smooth muscle
(C) Iris – Involuntary smooth muscle
(D) Heart wall – Involuntary unstriated muscle
2. Match Column I with Column - I and select the correct option from the codes given below.
Column I
A. Simple columnar
B. Cardiac muscle
C. Adipose tissue
D. Hyaline cartilage
Column II
i. Wall of heart epithelium
ii. Bone joints
iii. Inner lining of stomach and intestine
iv. Below the skin in the abdomen, buttockes, thighs and breasts
v. Diaphragm
(A) A-iii, B-i, C-ii, D-iv
(B) A-iii, B-v, C-ii, D-iv
(C) A-i, B-iii, C-iv, D-v
(D) A-iii, B-i, C-iv, D-ii
3. Which of the following is a wrongly matched pair?
(A) Unicellular glandular cells – Goblet cell
(B) Saliva – Exocrine secretion
(C) Fusiform fibres – Smooth muscle
(D) Cartilage – Areolar tissue
4. Match Column-I with Column -II and select the correct option from the codes given below.
Column-I
A. Hyaline cartilage
B. Fibrous cartilage
C. Elastic cartilage
D. Calcified cartilage
Column-II
i. Pectoral girdle of frog
ii. Long bones, sternum, ribs
iii. Pubic symphysis
iv. Eustachian tube, epiglottis
(A) A-i, B-ii, C-iii, D-iv
(B) A-ii, B-iii, C-iv, D-i
(C) A-ii, B-iv, C-iii, D-i
(D) A-iv, B-iii, C-ii, D-i
5. Which one of the following structures in *Pheretima* is correctly matched with its function?
(A) Clitellum – Secretes cocoon
(B) Gizzard – Absorbs digested food
(C) Setae – Provides defence against predators
(D) Typhlosole – Storage of extra nutrients
6. Which of the following structure is correctly matched with its description?
(A) Septal nephridia and – Both are exonephric pharyngeal nephridia
(B) Typhlosole – Helps in grinding the soil particles and decaying leaves.
(C) Hepatic caeca – Blind tubules present at the junction of foregut and mid-gut in the alimentary canal of the cockroach.
(D) Gizzard – Internal median fold present in the dorsal wall of the intestine of earthworm.

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. The polysaccharide present in the matrix of cartilage is known as [CBSEAIPT-2000]
(A) cartilagin (B) ossein
(C) chondriotin (D) casein
2. Simple epithelium is a tissue in which the cells are [CBSEAIPT-2000]
(A) hardened and provide support to the organ
(B) cemented directly to one another to form a single layer
(C) continuously dividing to provide form to an organ
(D) loosely connected to one another to form an irregular organ
3. If a piece of bone such as femur of frog is kept in dilute HCl for about a week. It will [CBSEAIPT-2000]
(A) assume black colour (B) shrink in size
(C) turn flexible (D) crack into pieces
4. Which cells do not form layer and remain structurally separate ? [CBSEAIPT-2001]
(A) Epithelial cells (B) Muscle cells
(C) nerve cells (D) Gland cells
5. During an injury nasal septum gets damaged and for its recovery which cartilage is preferred? [CBSEAIPT-2001]
(A) Hyaline cartilage (B) Elastic cartilage
(C) Calcified cartilage (D) Fibrous cartilage
6. Which cartilage is present at the end of long bones? [CBSEAIPT-2002]
(A) Calcified cartilage (B) Hyaline cartilage
(C) Elastic cartilage (D) Fibrous cartilage
7. Which one of the following contains the largest quantity of extracellular material? [CBSEAIPT-2003]
(A) Myelinated nerve fibres
(B) Striated muscle
(C) Areolar tissue
(D) Stratified epithelium
8. Mast cells of connective tissue contain [CBSEAIPT-2004]
(A) vasopressin and relaxin
(B) heparin and histamine
(C) heparin and calcitonin
(D) serotonin and melanin
9. Areolar connective tissue joins [CBSEAIPT-2006]
(A) integument with muscles
(B) bones with muscles
(C) bones with bones
(D) fat body with muscles
10. A drop of each of the following, is placed separately on four slides. Which of them will not coagulate? [CBSEAIPT-2007]
(A) Blood plasma
(B) Blood serum
(C) Sample from the thoracic duct of lymphatic system
(D) Whole blood from pulmonary vein
11. In which one of the following preparations are you likely to come across cell junctions [CBSEAIPT-2007]
(A) Ciliated epithelium (B) Thrombocytes
(C) Tendon (D) Hyaline cartilage
12. Which one of the following mammalian cells is not capable of metabolising glucose to carbon-dioxide aerobically [CBSEAIPT-2007]
(A) Red blood cells (B) White blood cells
(C) Unstriated muscle cells (D) liver cells
13. Which type of white blood cells are concerned with the release of histamine and the natural anticoagulant heparin [CBSEAIPT-2008]
(A) Neutrophils (B) Basophils
(C) Eosinophils (D) Red blood cells
14. The most active phagocytic white blood cells are [CBSEAIPT-2008]
(A) neutrophils and eosinophils
(B) lymphocytes and macrophages
(C) eosinophils and lymphocytes
(D) neutrophils and monocytes

1. Pseudostratified epithelium is found in
(A) seminiferous tubule (B) Fallopian tube (C) trachea (D) kidney tubules
2. **Assertion :** Gap junctions perform cementing function to keep the neighbouring cells together.
Reason : Tight junctions facilitate the cell to communicate with each other by connecting the cytoplasm of adjoining cells, for rapid transfer of ions, small and big molecules, etc.
(A) Both assertion and reason are true and reason is the correct explanation of assertion.
(B) Both assertion and reason are true but reason is not the correct explanation of assertion.
(C) Assertion is true but reason is false.
(D) Both assertion and reason are false.
3. Choose the wrong statement.
(A) Tight junctions help to stop substances from leaking across a tissue.
(B) Adhering junctions perform cementing to keep neighbouring cells together.
(C) Gap junction facilitate the cells to communicate with each other by connecting the nuclei of adjoining cells.
(D) Compound epithelium has a limited role in secretion and absorption.
4. Match the following.
- | Column - I | Column - II |
|--------------------------------------|------------------------|
| A. Squamous epithelium | i. Bone |
| B. Dense regular connective tissue | ii. Skin |
| C. Glandular epithelium | iii. Air sacs of lungs |
| D. Specialised connective tissue | iv. Tendon |
| E. Dense irregular connective tissue | v. Goblet cells |
- (A) A-ii, B-v, C-iii, D-iv, E-i
(B) A-iii, B-v, C-i, D-ii, E-iv
(C) A-iii, B-iv, C-v, D-i, E-ii
(D) A-v, B-i, C-ii, D-iv, E-iii
(E) A-iv, B-iii, C-v, D-ii, E-i
5. Choose the incorrect statement from the following.
(A) Adipose tissue is a type of dense connective tissue.
(B) Tendons attach muscle to bone.
(C) Cartilage is made up of chondrocytes.
(D) Ciliated epithelium is the modified columnar epithelium.
6. The function of the gap junction is to
(A) separate two cells from each other
(B) stop substance from leaking across a tissue
(C) performing cementing to keep neighbouring cells together
(D) facilitate communication between adjoining cells by connecting the cytoplasm for rapid transfer of ions, small molecules and some large molecules.
7. Most of the cartilages in vertebrate embryo are replaced in adult by
(A) blood (B) bones (C) tendons (D) ligaments
(E) muscle

www.blog.neetnearme.com

BIOTECHNOLOGY: PRINCIPLE & PROCESSES

“Wonder is what sets us apart from other life forms. No other species wonders about the meaning of existence or the complexity of the universe or themselves.”.

“HERBERT BOYER (1936)”

INTRODUCTION

B iotechnology is a technology based on biology, especially when used in agriculture, food science and medicine. it deals with using live organisms or enzymes from organisms to produce products and processes useful to humans. The term brings to thought to create or develop new animals. Others dream of almost unlimited sources of human therapeutic drugs. In this sense, making of curd, bread or wine, which are all microbe-mediated processes, could also be thought as a form of biotechnology. However, it is used in a restricted sense today, to refer to such of those processes which use genetically modified organisms to achieve the same on a large scale.

This chapter deals with the basic principles of biotechnology, the components central to the process of gene cloning such as DNA manipulative enzymes and vectors which transport the desired gene into host cell. Later part of the chapter turns focus to PCR process and applications along with obtaining the desired product on large scale using bioreactors.

Biotechnology : Principles & Processes

Biotechnology is the use of living systems and organisms to develop or make products, or "any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.

Or in simple language Biotechnology is a technology that involves the use of living organisms. Biotechnology is mainly used in agriculture, food science, and medicine. In biotechnology, living organisms are used to make useful chemicals and products or to perform an industrial task.

Old Biotechnology is based on the Natural. Capabilities of micro organism.

Ex - Formation of citric Acid, Production of Penicillin by *Penicillium Notatum*.

New Biotechnology is based on Recombinant DNA biotechnology

Ex - Human gene Production Insulin

it is has been used to Transformed an Bacteria like *E.coli*

Principles of Biotechnology -

The two core techniques enable the birth of modern biotechnology.

1. Chemical - Engineering:- Help the Biotechnology to Produce some Product

Ex - Antibiotics, vaccines and enzyme etc.

In modern Biotechnology : different type of valuable Product are Produced with help of microbiology, Biotechnology, tissue culture, molecular - biology and Immunology

2. Genetic Engineering :- This technique is to alter the chemistry of genetic material (DNA and RNA) to introduce these into host organism and to change the phenotype of the host organism.

CHECKPOINT: - Father of Genetic Engineering called Paul-Berg. He is a first time formed Recombinant DNA

Microbes an House hold Productes :-

1. A common example is the Production of curd from milk, micro-organism

Ex - *Lactobacillus* and other commonly called Lactic Acid Bacteria (L.A.B.) Grow over Milk and convert to curd, during growth the LAB produce acid coagulated and partially digest to milk protein A small amount of the curd add to the fresh milk and milk fluid contain some percentage of LAB, at suitable temperature multiply. So converting milk to curd which also improve its nutrition quantity by increasing vit B₁₂ in our stomach. The LAB play very beneficial role in checking disease causing microbes.

2. Yeast :- Louis Pasteur show in the middle of nineteenth century that a beer and butter milk are produced from fermentation is brought by yeast. Yeast is microscopic single called organism.

Saccharomyces - cerevisiae

Sucrose $\xrightarrow{\text{yeast}}$ Glucose+Fructose

Glucose $\xrightarrow{\text{yeast}}$ $2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2$

$\text{C}_{12}\text{H}_{22}\text{O}_{11} + \text{H}_2\text{O} \xrightarrow{\text{yeast}}$ $\text{C}_6\text{H}_{12}\text{O}_6 + \text{C}_6\text{H}_{12}\text{O}_6$

$\text{C}_6\text{H}_{12}\text{O}_6 + \text{H}_2\text{O} \longrightarrow 2\text{C}_2\text{H}_5\text{O}_2 + 2\text{CO}_2$

Complex organic compound convert alcohol by yeast fermentation .

Note- First time Biotechnology word was proposed by Karl-Aerechy. The technique of genetic engineering which include creation of recombinant DNA, use of gene cloning and gene transfer, overcome this limitation and allow us to isolate and introduce only one or a set of desirable genes without introducing undesirable genes into the target organism.

BIOLOGY FOR NEET & AIIMS

- Genetic engineering (Recombinant DNA Technology):
- It is a type of biotechnology involving manipulation of DNA.
- Biotechnology deals with techniques of using live organisms or enzymes from organisms to produce products & processes useful to humans.
- Genetic engineering involves techniques to alter the chemistry of genetic material (DNA & RNA) to introduce these into host organism and thus change the phenotype of host organism.
- Stanley Cohen & Herbert Boyer (1972) first of all contrast recombinant DNA by joining an antibiotic resistance gene to the plasmid of *Salmonella typhimurium*.
- Paul Bergh (Father of genetic engineering) transferred a gene of SV-40 virus into *E. coli* with the help of λ -phage vector.
- There are three basic steps in genetically modifying an organism :-
 - (i) Identification of DNA with desirable genes.
 - (ii) Introduction of the identified DNA into the host.
 - (iii) Maintenance of introduced DNA in the host & transfer of the DNA to its progeny.

TOOLS OF RECOMBINANT DNA TECHNOLOGY

→ Four types of tools are required :

1. Enzymes
2. Vectors
3. Passenger DNA
4. Host cells

(1) Enzymes : Five different enzymes are generally required.

- (a) Lysing enzyme : Required for lysis of the cells. e.g. Lysozyme.
- (b) Cleaving enzyme : Required for cutting of DNA molecules.

→ Restriction endonuclease enzymes are used for this purpose.

→ They are also known as 'molecular scissor'

→ The first restriction endonuclease discovered was Hind-II.

→ All the restriction endonuclease are naturally found in bacteria as a part of their defence system.'

→ All restriction enzymes cuts DNA at specific base sequence known as recognition / restriction sequence.

→ More than 900 restriction enzymes have been isolated from over 230 strains of bacteria.

→ In the naming of these enzymes, first letter of name comes from genes & second two letters from species of bacteria. The fourth letter indicates strain of bacteria. Roman number following the names indicates the order in which the enzyme were isolated from that strain of bacteria.

→ The restriction site of these enzyme is a specific pallindromic nucleotide sequence in the DNA.

- (c) Synthesizing enzyme : Required for synthesis of DNA.
e.g. DNA polymerase, Reverse transcriptase.
- (d) Joining enzyme : Required for joining of DNA segments. e.g. DNA ligase.
- (e) Alkaline phosphatase : It cut off phosphate group from the 5' end of linearised circular DNA & prevents its recircularization.

(2) Vector/ Vehicle DNA:

→ They are the DNA used as carrier for transferring a fragment of DNA into suitable host cell.

→ A vector must have following three features :

- (i) Presence of 'Ori' to start the replication.

SOLVED EXAMPLE

Ex.1 Which of these is used as vector in gene therapy for SCID

Or

Which of the following has the ability to transform normal cells into cancerous cell in animal

- (A) Arbovirus (B) Rotavirus
 (C) Enterovirus (D) Parvovirus
 (E) Retrovirus

Sol. (E)

Ex.2 Which of the following organelle is related with genetic engineering/gene cloning

- (A) Golgi apparatus (B) Lysosomes
 (C) Mitochondria (D) Plasmids

Sol. (D) : Plasmids are extrachromosomal covalently closed circular doublestranded molecules of DNA present in most prokaryotes. Therefore they are used as a vector in genetic engineering.

Ex.3 Recombinant DNA (rDNA) technology is related with

- (A) C. Darwin (B) Stanley Cohen
 (C) Herbert Boyer (D) Both (B) and (C)

Sol. (D) : The first recombinant DNA was constructed by Stanley Cohen and Herbert in 1972. They cut the piece of DNA from a plasmid carrying antibiotic - resistance gene in the bacterium *Salmonella typhimrium* and linked it to the plasmid of *Escherichia coli*.

Ex.4 Which one of the following techniques made it possible to genetically engineer living organisms

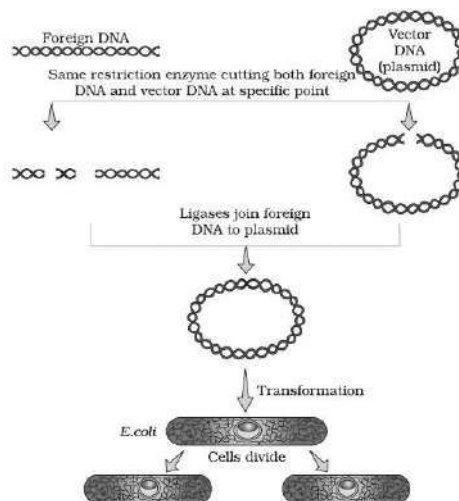
Or

The experimental manipulation of DNA of different species producing recombinant DNA is known as

- (A) Heavier isotope labelling
 (B) Hybridization
 (C) Recombinant DNA techniques
 (D) X-ray diffraction

Sol. (C)

Ex.5 The below figure refers to recombinant DNA technology. Identify A, B, C and D respectively



	A	B	C	D
(A)	Restriction Endonuclease	Restriction Endonuclease	DNA ligase	Transformation
(B)	Exonuclease	Endonuclease	Hydrolase	Transduction
(C)	Endonuclease	Exonuclease	DNA ligase	Transformation
(D)	Exonuclease	Endonuclease	DNA ligase	Transformation

Sol. (A)

Ex.6 Which of the following enzymes catalyse the removal of nucleotides from the ends of DNA

- (A) Endonuclease (B) Exonuclease
 (C) DNA ligase (D) Hind - II

Sol. (B)

Ex.7 Which of the given statements is correct in the context of visualizing DNA molecules separated by agarose gel electrophoresis.

- (A) DNA can be seen in visible light
 (B) DNA can be seen without staining in visible light
 (C) Ethidium bromide stained DNA can be seen in visible light
 (D) Ethidium bromide stained DNA can be seen under exposure to UV light

Sol. (D)

Exercise # 1**SINGLE OBJECTIVE****NEET LEVEL**

1. The linking of antibiotic resistance gene with the plasmid vector became possible with
(A) DNA polymerase (B) Exonucleases
(C) DNA ligase (D) Endonucleases
2. Main objective of production/use of herbicide resistant GM crops is to
(A) Encourage eco-friendly herbicides
(B) Reduce herbicide accumulation in food articles for health safety
(C) Eliminate weeds from the field without the use of manual labour
(D) Eliminate weeds from the field without the use of herbicides
3. Which of these is used as vector in gene therapy for SCID

Or

Which of the following has the ability to transform normal cells into cancerous cell in animal
(A) Arbovirus (B) Rotavirus
(C) Enterovirus (D) Parvovirus
(E) Retrovirus
4. Which one among the following is just a cloning plasmid not an expression plasmid
(A) pBAD-18-Cam (B) pBCSK
(C) pUC18 (D) pET
5. Branch dealing with genetic engineering is
(A) Eugenics (B) Euthenics
(C) Euphenics (D) None of these
6. Genetic engineering means
(A) Manipulation of cell contents
(B) Test tube babies
(C) Manipulation of cytochromes
(D) Manipulation (modification) of genes
7. Who among the following scientists is associated with the discoveries in genetic engineering
(A) Khorana (B) Watson
(C) Crick (D) Messelson
8. It is now possible to breed plants and animals with desired characters through
(A) Genetic engineering
(B) Chromosome engineering
(C) Ikebana technique
(D) Tissue culture
9. Which of the following organelles is related with genetic engineering/gene cloning
(A) Golgi apparatus (B) Lysosomes
(C) Mitochondria (D) Plasmids
10. In genetic engineering, a DNA segment (gene) of interest, is transferred to the host cell through a vector. Consider the following four agents (A-D) in this regard and select the correct option about which one or more of these can be used as a vector/vectors
Statements
(A) A bacterium (B) Plasmid
(C) Plasmodium (D) Bacteriophage
11. Recombinant DNA (rDNA) technology is related with
(A) C. Darwin (B) Stanley Cohen
(C) Herbert Boyer (D) Both (B) and (C)
12. A desirable change in genotype of an organism is obtained by
(A) DNA replication (B) Protein synthesis
(C) rDNA technology (D) m-RNA formation
13. Which of these is widely used in genetic engineering
(A) Anopheles (B) Dragon fly
(C) Dragon lizard (D) Fruit fly
14. Identify the plasmid
(A) AIU I (B) Hind III
(C) Eco RI (D) pBr 322
15. In recombination vector used is
(A) Protein
(B) Agrobacterium tumefaciens
(C) Nucleic acid
(D) Cellulose
16. First biochemical to be produced commercially by microbial cloning and genetic engineering is
(A) Human insulin (B) Penicillin
(C) Interferons (D) Fertility factors
17. Which of the following option is correct for recombinant DNA technology
(A) Exonuclease enzyme removes nucleotides from site within DNA
(B) Endonuclease enzyme removes nucleotides from the ends of DNA
(C) Endonuclease enzyme cut long polandric DNA strands
(D) Exonuclease enzyme removes nucleotides from ends of DNA

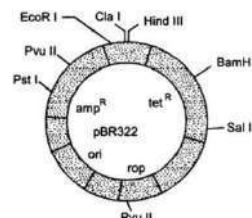
Exercise # 2

SINGLE OBJECTIVE

AIIMS LEVEL

1. Restriction endonucleases are most widely used in recombinant DNA technology. They are obtained from
 (A) Bacteriophages (B) Bacterial cells
 (C) Plasmids (D) All prokaryotic cells
2. In recombinant DNA technique the term vector refers to
 (A) Plasmids that can transfer foreign DNA into a living cell
 (B) Cosmids that can cut DNA at specific base sequence
 (C) Plasmids that can join different DNA fragments
 (D) Cosmids that can degrade harmful proteins
3. An analysis of chromosomal DNA using the southern hybridization technique does not use
 (A) Autoradiography (B) PCR
 (C) Electrophoresis (D) Blotting
4. Genetic engineering has been successfully used for producing
 (A) Animals like bulls for farm work as they have super power
 (B) Transgenic mice for testing safety of polio vaccine before use in humans
 (C) Transgenic models for studying new treatments for certain cardiac diseases
 (D) Transgenic Cow-Rosie which produces high fat milk for making ghee
5. pBR322 which is frequently used as a vector for cloning gene in *E. coli* is a/an
 (A) Original bacterial plasmid
 (B) Modified bacterial plasmid
 (C) Viral genome
 (D) Transposon
6. Which one of the following techniques made it possible to genetically engineer living organisms. The experimental manipulation of DNA of different species producing recombinant DNA is known as
 (A) Heavier isotope labeling
 (B) Hybridization
 (C) Recombinant DNA techniques
 (D) X-ray diffraction
7. The enzyme which are absolutely necessary for recombinant DNA technology are
 (A) Restriction endonucleases and topoisomerases
 (B) Endonucleases and polymerases
 (C) Restriction endonucleases and ligases
 (D) Peptidases and ligases

8. The figure below is the diagrammatic representation of the *E. coli* vector pBR 322. Which one of the given options correctly identifies its certain component (s)



- (A) Ori-original restriction enzyme
 - (B) Rop-reduced osmotic pressure
 - (C) Hind III, EcoRI - selectable markers
 - (D) amp^R, tet^R - Antibiotic resistance genes
9. PCR and Restriction Fragment Length Polymorphism are the methods for
 (A) Study of enzymes
 (B) Genetic transformation
 (C) DNA sequencing
 (D) Genetic-Fingerprinting
10. Fearing that the child to be born may have a genetic disorder, a couple goes to a doctor. Which one of the following techniques is likely to be suggested by the doctor to cure the genetic disorder
 (A) Hybridoma technology
 (B) Gene therapy
 (C) rDNA technology
 (D) Embryo transfer
11. In genetic engineering, the antibiotics are used
 (A) As selectable markers
 (B) To select healthy vectors
 (C) As sequences from where replication starts
 (D) To keep the cultures free of infection
12. The colonies of recombinant bacteria appear white in contrast to blue colonies of non-recombinant bacteria because of
 (A) Inactivation of glycosidase enzyme in recombinant bacteria
 (B) Non-recombinant bacteria containing beta-galactosidase
 (C) Insertional inactivation of alpha-galactosidase in non-recombinant bacteria
 (D) Insertional inactivation of alpha-galactosidase in recombinant bacteria

Exercise # 3**PART - 1****MATRIX MATCH COLUMN**

1. Match Column - I and Column - II and select the right option given below.
- | Column - I | Column - II |
|------------------------------------|------------------------------------|
| (I) Recombinant DNA technology | (A) Vector |
| (II) Cloning Vehicle | (B) Sealing enzyme |
| (III) Macromolecular | (C) Electrophoresis |
| (IV) DNA Ligase | (D) Genetic engineering |
| (A) I - D, II - A, III - B, IV - C | (B) I - A, II - D, III - B, IV - C |
| (C) I - D, II - A, III - C, IV - B | (D) I - B, II - A, III - D, IV - C |
2. Match the scientists in Column-I with their related discoveries in Column-II and select the correct option from the codes given below.
- | Column-I | Column-II |
|-------------------------------------|--|
| (A) Kary Mullis | (i) Father of genetic engineering |
| (B) Paul Berg | (ii) Nobel prize for the discovery of restriction endonucleases |
| (C) Stanley Cohen and Herbert Boyer | (iii) Developed polymerase chain reaction |
| (D) Arber, Smith and Nathan | (iv) Isolated an antibiotic resistant gene from a plasmid of the bacterium <i>Salmonella typhimurium</i> |
| (A) A-(iii), B-(i), C-(iv), D-(ii) | (B) A-(iii), B-(iv), C-(i), D-(ii) |
| (C) A-(iv), B-(ii), C-(iii), D-(i) | (D) A-(i), B-(iii), C-(iv), D-(ii) |
3. Match Column-I with Column-II and select the correct answer from codes given below.
- | Column-I | Column-II |
|------------------------------------|------------------------------------|
| (A) amp^r | (i) Artificial plasmid |
| (B) macromolecular separation | (ii) Selectable marker |
| (C) Hind III | (iii) Electrophoresis |
| (D) pBR322 | (iv) <i>Haemophilus influenzae</i> |
| (A) A-(iii), B-(ii), C-(i), D-(iv) | (B) A-(iv), B-(i), C-(iii), D-(ii) |
| (C) A-(ii), B-(iii), C-(iv), D-(i) | (D) A-(ii), B-(iv), C-(i), D-(iii) |
4. Match the terms given in Column-I with their definitions in Column-II and select the correct answer from codes given below.
- | Column-I | Column-II |
|------------------------------------|---|
| (A) Transformation | (i) Sequences cut by restriction enzymes |
| (B) Recognition | (ii) Process by which DNA sequences fragments are separated based on their size |
| (C) Gel electrophoresis | (iii) Plasmid DNA that has incorporated human DNA |
| (D) Recombinant DNA | (iv) Process by which bacteria take up pieces of DNA from the environment |
| (A) A-(iii), B-(i), C-(ii), D-(iv) | (B) A-(iv), B-(i), C-(ii), D-(iii) |
| (C) A-(i), B-(ii), C-(iii), D-(iv) | (D) A-(ii), B-(iii), C-(iv), D-(i) |
5. Match Column-I with Column-II with respect to the nomenclature of restriction enzyme Eco R I and select the correct answer from codes given below.
- | Column-I | Column-II |
|------------------------------------|------------------------------------|
| (A) E | (i) 1st in order of identification |
| (B) Co | (ii) Name of genus |
| (C) R | (iii) Name of species |
| (D) I | (iv) Name of strain |
| (A) A-(iii), B-(i), C-(ii), D-(iv) | (B) A-(iv), B-(i), C-(iii), D-(iv) |
| (C) A-(i), B-(ii), C-(iii), D-(iv) | (D) A-(ii), B-(iii), C-(iv), D-(i) |

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. Plasmids are suitable vectors for gene cloning because
 - (A) these are small circular DNA molecules which can integrate with host chromosomal DNA
 - (B) these are small circular DNA molecules with their own replication origin site
 - (C) these can shuttle between prokaryotic and eukaryotic cells
 - (D) these often carry antibiotic resistance genes
2. Plasmid is
 - (A) fragment of DNA which acts as vector
 - (B) a fragment which joins two genes
 - (C) mRNA which acts as carrier
 - (D) autotrophic fragment
3. In bacteria, plasmids
 - (A) extrachromosomal material
 - (B) main DNA
 - (C) non-functional DNA
 - (D) repetitive gene
4. A mutant strain of T_4 -bacteriophage R-II, fails to lyse the E. coli but when two strains R-II^x and R-II^y are mixed then they lyse the E. coli. What may be the possible reason?
 - (A) Bacteriophage transforms in wild
 - (B) It is not mutated
 - (C) Both strains have similar cistrons
 - (D) Both strains have different cistrons
5. Manipulation of DNA in genetic engineering became possible due to the discovery of
 - (A) restriction endonuclease
 - (B) DNA ligase
 - (C) transcriptase
 - (D) primase
6. ELISA is used to detect viruses where the key reagent is
 - (A) alkaline phosphatase
 - (B) catalase
 - (C) DNA probe
 - (D) RNase
7. The Ti plasmid, is often used for making transgenic plants. This plasmid is found in
 - (A) *Azotobacter*
 - (B) *Rhizobium* of the roots of leguminous plants
 - (C) *Agrobacterium*
 - (D) Yeast as a 2 μ m plasmid
8. In transgenics, expression of transgene in target tissue is determined by
 - (A) enhancer
 - (B) transgene
 - (C) promoter
 - (D) reporter
9. Restriction endonucleases
 - (A) are present in mammalian cells for degradation of DNA when the cell dies
 - (B) are used in genetic engineering for ligating two DNA molecules
 - (C) are used for *in vitro* DNA synthesis
 - (D) are synthesised by bacteria as part of their defense mechanism
10. The linking of antibiotic resistance gene with the plasmid vector became possible with
 - (A) DNA polymerase
 - (B) exonucleases
 - (C) DNA ligase
 - (D) endonucleases
11. Gel electrophoresis is used for
 - (A) construction of recombinant DNA by joining with cloning vectors
 - (B) isolation of DNA molecules
 - (C) cutting of DNA into fragments
 - (D) separation of DNA fragments according to their size
12. The genetic defect - Adenosine Deaminase (ADA) deficiency may be cured permanently by
 - (A) periodic infusion of genetically engineered lymphocytes having functional ADA cDNA
 - (B) administering adenosine deaminase activators
 - (C) introducing bone marrow cells producing ADA into cells at early embryonic stages
 - (D) enzyme replacement therapy
13. Polyethylene glycol method is used for
 - (A) biodiesel production
 - (B) seedless fruit production
 - (C) energy production from sewage
 - (D) gene transfer without a vector
14. Which one of the following is commonly used in transfer of foreign DNA into crop plants?
 - (A) *Trichoderma harzianum*
 - (B) *meloidogyne incognita*
 - (C) *Agrobacterium tumefaciens*
 - (D) *Penicillium expansum*

1. Which one of the following techniques made it possible to genetically engineer living organisms?
 (A) Recombinant DNA techniques (B) X-ray diffraction
 (C) Heavier isotope labelling (D) Hybridisation
2. In genetic fingerprinting, the 'probe' refers to _____
 (A) a radioactively labelled single stranded DNA molecule
 (B) a radioactively labelled single stranded RNA molecule
 (C) a radioactively labelled double stranded RNA molecule
 (D) a radioactively labelled double stranded DNA molecule
3. Plants in comparison to animals are more rapidly manipulated by genetic engineering. Select out the most probable reason for this
 (A) Totipotency shown by plant cells
 (B) Single somatic cell can regenerate a whole plant body
 (C) Genetic engineering is supplemented with plant tissue culture techniques
 (D) All of the above
4. A foreign DNA and plasmid cut by the same restriction endonuclease can be joined to form a recombinant plasmid using
 (A) EcoRI (B) Taq polymerase (C) Polymerase III (D) Ligase.
5. Which of the following restriction enzymes produces blunt ends?
 (A) Sall (B) EcoRV (C) XhoI (D) HindIII
6. Match the items in column I with their use in column II and choose the right option
- | | |
|------------------------------------|--|
| Column I | Column II |
| (A) ELISA | (i) Antigen- antibody interaction |
| (B) PCR | (ii) Gene amplification |
| (C) Biolistics | (iii) Direct introduction of recombinant DNA |
| (D) Micro-injection | (iv) Gold coated DNA |
| (A) A-(iii), B-(iv), C-(i), D-(ii) | (B) A-(ii), B-(i), C-(iv), D-(iii) |
| (C) A-(iv), B-(i), C-(ii), D-(iii) | (D) A-(i), B-(iv), C-(ii), D-(iii) |
| (E) A-(i), B-(ii), C-(iv), D-(iii) | |
7. Match the items in column I with their uses in column II and choose the right option
- | | |
|--------------------------------------|------------------------------------|
| Column I | Column II |
| (A) <i>Bacillus thuringiensis</i> | (i) Restriction endonuclease |
| (B) <i>Agrobacterium tumefaciens</i> | (ii) Thermostable DNA polymerase |
| (C) <i>Thermus aquaticus</i> | (iii) Insecticidal protein |
| (D) <i>Escherichia coli</i> | (iv) Ti plasmid |
| (A) A-(iii), B-(iv), C-(i), D-(ii) | (B) A-(ii), B-(i), C-(iv), D-(iii) |
| (C) A-(iv), B-(i), C-(ii), D-(iii) | (D) A-(i), B-(iv), C-(ii), D-(iii) |
| (E) A-(iii), B-(iv), C-(ii), D-(i) | |
8. Which organism is used to transfer T-DNA?
 (A) *Streptomyces hygroscopicus* (B) *Agrobacterium tumefaciens*
 (C) *Salmonella typhi* (D) *Escherichia coli*