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5 MOST FREQUENTLY ASKED TOPICS IN NEET

- Kingdom Monera
- Eukaryotic Cell
- Digestion of Food
- Infertility
- Tools of Recombinant DNA Technology

Kingdom Monera

- Which of the following are found in extreme saline conditions?
(a) Eubacteria (b) Cyanobacteria
(c) Mycobacteria (d) Archaeobacteria
- Which among the following are the smallest living cells, known without a definite cell wall, pathogenic to plants as well as animals and can survive without oxygen?
(a) *Pseudomonas* (b) Mycoplasma
(c) *Nostoc* (d) *Bacillus*
- Which of the following components provide sticky character to the bacterial cell?
(a) Nuclear membrane (b) Plasma membrane
(c) Glycocalyx (d) Cell wall
- DNA replication in bacteria occurs
(a) within nucleolus
(b) prior to fission
(c) just before transcription
(d) during S phase.
- Methanogens belong to
(a) Eubacteria (b) Archaeobacteria
(c) Dinoflagellates (d) Slime moulds.
- Which one of the following statements is wrong?
(a) Eubacteria are also called false bacteria.
(b) Phycomycetes are also called algal fungi.
(c) Cyanobacteria are also called blue-green algae.
(d) Golden algae are also called desmids.
- Pick up the wrong statement.
(a) Some fungi are edible.
(b) Nuclear membrane is present in Monera.
(c) Cell wall is absent in Animalia.
(d) Protists have photosynthetic and heterotrophic modes of nutrition.
- Cell wall is absent in
(a) mycoplasma (b) *Nostoc*
(c) *Aspergillus* (d) *Funaria*.
- The structures that help some bacteria to attach to rocks and/or host tissues are
(a) mesosomes (b) holdfast
(c) rhizoids (d) fimbriae.
- Archaeobacteria differ from eubacteria in
(a) cell membrane structure
(b) mode of nutrition
(c) cell shape
(d) mode of reproduction.
- The motile bacteria are able to move by
(a) fimbriae (b) flagella
(c) cilia (d) pili.
- Pigment containing membranous extensions in some cyanobacteria are
(a) pneumatophores (b) chromatophores
(c) heterocysts (d) basal bodies.
- Which of the following are likely to be present in deep sea water?
(a) Blue-green algae (b) Saprophytic fungi
(c) Archaeobacteria (d) Eubacteria

Eukaryotic Cell

14. Which of the following cell organelles is responsible for extracting energy from carbohydrates to form ATP?

- (a) Ribosome (b) Chloroplast
(c) Mitochondrion (d) Lysosome

15. Select the mismatch.

- (a) Gas vacuoles – Green bacteria
(b) Large central vacuoles – Animal cells
(c) Protists – Eukaryotes
(d) Methanogens – Prokaryotes

16. A cell organelle containing hydrolytic enzymes is

- (a) lysosome (b) microsome
(c) ribosome (d) mesosome.

17. 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.

18. Water soluble pigments found in plant cell vacuoles are

- (a) carotenoids (b) anthocyanins
(c) xanthophylls (d) chlorophylls.

19. Microtubules are the constituents of

- (a) centrioles, spindle fibres and chromatin
(b) centrosome, nucleosome and centrioles
(c) cilia, flagella and peroxisomes
(d) spindle fibres, centrioles and cilia.

20. Which one of the following cell organelles is enclosed by a single membrane?

- (a) Lysosomes (b) Nuclei
(c) Mitochondria (d) Chloroplasts

21. Which of the following are not membrane-bound?

- (a) Lysosomes (b) Mesosomes
(c) Vacuoles (d) Ribosomes

22. Cellular organelles with membranes are

- (a) endoplasmic reticulum, ribosomes and nuclei
(b) lysosomes, Golgi apparatus and mitochondria
(c) nuclei, ribosomes and mitochondria
(d) chromosomes, ribosomes and endoplasmic reticulum.

23. Match the columns and identify the correct option.

	Column I		Column II
A.	Thylakoids	(i)	Disc-shaped sacs in Golgi apparatus
B.	Cristae	(ii)	Condensed structure of DNA
C.	Cisternae	(iii)	Flat membranous sacs in stroma
D.	Chromatin	(iv)	Infoldings in mitochondria

- (a) A-(iii), B-(i), C-(iv), D-(ii)
(b) A-(iii), B-(iv), C-(ii), D-(i)
(c) A-(iv), B-(iii), C-(i), D-(ii)
(d) A-(iii), B-(iv), C-(i), D-(ii)

24. The solid linear cytoskeletal elements having a diameter of 6 nm and made up of a single type of monomer are known as

- (a) microtubules
(b) microfilaments
(c) intermediate filaments
(d) lamins.

25. The osmotic expansion of a cell kept in water is chiefly regulated by

- (a) mitochondria (b) vacuoles
(c) plastids (d) ribosomes.

26. Match the following and select the correct answer.

A.	Centriole	(i)	Infoldings in mitochondria
B.	Chlorophyll	(ii)	Thylakoids
C.	Cristae	(iii)	Nucleic acids
D.	Ribozymes	(iv)	Basal body of cilia or flagella

- A** **B** **C** **D**
(a) (iv) (ii) (i) (iii)
(b) (i) (iii) (iv) (iii)
(c) (i) (iii) (ii) (iv)
(d) (iv) (iii) (i) (ii)

27. The Golgi complex plays a major role

- (a) as energy transferring organelles
(b) in post translational modification of proteins and glycosylation of lipids
(c) in trapping the light and transforming it into chemical energy
(d) in digesting proteins and carbohydrates.

28. Which one of the following organelles in the figure correctly matches with its function?



- (a) Golgi apparatus, formation of glycolipids
(b) Rough endoplasmic reticulum, protein synthesis
(c) Rough endoplasmic reticulum, formation of glycoproteins
(d) Golgi apparatus, protein synthesis
29. A major site for synthesis of lipids is
(a) symplast (b) nucleoplasm
(c) RER (d) SER.

Digestion of Food

30. Which of the following options best represents the enzyme composition of pancreatic juice?
(a) Amylase, Pepsin, Trypsinogen, Maltase
(b) Peptidase, Amylase, Pepsin, Rennin
(c) Lipase, Amylase, Trypsinogen, Procarboxypeptidase
(d) Amylase, Peptidase, Trypsinogen, Rennin
31. Which hormones do stimulate the production of pancreatic juice and bicarbonate?
(a) Angiotensin and epinephrine
(b) Gastrin and insulin
(c) Cholecystokinin and secretin
(d) Insulin and glucagon
32. The enzyme that is not present in succus entericus is
(a) nucleosidase (b) lipase
(c) maltase (d) nuclease.
33. The initial step in the digestion of milk in humans is carried out by
(a) lipase (b) trypsin
(c) rennin (d) pepsin.
34. Which enzymes are likely to act on the baked potatoes eaten by a man, starting from the mouth as they move down the alimentary canal?
(a) Pancreatic amylase → Salivary amylase → Lipases
(b) Disaccharidase like maltase → Lipases → Nucleases
(c) Salivary amylase → Pancreatic amylase → Disaccharidases
(d) Salivary maltase → Carboxypeptidase → Trypsinogen

Infertility

35. In case of a couple where the male is having a very low sperm count, which technique will be suitable for fertilisation?
(a) Gamete intracytoplasmic Fallopian transfer
(b) Artificial Insemination
(c) Intracytoplasmic sperm injection
(d) Intra uterine transfer
36. Embryo with more than 16 blastomeres formed due to *in vitro* fertilisation is transferred into
(a) uterus (b) Fallopian tube
(c) fimbriae (d) cervix.
37. A childless couple can be assisted to have a child through a technique called GIFT. The full form of this technique is
(a) Gamete Internal Fertilisation and Transfer
(b) Germ cell Internal Fallopian Transfer
(c) Gamete Inseminated Fallopian Transfer
(d) Gamete Intra Fallopian Transfer.
38. Assisted reproductive technology, IVF involves transfer of
(a) ovum into the Fallopian tube
(b) zygote into the Fallopian tube
(c) zygote into the uterus
(d) embryo with 16 blastomeres into the Fallopian tube.
39. Artificial insemination means
(a) artificial introduction of sperms of a healthy donor into the vagina
(b) introduction of sperms of a healthy donor directly into the ovary
(c) transfer of sperms of a healthy donor to a test tube containing ova
(d) transfer of sperms of husband to a test tube containing ova.

Tools of Recombinant DNA Technology

40. The DNA fragments separated on an agarose gel can be visualised after staining with
(a) acetocarmine (b) aniline blue
(c) ethidium bromide (d) bromophenol blue.
41. DNA fragments are
(a) negatively charged
(b) neutral
(c) either positively or negatively charged depending on their size
(d) positively charged.
42. A gene whose expression helps to identify transformed cell is known as
(a) vector (b) plasmid
(c) structural gene (d) selectable marker.

43. What is the criterion for DNA fragments movement on agarose gel during gel electrophoresis ?
 (a) The smaller the fragment size, the farther it moves.
 (b) Positively charged fragments move to farther end.
 (c) Negatively charged fragments do not move.
 (d) The larger the fragment size, the farther it moves.
44. 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.
45. Which of the following restriction enzymes produces blunt ends?
 (a) *Sal I* (b) *EcoRV*
 (c) *Xho I* (d) *Hind III*
46. The *Taq* polymerase enzyme is obtained from
 (a) *Bacillus subtilis*
 (b) *Pseudomonas putida*
 (c) *Thermus aquaticus*
 (d) *Thiobacillus ferrooxidans*.
47. Which of the following is a restriction endonuclease?
 (a) DNase I (b) RNase
 (c) *Hind II* (d) Protease
48. Which of the following is not a feature of the plasmids?
 (a) Transferable
 (b) Single-stranded
 (c) Independent replication
 (d) Circular structure
49. The DNA molecule to which the gene of interest is integrated for cloning is called
 (a) template (b) carrier
 (c) transformer (d) vector.
50. The cutting of DNA at specific locations became possible with the discovery of
 (a) selectable markers (b) ligases
 (c) restriction enzymes (d) probes.
51. Which vector can clone only a small fragment of DNA?
 (a) Bacterial artificial chromosome
 (b) Yeast artificial chromosome
 (c) Plasmid
 (d) Cosmid
52. Commonly used vectors for human genome sequencing are
 (a) T - DNA (b) BAC and YAC
 (c) expression vectors (d) T/A cloning vectors.
53. DNA fragments generated by the restriction endonucleases in a chemical reaction can be separated by
 (a) electrophoresis
 (b) restriction mapping
 (c) centrifugation
 (d) polymerase chain reaction.

ANSWER KEY

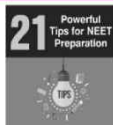
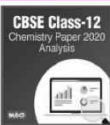
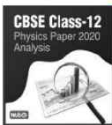
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|---------|---------|---------|---------|-----------|
| 1. (d) | 2. (b) | 3. (c) | 4. (b) | 5. (b) |
| 6. (a) | 7. (b) | 8. (a) | 9. (d) | 10. (a) |
| 11. (b) | 12. (b) | 13. (c) | 14. (c) | 15. (b) |
| 16. (a) | 17. (a) | 18. (b) | 19. (d) | 20. (a) |
| 21. (d) | 22. (b) | 23. (d) | 24. (b) | 25. (b) |
| 26. (a) | 27. (b) | 28. (b) | 29. (d) | 30. (c) |
| 31. (c) | 32. (d) | 33. (c) | 34. (c) | 35. (b,c) |
| 36. (a) | 37. (d) | 38. (b) | 39. (a) | 40. (c) |
| 41. (a) | 42. (d) | 43. (a) | 44. (d) | 45. (b) |
| 46. (c) | 47. (c) | 48. (b) | 49. (d) | 50. (c) |
| 51. (c) | 52. (b) | 53. (a) | | |



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ZOOM in



The syllabus for NEET is very vast which impedes students from acquiring in-depth knowledge and covering the entire syllabus at the same time. An important topic for NEET is therefore presented here in elaborate form to enable students grasp the topic, analyse the type of questions and SCORE HIGH.

BI

Ecological Succession

A typical community maintains itself, more or less in an equilibrium with the prevailing conditions of the environment. Although in nature, communities are never stable; rather, they are dynamic, changing more or less regularly over time and space. They are never found permanently in complete balance with their component species or with the physical environment. Environment is always changing over a period of time due to :

- variations in climatic and physiographic factors and
- the activities of the species of the communities themselves.

These influences bring about marked changes in the dominants of the existing community, which is thus, sooner or later replaced by another community at the same place. This process continues and successive communities develop, one after the other, over the same area, until the terminal final community again becomes more or less stable over a period of time. This occurrence of relatively definite sequence of communities over a period of time, in the same area, is known as **ecological succession**.

The authentic studies on succession were started in America by **Cowles (1899)**. **Clements (1907, 1916)** thereafter, put forth various principles that governed the process of succession and while studying plant communities, defined succession as 'the natural process by which the same locality becomes successively colonised by different groups or communities of plants'.

Odum (1971) preferred to designate this orderly process as **ecosystem development**, rather than the more often called, ecological succession.

During succession, some species colonise in an area and their population becomes more numerous, whereas population of previous species declines and even disappears. The present day communities in the world have come into existence because of succession, that has occurred over millions of years, since life started on earth.

The first biotic community which develops in a bare area with very little diversity is called **pioneer community**. This stage takes the longest time to change the environment for invasion of the next community.

Climax or **climatic climax community** is the stable, self-perpetuating and final biotic community that develops at the end of biotic succession and is in perfect harmony with the physical environment. This community has **maximum diversity and niche specialisation**.

The various biotic communities that develop during biotic succession or the **intermediate communities** between the pioneer and climax communities are termed as **seral stages** or **transitional communities**. The entire sequence of developmental stages of biotic succession from pioneer to a climax community is known as **sere**.

GENERAL PROCESS OF SUCCESSION

The whole process of biotic succession is actually completed through a number of sequential steps, which follow one another. These steps in sequence are as follows :

- (i) **Nudation** : Formation of bare area without any form of life is called nudation. The causes of nudation may be **climatic** (e.g., wind, floods, drought, storm, frost, etc.), **topographic** (e.g., glaciation, volcanic eruptions, etc.) or **biotic** (e.g., epidemic, human activities, etc).
- (ii) **Invasion** : Successful establishment of a species in a bare area is called invasion. It is completed in three steps: **migration** (dispersal), **ecesis** (establishment) and **aggregation** (species stay close to each other).
- The transfer of seeds, spores or other propagules of the **first settler species** to the bare area is called **migration**. It is generally brought about by the agency of wind and water.
 - The species which invade the bare area must grow, establish and reproduce for successful succession. This depends largely on the **characteristics of substratum, climatic and other environmental factors** of the area. Those species which get adjusted to this situation ultimately get **established**. As a result of **ecesis**, individuals of the species become established in the area.
 - After ecesis, the individuals of the species **increase in number** by reproduction and they get close to each other. This process is called **aggregation**.
- (iii) **Competition and co-action** : Initially, many species invade the bare area simultaneously. However, those which find the environment favourable ultimately establish and get aggregated in the limited available area. This results in competition, mainly for **space and food**. Competition may be **interspecific or intraspecific**. Various kinds of interspecific and intraspecific interactions affect the individuals of species in various ways called **co-action**. The species which are unable to compete are ultimately eliminated.
- (iv) **Reaction** : The living organisms **reciprocally influence** and get influenced by the environment. This is known as **reaction**. As a result of reaction, changes take place in **soil, water, light conditions, temperature, etc.**, of the area. Thus, the **environment of the area gets modified**, becoming unsuitable for the existing community, which in course of time, gets replaced by another community (**seral community**).
- (v) **Stabilisation** : Finally, the terminal or climax community becomes stabilised for a longer period of time as it can maintain itself in equilibrium with the prevailing conditions. The climatic causes determine the nature of the climatic climax, *i.e.*, the end point of succession. They have a profound effect in determining the population from the beginning to end, the number and kinds of stages, as well as the reactions of the successive stages. The process of succession in the tropics is similar to that in temperate regions but the plant populations are often quite different due to the climate.

TYPES OF ECOLOGICAL SUCCESSION

The various types of succession have been grouped in different ways, on the basis of different aspects. Some basic types of succession are, however, as follows:

Primary Succession

This is a biotic succession which occurs on a **previously bare or unoccupied area**, e.g., new exposed rock area, sand dunes, igneous rocks, deltas, newly created pond or reservoir. **Soil is absent** in the beginning of primary succession and there is **no humus**. The establishment of a new biotic community is **generally slow**.

The first group of organisms establishing on such bare or unoccupied areas are known as the **pioneers, primary community or primary colonisers**. As a result of ecological succession, changes in vegetation occur, which in turn, affect food and shelter for various types of animals.

Based on the nature of the habitat, succession of plants is of two types : **hydrarch** (or **hydrosere**) and **xerarch** (or **xerosere**). **Hydrosere** starts in regions where water is plenty and progresses from **hydric to mesic conditions** (adequate moisture conditions). On the other hand, **xerosere** starts in regions where moisture is present in minimal amounts, such as dry deserts, rocks, etc., and it progresses from **xeric to mesic conditions**. Both hydrarch and xerach successions lead to medium water conditions (mesic)-neither too dry nor too wet.

Secondary Succession

This succession of communities occur in previously inhabited areas, which have been naturally or artificially disturbed and where soil and some organisms are already present, e.g., cut over forest, abandoned crop land, ploughed fields and lands that have been flooded.

Natural phenomena, such as avalanches (massive snow-slides), **landslides, volcanic eruptions, earthquakes, floods, prolonged severe droughts and forest fires set by lightning**, destroy existing communities and pave the way for secondary succession. An **abandoned field, heavily overgrazed pasture, deforested tract** also provide sites for secondary succession.

Secondary succession is **much faster** than the primary succession because the soil, humus, certain organisms and reproductive structures of previous occupants within soil are already present. Surviving seeds, underground stems, persisting and new invading species rapidly grow on the return of favourable conditions. Pioneer community develops partly from previous occupants and partly from migrants. This re-establishes the biotic community through necessary seral changes, in due course of time.

Autogenic Succession

The succession resulting from changes brought about by the organisms themselves is called autogenic succession. In autogenic succession, the principal force of change comes from within the community. An abandoned agricultural field changing into a mature forest over long span of time is an example of autogenic succession.

Allogenic Succession

The succession resulting from changes brought about by factors external to the community is called allogenic succession. Such external forces may include climate change, massive disturbances or changes in temperature and other environmental factors.

Autotrophic Succession

This is characterised by early and continued dominance of autotrophic organisms like green plants. It starts in a predominantly inorganic environment and the energy flow is maintained indefinitely. The primary and secondary successions, both come under autotrophic succession and are widespread in nature.

Heterotrophic Succession

This succession is characterised by early dominance of heterotrophs such as bacteria, fungi and actinomycetes. It begins in a predominantly organic environment, e.g., a stream heavily polluted with sewage. In this type of succession, energy is maximum at the beginning followed by a progressive decline in the energy content. The end point is utilisation of all the energy and dispersion of the community.

Induced Succession

This occurs due to extensive external interference. Here, the initial community has high productivity which gradually decreases. Agriculture can be deemed as an example of induced succession. Here, a steady stage is maintained for an ultimate good harvest.

Retrogressive Succession

Due to environmental thrust and biotic influences the climax vegetation may retrograde into shrub land or savannah. This is referred to as retrogressive succession.

Deflected Succession

Sometimes due to changes in local conditions such as soil characteristic or microclimate, the process of succession becomes deflected in a different direction than that presumed under climatic conditions of the area. Thus, the climax communities are likely to be different from the presumed climatic climax community. This type of succession is called deflected succession.

SOME EXAMPLES OF PRIMARY SUCCESSION

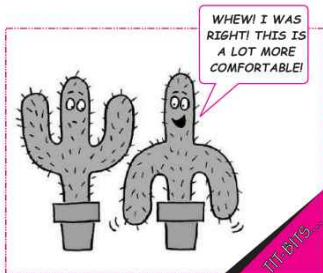
A. Lithosere

This is a type of xerosere originating on bare rock surfaces. The original substratum is deficient in water and lacks any organic matter, having only minerals in disintegrated unweathered state. The pioneers to colonise this primitive substratum are crustose type of lichens and through a series of successive seral stages, the succession finally terminates into forest trees, which constitute the climax community. The various stages of a lithosere and their component plant species appearing on a rock are as follows :

(i) Lichen stage

Lichens are the first to appear on a bare rock. The lichens which colonise bare rock are crustose lichens, e.g., *Rhizocarpon*, *Rinodina*, etc. These lichens are resistant to desiccation in extreme temperature. Their propagules, dropped by wind on a rock

The species which is quicker to exploit any vacant patches in the environment before more competitive species occupies the place is known as **fugitive species**.



and moistened by rain or dew, develop attaching rhizoids and grow into lichens. The lichens produce **organic acids** which corrode the rock surface, producing depressions and releases minerals which facilitate further growth of the lichens. The lichens hold the fine particles of rock, along with the sand particles brought by wind, in the depressions, to initiate **soil formation**. Dead lichens contribute **organic matter** to the forming soil which slowly becomes **fertile**.

Crustose lichens are then replaced by foliose type of lichens, e.g., *Dermatocarpon*, *Parmelia*, etc. These lichens have large leaf-like thalli, they can absorb and retain more water and are able to accumulate dust particles which help in the further build up of the substratum. Thus, some humus becomes accumulated. The weathering of rocks and its mixing with humus results in the development of a fine thin soil layer on rock surface and thus there is a change in the habitat.

(ii) Moss stage

In the **meagre soil** formed by lichens, moss appears as the first plant community. Mosses (e.g., *Tortula*, *Grimmia*) can gain a hold in the succession even there is a thin layer of lichen remains. Mosses being taller and gregarious, kill the lichens with their shade and replace them. Mosses break up the rock further, later adding humus to the soil, **increasing its thickness, fertility and water-holding capacity**.

(iii) Herb or grass stage

Due to more extensive growth of mosses more soil is accumulated there and more minerals are added to it due to leaching out from the overlying vegetation. This changed habitat favours the growth of some herbaceous weeds which are chiefly the annuals, in turn being followed by some biennials and perennials. Annual grasses (e.g., *Aristida*, *Poa*, *Eleusine*) hold the rock particles in place. Their roots penetrate deeper, causing more **weathering of rocks**. Being larger, the grasses replace the mosses. As time passes, grasses die, adding more moisture-retaining **humus to the soil**. This changes the composition of the soil and gradually develops conditions in which perennial grasses (e.g., *Cynodon*, *Cymbopogon*, *Heteropogon*) can grow.

These grasses rapidly spread by means of **runners and rhizomes**. They further enrich the soil, in which hard annual herbs, then biennial and perennial herbs can grow. All these plants, in turn, add to the thickness and fertility of the soil.

(iv) Shrub stage

Due to much accumulation of soil, the habitat becomes suitable for shrubs, which gradually replace the grasses and herbs (e.g., *Ziziphus*, *Capparis*, *Rhus*). The roots of the shrubs go deeper and fragment more rock material, making the soil still thicker. Their dead parts, decaying leaves add organic matter that makes soil more fertile and moist.

(v) Tree or climax community stage

Finally, the trees come in and replace the shrubs. The trees, by transpiration, make the environment cool and moist. The trees are not replaced and form the **climax community**. The type of climax community is determined by the climate of the region. **Rain forests** develop in the **moist, warm, tropical zones** and **coniferous or deciduous forests** grow in the **cool temperate regions**. In the areas having less rainfall, the primary succession produces grasslands. The shrub and tree stages fail to appear in such places. The plants of each community modify the soil by adding humus, enabling the next community to grow.

Each seral community modifies the environmental conditions in such a way that these are less favourable for itself and more favourable for the next community. In fact, each community acts to end itself. Succession of plant communities is accompanied by succession of animal communities. Each plant community in the sere is inhabited by a characteristic group of animals. The grass and shrub communities have spiders and grasshoppers. The forest community has ants, termites, earthworms, snails, centipedes, millipedes, birds, squirrels, etc.

Development of **climax forests** on bare rocks or sand dunes, i.e., primary succession, takes at least 1,000 years. The succession on a cow dung might be completed within 3 months.

• Snap Shots

- Opportunist species are plant species with short life spans that devote most of the energy to produce seeds so that newly available habitats can be exploited, e.g., grass.
- As succession progresses toward the climax, each of the following increases: rate of decomposition and nutrient cycling; soil richness and depth; species diversity; specialised niche.

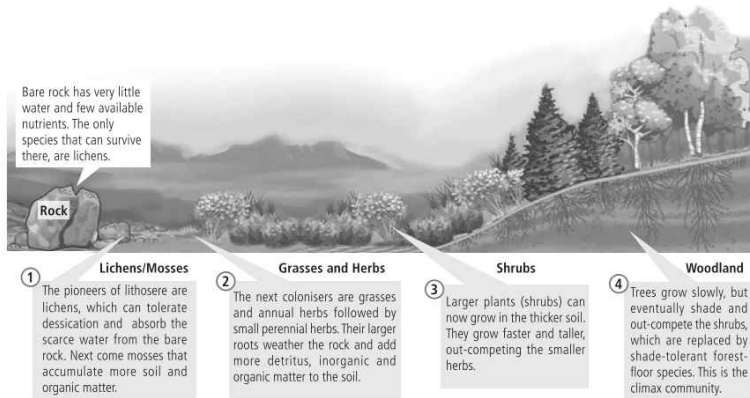


Fig.: Biotic succession on a bare rock (Lithosere)

B. Hydrosere

Series of biotic communities that develop in a newly formed pond or lake is called **hydrosere**. The various stages, together with the chief components of plant species during primary succession in water are as follows:

(i) Phytoplankton stage

This stage constitutes the **pioneer community**. Some blue-green algae, green algae, diatoms and bacteria, etc., are the first organisms to colonise the primitive medium of the pond.

(ii) Rooted submerged stage

As a result of death and decomposition of phytoplanktons, there develops soft mud at the bottom of the pond. This new habitat which tends to be a bit shallower and where light penetration may now occur easily becomes suitable for the growth of rooted submerged hydrophytes, e.g., *Hydrilla*, *Ceratophyllum*, *Potamogeton*, etc.

(iii) Floating stage

The roots of the plants of this stage are anchored to the floor and their leaves float on the surface of water, e.g., *Nymphaea*, *Nelumbo*. These plants make the water rich in minerals and add organic matter, which becomes suitable for the growth of some free floating plants, e.g., *Lemna*, *Pistia*, *Azolla*, *Eichhornia*, *Salvinia*, etc. The amount of water decreases very quickly as soil is quickly built-up and in a short time, water becomes very shallow.

(iv) Reed-swamp stage

This stage is also known as **amphibious stage** as the plants of community are rooted but most parts of their shoots (assimilatory organs) remain exposed to air, e.g., *Typha*, *Sagittaria*, *Scirpus*, etc. They possess well-developed rhizomes and form a very dense vegetation. Plants of swamp stage transpire huge quantities of water and also produce abundant organic matter.

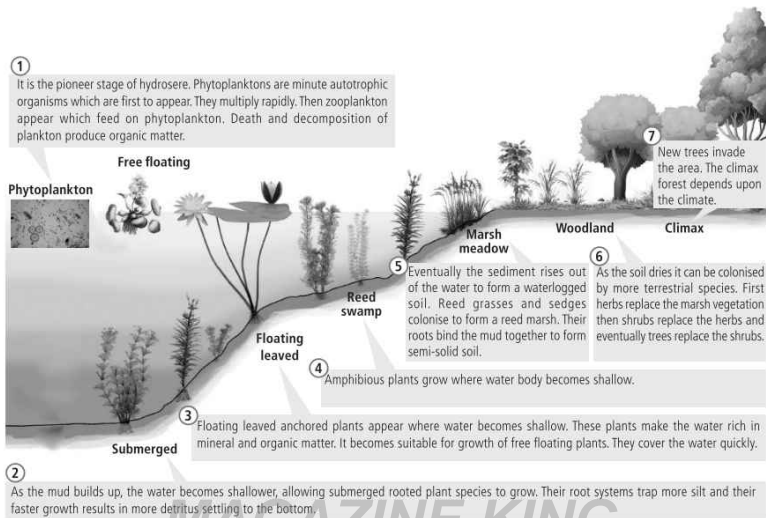


Fig.: Series of biotic succession in a newly formed pond or lake (Hydrosere)

(v) Sedge or marsh meadow stage

Due to the successive decrease in water level and further changes in the substratum, species of *Carex*, *Juncus*, *Cyperus*, *Eleocharis*, etc., colonise this area. With the help of their much branched rhizomatous systems, they form a mat-like vegetation towards the centre of the pond. As a result of **high rate of transpiration**, there is much rapid loss of water. Sooner or later, the mud is exposed to air, due to which nutrients like ammonia, sulphides, etc., become oxidised to nitrates and sulphates. Thus, **mesic conditions** approach the area and marshy vegetation disappears, gradually providing way for the next stage.

(vi) Woodland stage

After the disappearance of marshy sedge-meadow stage, the area is now invaded by terrestrial plants, which are low shrubs (e.g., *Salix*, *Cornus*) and trees (e.g., *Populus*, *Alnus*). By this time there is much accumulation of humus and **mineralisation of soil** favours the arrival of new trees in the area.

(vii) Climax forest stage

Forest stage is the climax community. In tropical climates with heavy rainfall, there develops tropical rainforest, whereas in temperate regions, there grows a mixed forest of *Acer*, *Quercus*, etc. In regions of moderate rainfall, there develop tropical deciduous forests or monsoon forests.

• Snap Shots •

- Bog is a most fascinating and unique type of wetland characterised by wet spongy, poorly drained peaty soil and a floating mat. A typical *Sphagnum* bog is highly acidic with a pH less than five. Less pH, less oxygen availability retard decomposition.
- Bogs are most common in parts of the world that were glaciated during Pleistocene Epoch.

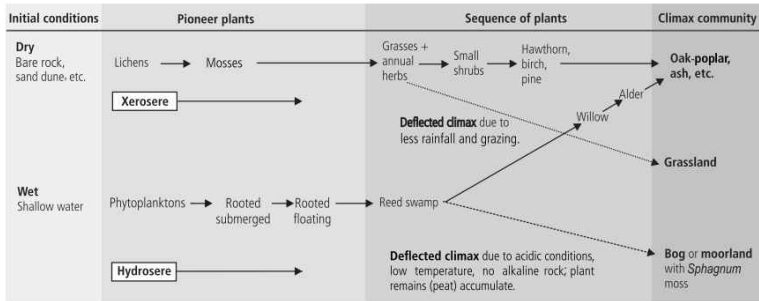


Fig.: Summary of types of primary succession

ATTRIBUTES OF SUCCESSION

The **four major structural and functional attributes** of ecological succession are as follows:

- There is an increase in structural complexity among the kinds of animals and plants change continuously with succession, irrespective of their taxonomic group.
- The diversity of species tends to increase with succession. Increase in diversity of heterotrophs is especially striking. The variety of microbes and heterotrophic plants and animals is likely to be much greater in the later stages of succession than in the early stages. Maximum diversity of autotrophs in many ecosystems seems to be reached earlier in succession.
- Biomass and standing crop of organic matter increase with succession. According to **Odum**, the increase in amount of and the change in organic structure, are two of the main factors bringing about the succession of species. The enlargement of organic structure is of course, related in a cause-and-effect manner to the increase in species diversity. As biomass increases, stratification and zonation create many new habitat niches such as litter, humus, bark and dead wood in a forest.
- Species, biomass, and the P/R ratio (the ratio of gross production of the community to total respiration of the community, *i.e.*, the respiration of both animals and plants) continue to change long after the maximum gross primary production possible for the site has been achieved. Thus, a decrease in net community production and a corresponding increase in community respiration are two of the most striking and important trends in succession.

- Margalef (1963)**, while presenting his **idea of maturity** in succession, states 'status of succession in ecology may be thought of as equivalent to development in biology.' According to him, with the progressive changes, the succession attains maturity. **E.P. Odum (1969, 1971)** elaborated the idea of maturity and modifications and put forth his concept of **ecosystem strategy**. According to this concept, in any ecosystem, there is a tendency of **homeostasis** while under the influence of unfavourable external environment, but in a balanced state, the system grows.
- In an autotrophic succession, diversity of species tends to increase, with an increase in organic matter content and biomass supported by the available energy. Thus, in a climax community, the available energy and biomass formation increases. But in a heterotrophic succession, reverse happens, as there occurs a gradual depletion of energy, where rates of respiration always exceed production rates.
- In an ecosystem, both the autotrophic and heterotrophic successions operate in a coordinated manner. The autotrophic ones go on deriving mineral elements from the soil and atmosphere, whereas the heterotrophic ones manage to return these elements to soil and atmosphere, through decomposition of complex dead organic matter. Thus, succession reaches a stage when the amount of energy and nutrients received from the environment by plants is again returned in more or less similar amount to the environment by decomposition (through heterotrophs). This stage may be thought of as a climax stage. This maturation and development of ecosystems has been characterised by **E. Odum** as a 'strategy of increased control of the physical environment towards achieving a homeostasis which provides maximum protection from environmental perturbations'. This dynamic and largely predictable process of community-controlled modification of the environment, sooner or later, results in stabilised ecosystem. **Odum (1969)** has identified a number of trends to be expected in the development of ecosystems, which are shown in the given table.

Table : A tabular model of ecological succession

	Attributes	Developmental Stages	Mature Stages
Community energetics			
1.	Gross production/community respiration (P/R ratio)	Greater or less than 1	Approaches 1
2.	Gross production/standing crop biomass (P/B ratio)	High	Low
3.	Biomass supported/unit energy flow (B/E ratio)	Low	High
4.	Net community production (yield)	High	Low
5.	Food chains	Linear, predominantly grazing	Web-like, predominantly detritus
Community structure			
6.	Total organic matter	Low	High
7.	Inorganic nutrients	Extrabiotic	Intrabiotic
8.	Species diversity	Low	High
9.	Biochemical diversity	Low	High
10.	Stratification and spatial heterogeneity (pattern diversity)	Poorly organised	Well-organised
Life history			
11.	Niche specialisation	Broad	Narrow
12.	Size of organism	Small	Large
13.	Life cycles	Short, simple	Long, complex
Nutrient cycling			
14.	Mineral cycles	Open	Closed
15.	Nutrient exchange rate between organisms and environment	Rapid	Slow
16.	Role of detritus in nutrient regeneration	Unimportant	Important
Overall homeostasis			
17.	Entropy	High	Low
18.	Information	Low	High
19.	Internal symbiosis	Undeveloped	Developed
20.	Stability (resistance to external perturbations)	Poor	Good

IMPORTANCE OF ECOLOGICAL/BIOTIC SUCCESSION

- Ecological succession provides diversity to a biotic community.
- It plays a major role in evolution of plants and animals.
- Information gained through biotic succession is used in having controlled growth of one or more species by preventing their next seral stages from invading the area, *e.g.*, maintenance of teak forest.
- It gives information about the techniques to be used during reforestation and afforestation.

POWER EXERCISE

- Ecological succession on coastal sand is
 - psammosere
 - xerosere
 - halosere
 - hydrosere.
- The primary succession refers to the development of communities on a
 - forest clearing after devastating fire
 - newly exposed habitat with no record of earlier vegetation
 - freshly cleared crop field
 - pond, freshly filled with water after a dry phase.
- Which of the following is/are replaced by another community during succession?
 - Pioneer community
 - Climax community
 - Seral community
 - Both (a) and (c)
- Lichen is the pioneer vegetation on which succession?
 - Hydrosere
 - Lithosere
 - Psammosere
 - None of these

5. Last stable community in succession dependent on climate is
 (a) seral community (b) climax community
 (c) both (a) and (b) (d) none of these.
6. Succession is
 (a) orderly process of community change till stability
 (b) gradual, directional and continuous process
 (c) series of biotic communities that appear gradually in a barren area
 (d) all of these.
7. Both hydrarch and xerarch successions lead to
 (a) medium water conditions
 (b) xeric conditions
 (c) highly dry conditions
 (d) excessive wet conditions.
8. Read the given paragraph and select the correct sequence of words to complete it.
 The two forms of succession are _____ succession, in which a community develops where no community existed before, and _____ succession, in which a community develops again after a disturbance. The conversion of a lake to a terrestrial community is a kind of _____ succession.
 (a) primary, secondary, tertiary
 (b) primary, secondary, primary
 (c) secondary, primary, secondary
 (d) primary, secondary, secondary
9. The pioneer species in xerarch and hydrarch succession are respectively
 (a) lichens and sedges
 (b) phytoplanktons and sedges
 (c) lichens and zooplanktons
 (d) lichens and phytoplanktons
 (e) phytoplanktons and lichens. (Kerala PMT 2016)
10. Select the correct statement about secondary succession.
 (a) Pioneer community always comes from outside.
 (b) Seral communities are few.
 (c) Environment is very hostile in the beginning.
 (d) Both (b) and (c)
11. In ecological succession the climax community is best recognised by the following state
 (a) $P = R$ (b) $P > R$
 (c) $P < R$ (d) $P \neq R$.
12. Select the correct statement.
 (a) The diversity of species tend to increase with succession.
 (b) Biomass and standing crop increase with succession.
 (c) The succession resulting from changes brought about by factors external to community is called allogenic succession.
 (d) All of these
13. Which of the following is a pioneer in xerarch succession?
 (a) Phytoplanktons (b) Lichens
 (c) Bryophytes (d) Rooted hydrophytes
 (e) Sedges (Kerala PMT 2012)
14. During the stages of succession in a given ecosystem, the following changes in characteristics may be observed.
- | | Characteristic | Stages in ecosystem development | |
|----|----------------------|---------------------------------|-------|
| | | Early | Late |
| A. | Total organic matter | Low | High |
| B. | Species diversity | Low | High |
| C. | Size of organism | Small | Large |
| D. | Food chains | Short | Long |
- Which one of the characteristics, A, B, C or D is responsible for the apparent high degree of stability associated with a climax ecosystem?
 (a) B (b) D (c) A (d) C
15. The correct sequence of plants in a hydrosere is
 (a) *Volvox* → *Hydrilla* → *Pistia* → *Scirpus* → *Carex* → *Quercus*
 (b) *Pistia* → *Volvox* → *Scirpus* → *Hydrilla* → *Quercus* → *Carex*
 (c) *Quercus* → *Carex* → *Volvox* → *Hydrilla* → *Pistia* → *Scirpus*
 (d) *Quercus* → *Carex* → *Scirpus* → *Pistia* → *Hydrilla* → *Volvox*.



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16. Which one of the following statements is correct for secondary succession?
- It begins on a bare rock.
 - It occurs on a deforested site.
 - It follows primary succession.
 - It is similar to primary succession except that it has a relatively fast pace. (AIPMT Prelims 2011)
17. The second stage of hydrosere is occupied by plants like
- Azolla*
 - Typha*
 - Carex*
 - Vallisneria*.
18. Match column I with column II and select the correct answer from the given codes.
- | Column I | Column II |
|------------------------------------|--|
| A. Presence of 3-4 vertical layers | (i) Blue green algae |
| B. A biome having grasses | (ii) Stratification with scattered trees |
| C. Man made ecosystem | (iii) Savannah |
| D. Pioneer in hydrosere | (iv) Dam |
- A-(ii), B-(iii), C-(iv), D-(i)
 - A-(ii), B-(iii), C-(i), D-(iv)
 - A-(i), B-(iii), C-(iv), D-(ii)
 - A-(iii), B-(iv), C-(ii), D-(i)
19. Succession occurs in
- plant
 - animal
 - both (a) and (b)
 - none of these. (BHU 2010)
20. Identify the shrub stage of xerosere.
- Ziziphus*
 - Rhizocarpon*
 - Heteropogon*
 - Parmelia*
21. Which of the following pair is correctly matched with respect to lithosere?
- Pioneer community – Phytoplanktons
 - Grass stage – *Dermatocarpon*
- Climax community – *Cyperus*
 - Moss stage – *Grimmia*
22. Which of the following changes takes place during biotic succession?
- Increase in biomass and decrease in humus content of soil
 - Mesic conditions change into aquatic conditions
 - Reduction in ratio of productivity and standing crop (P/B)
 - Decrease in respiratory consumption and productivity
23. Identify the plant belonging to the reed-swamp stage in hydrarch succession.
- Juncus*
 - Sagittaria*
 - Salix*
 - Trapa* (J&K CET 2008)
24. Read the given statements and select the correct one.
- Members of organisms of pioneer community have long life span.
 - Biomass of climax community is less than that of seral community.
 - Plants of reed swamp stage reduce the organic matter of soil.
 - In succession, mature stages have predominately detritus food chains while developmental stages have grazing food chains.
25. Select the option that can be derived by deflected succession.
- Grassland
 - Oak woods
 - Agricultural land
 - All of these

ANSWER KEY

1. (a) 2. (b) 3. (d) 4. (b) 5. (b)
 6. (d) 7. (a) 8. (b) 9. (d) 10. (b)
 11. (a) 12. (d) 13. (b) 14. (a) 15. (a)
 16. (b) 17. (d) 18. (a) 19. (c) 20. (a)
 21. (d) 22. (c) 23. (b) 24. (d) 25. (a)



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BIO Digest

This article covers high yield facts of the given topic.

Morphology of Flowering Plants

MAGAZINE KING

- Plant morphology (Gk. *morphe*-form, *logos*-study) is the branch of botany that deals with the study of forms and features of different plant organs like roots, stems, leaves, flowers, fruits, seeds etc.
- A flowering plant has a long, cylindrical, unbranched or branched axis that bears a number of lateral appendages. Plant axis is differentiated into an **underground root system** and an **above ground shoot system**.
- Plants can be classified on the basis of height and nature of stem (**herbs, shrubs, and trees**), life span (**annuals, biennials and perennials**) and frequency of flowering or fruiting (**monocarpic and polycarpic**).

MORPHOLOGY OF ROOT

- The root is typically a non-green underground descending portion of the plant axis which gives rise to similar types of endogenous lateral branches and does not possess nodes and internodes. They are positively geotropic, positively hydrotropic and negatively phototropic.
- A typical root consists of **5 major zones** :
 - Root cap**- It covers the root apex and protects the young growing cells of the apical region
 - Meristematic zone**- Present just above the root cap, made up of compact cells having dense protoplasm and large nucleus.
 - Region of cell elongation**- Above the meristematic zone the cells elongate rapidly resulting in increase in the length of the root.
 - Root hair zone or cell maturation zone**- Here different types of primary tissues differentiate. Unicellular and ephemeral root hairs are formed from the epidermal cells in this zone.
 - Zone of mature cells**- Constitutes the major portion of root, where cells do not undergo any further change.

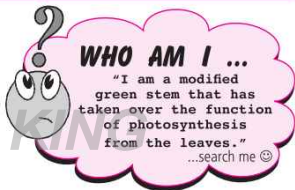
There are three types of root systems occurring in plants: **tap root system**, **fibrous root system** and **adventitious root system**. A comparative account between the three is summarised in the given table.

Table: Comparison between tap root system, fibrous root system and adventitious root system

	Tap root system	Fibrous root system	Adventitious root system
(i)	It is formed from the radicle of the embryo.	It occurs in place of tap root system at the base of main stem.	It may develop from any part of the plant other than radicle.
(ii)	It is always underground.	It is always underground.	It may be underground or aerial.
(iii)	It consists of a single primary (main) root.	Primary root is short lived. Instead underground roots arise in groups from base of stem.	Primary root is absent and it consists of roots forming a cluster.
(iv)	Primary root produces distinct secondary roots, tertiary roots and rootlets in acropetal succession.	The main roots are of equal length and give off small branches. Main roots and their branches are thin and thread like.	The roots may be thick, thin or variously modified.
(v)	It may be surface or deep feeder, the deep feeder being the usual feature.	It is usually surface feeder.	It is usually surface feeder.
(vi)	It is commonly found in dicots.	It is commonly found in monocots.	It is found both in dicots and monocots.

Modifications of Roots

- Primary functions of roots are anchorage (or fixation) of the plant and absorption of water and minerals from the soil for their transport to the shoot system. However, roots undergo morphological modifications to perform various functions such as food storage, mechanical support etc. as discussed briefly in the given flow charts.



Fleshy tap roots

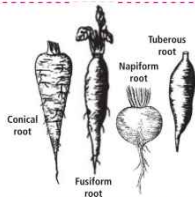
Tap roots become swollen and fleshy with stored food. These are of following types:

Conical : Thicker on the upper end and tapering at the lower end, e.g., carrot.

Tuberous : Swollen and without any definite shape, e.g., *Mirabilis*.

Napiform : Much swollen and spherical at the upper end and taper downward into a thread like structure, e.g., turnip.

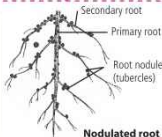
Fusifiform : Swollen in the middle and tapering on both ends, e.g., radish.



Modifications of tap root

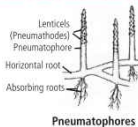
Nodulated (Tuberous)

Root nodules (small swellings) are present on the roots and their branches which help to perform biological N_2 -fixation, e.g., leguminous plants.



Pneumatophores (Respiratory roots)

Upright breathing aerial roots which develop at short intervals, found in plants growing in mangroves or saline swamps, e.g., *Avicennia*.





INTEXT PRACTICE QUESTIONS

1. Differentiate between tap root system and adventitious root system.
2. State any two vital function performed by roots.

Modifications of adventitious root

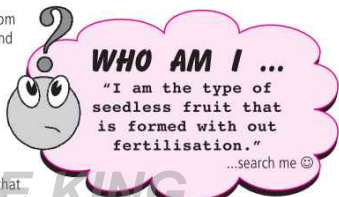
- On the basis of storage of food adventitious roots are modified into tuberous roots (e.g., *Ipomoea*), fasciculated roots (e.g., *Dahlia*), nodulose roots (e.g., *Curcuma amada*), moniliform roots (e.g., *Momordica*) and annulated roots (e.g., *Psychotria*).
- On the basis of mechanical support these are modified into prop roots (e.g., *Ficus benghalensis*), stilt roots (e.g., *Sorghum*) and climbing or clinging roots (e.g., *Hedera*).
- On the basis of vital functions these roots are modified into haustorial or parasitic roots (e.g., *Cuscuta*), floating roots (e.g., *Jussiaea*), epiphytic roots (e.g., *Vanda*), assimilatory roots (e.g., *Tinospora*) and reproductive roots (e.g., *Dahlia*).

MORPHOLOGY OF STEM

- Stem is an ascending part of the plant body that develops from the plumule of the embryo and is usually negatively geotropic and positively phototropic.

Buds

- Stem grows by means of a terminal bud which represents a condensed immature or embryonic shoot possessing a growing point. The buds are generally small in size. The largest bud is that of cabbage. According to their nature/structure buds can be **vegetative** (form leafy shoots only), **floral** (reproductive buds that develop into flowers) and **mixed** (both vegetative and floral branches).



Branching Patterns of the Stem

- **Modifications of stem** are of three types - **underground**, **aerial** and **subaerial**.
- **Underground modifications** : (a) **Stem tuber** : Swollen end of underground branch of main stem which possesses eyes/nodes, e.g., *Solanum tuberosum*. (b) **Sucker** : Formed from the nodes of underground stem and comes up obliquely in the form of leafy shoot, e.g., *Chrysanthemum*. (c) **Rhizome** : A perennial fleshy underground stem having nodes and internodes, e.g., ginger. (d) **Corm** : A subspherical, underground stem growing vertically inside soil, possesses adventitious roots at base and axillary buds in axils of scale leaves, e.g., *Colocasia*. (e) **Bulb** : Highly reduced disc like stem with numerous fleshy scale leaves covering a central terminal bud, adventitious roots arise from the under surface e.g., onion.
- **Aerial modifications**: (a) **Stem tendrils** : Fine, sensitive thread like wiry structures which can coil around a support e.g., *Cucurbita* (b) **Phylloclades** : Flattened (e.g., *Opuntia*) or cylindrical (e.g., *Casuarina*) green, fleshy structures which have taken over the photosynthetic function of leaves. (c) **Cladodes (Cladophylls)** : Green stems of limited growth, generally one or two internodes long and perform the function of photosynthesis, e.g., *Asparagus* (one internode long). (d) **Thorns** : Stiff, hard pointed structures that perform defensive functions and check transpiration, e.g., *Citrus*.
- **Subaerial modifications** : (a) **Runners** : Green, above ground horizontal branches which develop at the bases of erect shoots which are called crowns, e.g., *Oxalis*. (b) **Stolons** : Elongated horizontal arched runners; lower portion of nodes gives rise to roots, e.g., *Fragaria* (strawberry). (c) **Offset** : One internode long, short and thickened special horizontal branches, that develop a tuft or rosette of leaves at nodes, e.g., *Pistia*, *Eichhornia*.



INTEXT PRACTICE QUESTIONS

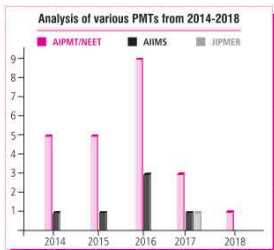
3. Briefly describe phylloclades.

MORPHOLOGY OF LEAF

- Leaf is a green lateral flattened outgrowth borne on the node of a stem or its branch and is characteristically photosynthetic. Leaves originate from the shoot meristem as leaf primordia and gradually enlarge. They are the most important vegetative organs of a plant as they synthesise food in them.

Types of leaves

- On the basis of their origin and functions, leaves can be:
 - (i) **Cotyledonary leaves** : Embryonic leaves (cotyledons) emerging at the time of seed germination, e.g., dicots and monocots.
 - (ii) **Bract leaves (bracts)** : Leaves containing flower or inflorescence in their axil e.g., *Bougainvillea*.
 - (iii) **Scale leaves or cataphylls** : Small, sessile, non-chlorophyllous, membranous structures, occurring on underground stems like rhizomes, bulbs, etc. e.g., *Zingiber officinale* and some aerial stems, e.g., *Ruscus*.
 - (iv) **Floral leaves or sporophylls**: Sepals, petals, androecium and gynoecium all are considered as modified leaves and are called floral leaves or sporophylls.
 - (v) **Foliage leaves** : Common green leaves of plants which form the main seat of photosynthesis.
 - (vi) **Prophylls** : First few leaves on a stem which differ from other leaves are termed as prophylls.
 - (vii) **Bracteoles** : Two small leaf-like structures which are found attached to the stalk of flower.



- A leaf consists of three parts – leaf base, petiole and lamina.

Leaf base (hypopodium) is the lower most part of the leaf and is joined to the node of the stem. In **pulvinate** leaves, leaf base is swollen and is called as **pulvinus**; leaf is easy to pluck due to weak attachment with stem, e.g., gram. In some plants, leaf base consists of small appendages on both sides, these are called **stipules** which protect young leaves and axillary buds.

Petiole (mesopodium) is a cylindrical or subcylindrical smooth or grooved stalk of the leaf which connects the lamina with the base. Leaf having petiole is called **petiolate** and the one without it is called **sessile**.

Lamina (epipodium) or leaf blade is green, flattened part of leaf performing the important functions of photosynthesis, transpiration and respiration. Depending upon the incision of lamina, leaves can be **simple** (smooth or incised margins, incisions not deep upto midrib) or **compound** (incisions reach midrib dividing leaf into leaflets).

- **Venation** (arrangement of veins and veinlets on the lamina) is of two types (i) In **parallel venation**, the veins run parallel to each other, common in monocots and rare in dicots, e.g., *Eryngium*, etc. (ii) In **reticulate venation**, the main vein by forming a number of branches gives rise to a net like structure in the leaf, common in dicots and rare in monocots, e.g., *Smilax*, etc.
- **Phyllotaxy** (arrangement of leaves on the true stem and its branches) facilitates the leaves to obtain maximum light for photosynthesis. It may be of 3 types: (i) **Alternate or spiral**: Only one leaf is borne on a node and the leaves of the adjacent nodes roughly lie towards the opposite side, e.g., shoe flower. (ii) **Opposite**: Each node gives rise to two leaves, arranged opposite to each other e.g., *Syzygium*, *Calotropis*. (iii) **Whorled**: More than two leaves are formed from each node, which are arranged in a whorl, e.g., *Alstonia*, *Nerium*.

COMIC CAPSULE

MONTHLY TEST DRIVE CLASS XII ANSWER KEY

1. (b) 2. (c) 3. (c) 4. (a) 5. (b)
6. (a) 7. (b) 8. (b) 9. (c) 10. (b)
11. (a) 12. (d) 13. (b) 14. (c) 15. (d)
16. (c) 17. (a) 18. (a) 19. (a) 20. (b)
21. (c) 22. (c) 23. (a) 24. (b) 25. (b)
26. (c) 27. (b) 28. (b) 29. (c) 30. (c)
31. (a) 32. (b) 33. (c) 34. (c) 35. (b)
36. (c) 37. (a) 38. (b) 39. (b) 40. (c)

Modifications of Leaf

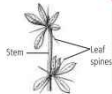
- A leaf or its part is occasionally modified into specialised structures to perform some functions.

Leaf tendrils



Tendrils are wire-like sensitive structures that help the plants in climbing by coiling around a support. These can be **whole leaf tendrils**, e.g., *Lathyrus aphaca* (wild pea), **leaflet tendrils**, e.g., *Lathyrus odoratus* (sweet pea), **petiolar tendrils**, e.g., *Tropaeolum majus* (garden nasturtium), **Rachis tip tendrils**, e.g., *Lens culinaris* (lentil), **leaf tip tendrils**, e.g., *Gloriosa superba* (Glory lily) and **stipular tendrils**, e.g., *Smilax*.

Leaf spines



Leaf gets modified into spine in order to protect the plant from grazing animals as well as reduce the rate of transpiration, e.g., *Berberis*, *Acacia*.

Leaflet hooks



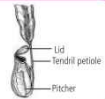
The terminal leaflets of the compound leaves become transformed into three stiff claw-like and curved hooks. The hooks help the plant in climbing, e.g., *Doxantha unguis-cati*.

Phyllodes



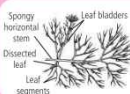
Phyllodes are flat, green-coloured, photosynthetic leaf-like modifications of petiole of rachis, e.g., Australian *Acacia* (*Acacia auriculiformis*), *Parkinsonia*, etc.

Leaf pitcher



In some insectivorous plants, the leaves or their parts are modified into special **insect catching organs**. They catch and digest insects to fulfill their nitrogen requirements, e.g., *Nepenthes*.

Leaf bladders



In insectivorous hydrophytes like *Utricularia* leaf is profusely dissected and some parts of it are modified into bladder like structures which help in catching water insects.

Succulent leaves



Succulent leaves occur in plants of saline and xerophytic habitats, e.g., *Aloe*, *Agave*, *Bryophyllum*.

Modifications of leaf



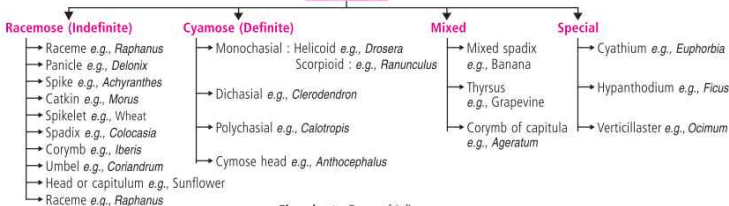
INTEXT PRACTICE QUESTIONS

- Distinguish between reticulate and parallel venation.
- What are the important modifications of leaves? Give suitable examples.

INFLORESCENCE

- Inflorescence is the arrangement of flowers on the floral axis (peduncle). In **racemose type**, main axis of inflorescence has an indefinite (indeterminate) growth and it gives rise to (lateral or axillary) flowers in an **acropetal order** (i.e., the youngest flower is at the apex while the oldest is at the base) or **centripetal order**. In **cymose** inflorescence, the growth of the main axis is limited as it is terminated by a flower, the arrangement of flowers is **basipetal** or **centrifugal**.

Inflorescence



Flowchart : Types of inflorescence

FLOWER

- It is a **specialised condensed shoot** meant for carrying out the **sexual reproduction**. It bears floral leaves and gives rise to seeds and fruits. The study of flowers is called **anthology**.

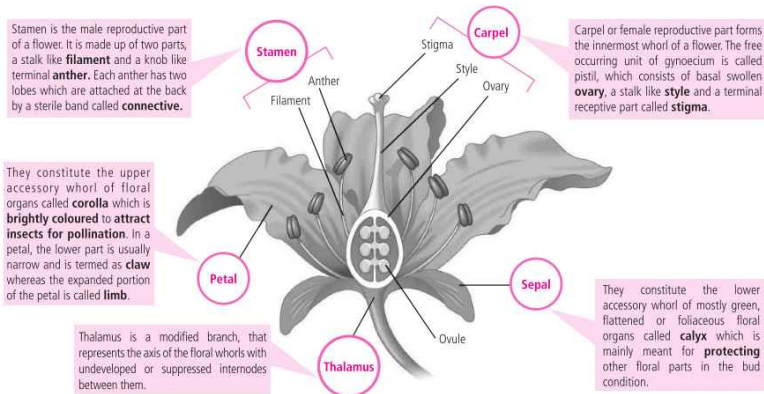


Fig. : Parts of a typical flower

- Flower bears floral leaves (sepals, petals, stamens and carpels), carries on sexual reproduction and gives rise to seeds and fruits. **Pedicel** is the stalk of flower. The tip of the pedicel is called **thalamus (torus or receptacle)** which is formed by the **condensation of internodes of the floral axis**.
- Actinomorphic flowers** can be cut into two equal parts in any vertical plane, e.g., *Solanum*. **Zygomorphic flowers** can be cut into two equal parts in only one vertical plane, e.g., *Pisum*. **Asymmetric flowers** cannot be cut into two equal parts in any plane, e.g., *Canna*.
- A flower with superior ovary is called **hypogynous**, with inferior ovary is **epigynous**, with sub-inferior ovary is **perigynous**. In **pentamerous** flower each whorl especially calyx and corolla possesses 5 members. In **trimerous** and **tetramerous** flowers, each whorl possesses 3 and 4 members, respectively.
- The mode of arrangement of sepals or petals or tepals in relation to one another in a flower bud is called **aestivation**. When these units are not overlapping it is **valvate aestivation**. When out of the total number of units, one is completely out, one is completely in and the rest are in and out it is **imbricate aestivation**. In **descending imbricate** (vexillary) **aestivation**, the standard petal is large and overlaps the two wing petals which in turn overlap the keel petal. In **ascending imbricate**, posterial petal is overlapped by two lateral ones which are being overlapped by two anterior ones. When of the total number of units, two are completely out, two are completely in and the fifth one is in and out, it is **quincuncial aestivation**. In **contorted or twisted aestivation** all units are in and out.
- On the basis of cohesion of their parts, stamens may be **monadelphous** (e.g., *Hibiscus*, *Abutilon*), **diadelphous** (e.g., *Pisum*, *Indigofera*), **polyadelphous** (e.g., *Citrus*), **syngenesious** (e.g., *Tridax*, *Helianthus*), **synandrous** (e.g. *Cucurbita*, *Coccinia*). When stamens adhere to either sepals or petals the condition is known as **episepalous** (e.g. *Quisqualis indica*) or **epipetalous**, (e.g., *Solanum*) respectively.
- Placenta** refers to the parenchymatous cushion present inside the ovary where ovules are borne. Number, position, and

arrangement of placentae inside an ovary is called **placentation**. It can be : **marginal** (placenta on ventral suture in monocarpellary ovary, e.g. pea), **basal** (single placenta on floor of unilocular ovary, e.g. *Tridax*), **axile** (placenta along axis, radial septa present, e.g. *Hibiscus*), **free central** (placenta along axis, no radial septa, e.g. *Dianthus*) and **parietal** (placenta on inner wall of syncarpous ovary, e.g., *Brassica*).

FRUIT

- True fruit or **eu carp** is a structure formed from ripened ovary under the influence of ripening ovules and is meant for protecting them. It consists of pericarp formed from the wall of the ovary and seeds formed from ovules. E.g., mango, brinjal, tomato, cucumber, pea, etc. When in formation of a fruit other floral parts, (e.g., thalamus, base of sepal, petals, etc.) participate, it is called false fruit or **pseudocarp**, e.g., apple, pear etc.

A fruit formed without fertilisation, i.e., a seedless fruit is called **parthenocarp**, e.g., banana.

Types of Fruit

Fruits can be classified as:

- **Simple fruits** : Develop from mono or multicarpellary, syncarpous ovary. They can be classified into dry and fleshy.
 - (i) **Dry fruits** are further classified into (a) **Dehiscent** : **Pod** (e.g., Gram), **Follicle** (e.g. *Delphinium*), **Siliqua** (e.g., Mustard), **Silicula** (e.g., *Iberis*), **Capsule** (e.g., Cotton). (b) **Indehiscent** : **Cypsela** (e.g., Marigold), **Caryopsis** (e.g., Maize), **Achene** (e.g., *Mirabilis*), **Samara** (e.g., *Holoptelia*), **Nut** (e.g., *Litchi*). (c) **Schizocarpic** : **Lomentum** (e.g., *Mimosā*), **Cremocarp** (e.g., Coriander), **Double samara** (e.g., *Acer*), **Regma** (e.g., *Ricinus*), **Carcerulus** (e.g., *Althaea*).
 - (ii) **Fleshy fruits** are **Drupe** (e.g., Mango), **Berry** (e.g., Tomato), **Pepo** (e.g., Cucumber), **Pome** (e.g., Pear), **Hesperidium** (e.g., Orange), **Balausta** (e.g., Pomegranate).
- **Aggregate fruits** : Develop from multicarpellary apocarpous ovary. Types of aggregate fruits are **Etaerio of achenes** (e.g., Rose), **Etaerio of follicles** (e.g., *Michelia*), **Etaerio of drupes** (e.g., Raspberry), **Etaerio of berries** (e.g., Custard apple).
- **Composite fruits** : Develop from complete inflorescence and include **Sorosis** (e.g., Pineapple) and **Syconus** (e.g., Banyan).

SEED

- Morphologically, seed is the integumented, mature, megasporangium which is developed from fertilised ovule and contains an embryo. A seed may have one or two coverings called **seed coats**— outer, thick, hard, leathery **testa** and the inner, thin, papery **tegmen**.
- With the help of a stalk called **funicle**, a seed is attached to the fruit wall and funicle is attached to seed at **hilum**. **Raphe** is the part of funicle that is fused with the seed coats or integuments. **Chalaza** is that region from which the seed coats originate. **Micropyle** is a small opening present at one end of the seed. **Kernel** is obtained by removing the seed coat and it mainly consists of the embryo. Kernel may also contain endosperm (reserve food), present in **endospermic or albuminous seeds** like cereals, castor, coconut, etc. In **exalbuminous or non-endospermic seeds** like gram, pea, mustard, etc., endosperm is fully consumed by the embryo. There is one cotyledon in monocots and two cotyledons in dicots. In some seeds (called perispermic seeds e.g., *Ricinus communis*), below the seed coat a very thin membrane is found over kernel called **perisperm** (the **persistent nucellus**). The embryonal axis is differentiated into radicle and plumule. In monocot seeds, the radicle is protected by a sheath called **coleorhiza** and the plumule is protected by **coleoptile**.

DESCRIPTION OF SOME IMPORTANT ANGIOSPERM FAMILIES

- **Floral formula** is the summarised account of the floral characters of a plant or a family represented by symbols, whereas **floral diagram** is a diagrammatic representation of the pooled up information from transverse sections of the flower bud in relation to mother axis.

Table : A comparative account of Families Fabaceae, Solanaceae and Liliaceae

Characters	Fabaceae	Solanaceae	Liliaceae
Systematic position	Class – Dicotyledonae Subclass – Polypetalae Series – Calyciflorae Order – Rosales Family – Fabaceae	Class – Dicotyledonae Subclass – Gamopetalae Series – Bicarpellatae Order – Polemoniales Family – Solanaceae	Class – Monocotyledoneae Series – Coronarieae Order – Liliales Family – Liliaceae
Inflorescence	Raceme or spike (panicle in <i>Dalbergia</i>)	Axillary or extra-axillary cyme, rarely solitary axillary (<i>Petunia</i>) or terminal (<i>Datura</i>)	Racemose, sometimes solitary or umbellate condensed cymes
Flower	Bisexual, zygomorphic, bracteate or ebracteate, pedicellate or sessile, perigynous or occasionally hypogynous, pentamerous	Bisexual, actinomorphic, ebracteate or bracteate, pedicellate, hypogynous, pentamerous, cyclic	Bisexual, actinomorphic, zygomorphic in few cases, bracteate or ebracteate, pedicellate, complete or incomplete, unisexual in <i>Ruscus</i> and <i>Smilax</i> , hypogynous, generally pentacyclic, trimerous
Calyx	Sepals five, gamosepalous, valvate or imbricate aestivation, usually campanulate	Sepals five, gamosepalous, valvate aestivation, persistent, accrescent (<i>Physalis</i>), campanulate or tubular, hairy	Perianth : Tepals six (3 + 3), often united into tube, valvate or imbricate aestivation, sepaloid or petaloid
Corolla	Petals five, polypetalous, papilionaceous, imbricate aestivation	Petals five, variously shaped, infundibulum, campanulate, rotate, united, valvate aestivation, plicate or folded like a fan in bud	
Androecium	Ten, usually diadelphous [(9) + 1], anthers ditheous, introrse, dehiscence longitudinal	Stamens five, epipetalous, filaments free, anthers bitheous, basifixed or dorsifixed, introrse, longitudinal or porous dehiscence.	Stamens six (3 + 3), free or monadelphous (e.g., <i>Ruscus</i>), epiphyllous, basifixed, dorsifixed, or versatile anther, longitudinal dehiscence
Gynoecium	Ovary superior, monocarpellary, unilocular with many ovules, marginal placentation	Bicarpellary, syncarpous, ovary superior, bilocular, sometimes tetralocular due to false septum, placenta swollen with many ovules, axile placentation, ovary is obliquely placed	Tricarpellary, syncarpous, superior ovary, trilocular with 2-many ovules, axile placentation, rarely parietal, styles united or separate, stigma free or fused, trilobed
Fruit	Legume rarely lomentum	Berry or capsule	Capsule, rarely berry
Seeds	One to many, non-endospermic	Many, endospermous	Endospermous
Floral formula	$\% \text{ } \overline{\text{K}}_{(5)} \text{ } \overline{\text{C}}_{1+2+(2)} \text{ } \overline{\text{A}}_{(9)+1} \text{ } \overline{\text{G}}_{1}$	$\overline{\text{K}}_{(5)} \text{ } \overline{\text{C}}_{(5)} \text{ } \overline{\text{A}}_5 \text{ } \overline{\text{G}}_{(2)}$	$\overline{\text{K}}_{\overline{\text{P}}_{3+3} \text{ or } (3+3)} \text{ } \overline{\text{A}}_{3+3} \text{ } \overline{\text{G}}_{(3)}$
Floral diagram			
T.S. Ovary			

Anatomy of Flowering Plants

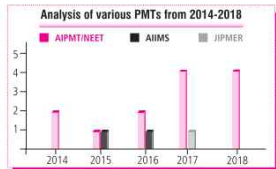
- Plant anatomy (Gk. *ana-up*, tome-cutting) is the branch of science which deals with the study of gross internal structure of plant organs, as observed after section cutting.
- The first detailed account of internal structures of plant was published by an English physician **Nehemiah Grew** (1641-1712) in his book "**The Anatomy of Plants**". N.Grew is known as '**father of plant anatomy**'.

TISSUES

- A group of structurally similar or dissimilar cells that have a common origin and perform or help to perform a common function is called as a **tissue**. With the exception of some lower plants, the internal structures of most plants are complex and comprise of different types of tissues.
- On the basis of their ability to divide, plant tissues have been broadly classified into **two main types: meristematic tissues** and **permanent tissues**.

MERISTEMATIC TISSUES

- A meristematic tissue (or meristem) is a group of similar and immature cells that are preparing to divide or are in continuous state of division.
- Meristematic cells show few characteristics, such as (a) ability to grow and divide (b) thin cellulosic walls (c) isodiametric, rounded, oval or polygonal in shape (d) compactly arranged without intercellular spaces. (e) dense cytoplasm, prominent nucleus (f) high metabolic rate etc.
- On the **basis of origin**, meristems may be primary (origin from embryonic cells) or secondary (originated by dedifferentiation of permanent tissues). Apical, intercalary and fascicular meristems are **primary meristems** as they originate from the embryonic meristems or **promeristems**. They retain the meristematic nature throughout the plant life. Interfascicular cambium and cork cambium are **secondary meristems** since they originate as new meristems from the permanent tissues which have already undergone differentiation.
- They can be classified on the **basis of position** in plant body as :
 - Apical meristems** : They are present at the tips of stem, root and their branches. They lead to growth in length.
 - Intercalary meristems** : They are derived from the apical meristems and have been separated from them by formation of permanent tissues in between. These help in elongation of the organs and are commonly found at the bases of leaves and above (*e.g.*, grasses) or below the nodes (*e.g.*, mint).
 - Lateral meristems** occur on the sides and take part in increasing girth of the plant (secondary growth). The common examples are **fascicular vascular cambium** (primary meristem), **interfascicular cambium** and **cork cambium** or **phellogen**.



PERMANENT TISSUES

- Permanent tissues are formed as a result of division and differentiation of meristematic tissues.
- The cells of permanent tissues lose the capacity to divide and assume a definite shape, size and function, but in certain cases they may resume the meristematic activity.
- Permanent tissues are categorized into **three main types– simple tissues, complex tissues** and **special tissues/secretory tissues**.
- A **simple permanent tissue** is made up of similar permanent cells that carry out the same function or similar set of functions. Simple permanent tissues are of three types:
 - Parenchyma** : It consists of thin-walled **living cells** which have intercellular spaces between them and their **cell wall** is made of cellulose and **calcium pectate**. It serves functions of food storage, absorption, lateral conduction, photosynthesis, providing buoyancy, secretion etc.

- (ii) **Collenchyma** consists of refractile **non-lignified** living cells which possess **pectocellulose** thickenings in specific areas of their walls. It provides mechanical strength to young dicot stems, petioles and leaves and flexibility to the organs. It often contains chloroplasts for photosynthesis.
- (iii) **Sclerenchyma** : It consists of dead cells with hard and extremely thick secondary walls due to uniform deposition of **lignin**. Sclerenchyma is of two types, sclerenchyma fibres and sclereids. The **sclerenchyma fibres** occur in all those parts where mechanical strength is required. **Sclereids** are found in fruit walls of nuts and seed coat of legumes.
- Permanent tissues with more than one type of cells working as a unit are called **complex permanent tissues**. Complex permanent tissues include xylem and phloem.
 - (i) **Xylem** performs the function of transport of water or sap inside the plant and also provides mechanical strength. It consists of **tracheids**, **vessels** (both for conduction of water and dissolved salts), **xylem fibres** (mechanical strength); and **xylem parenchyma** (stores food and conducts water radially). First formed xylem is **protoxylem** and later formed xylem is **metaxylem**. Xylem can be: **exarch** (protoxylem lies towards the outside of metaxylem), **endarch** (protoxylem inner to metaxylem), **mesarch** (protoxylem in between metaxylem) and **centrarch** (protoxylem in centre of metaxylem).
 - (ii) **Phloem** transports organic food inside the body of the plant. It consists of four types of cells, viz. **sieve tubes** (conducting channels formed of several enucleated cells; due to the presence of sieve pits the end walls are commonly called **sieve plates**); **companion cells** (thin walled living cells on the sides of the sieve tubes); **phloem parenchyma** (parenchymatous cells which store food, resins, latex, etc.); and **phloem fibres**. The first formed primary phloem consists of narrow sieve tubes and is referred to as **protophloem** and the later formed phloem has bigger sieve tubes and is referred to as **metaphloem**.
- **Secretory or special tissues** are concerned with the secretion of various substances like resins, gums, tannins, latex, nectar, etc. There are two types of secretory tissues : glandular and laticiferous tissues.

THE TISSUE SYSTEMS

- Tissues together form tissue system which are of **three types** : **epidermal tissue system**, **ground tissue system** and **vascular tissue system**.

Epidermal Tissue System

- Epidermal tissue system consists of **epidermis** and **epidermal outgrowths**. Epidermis is the superficial layer covering the entire surface of the primary plant body and is itself covered with cuticle on aerial plants. All the epidermal cells are living (parenchymatous). **Epidermal outgrowths** may include **trichomes** (present on stem, prevent water loss), **root hairs** (present on root, absorb water and minerals from soil), etc.
- **Stomata** are the structures present on the epidermis of leaves for regulation of transpiration and gaseous exchange. The specialised green epidermal cells present around the stomata are called **guard cells** which regulate stomatal opening. Guard cells in **dicots** are **kidney** (bean) shaped and in **monocots** are **dumb-bell** shaped. The guard cells are surrounded by two or more epidermal cells called **subsidiary cells**. When subsidiary cells lie above the guard cells, the stomata are called **sunken**.

Ground Tissue System

- It consists of simple tissues and is derived partly from **periblem** and partly from **plerome**. It is of two types - **extrastelar** (**cortex**) and **intrastelar** (**includes pericycle, pith and medullary rays**). In leaves, it consists of chloroplast containing cells and is called **mesophyll**.

Vascular Tissue System

- Vascular tissue includes **stele** i.e., central column of plant body that consists of vascular bundles and pith (if present). It lies inner to pericycle. Each **vascular bundle** comprises of **xylem** and **phloem** and **cambium** (if present).



INTEXT PRACTICE QUESTIONS

6. Differentiate between exarch and endarch xylem.
7. What are the shapes of stomata in dicots and monocots?

ANATOMY OF DICOT AND MONOCOT PLANTS

- For a better understanding of tissue organisation of roots, stems and leaves, it is convenient to study the transverse sections of the mature zones of these organs. These are summarised in the following tables.

Table : Differences between internal structure of root and stem

Characters	Root	Stem
1. Outer layer	Epiblema	Epidermis
2. Hypodermis	Hypodermis is usually absent in young roots. A thick walled exodermis is present in some cases.	Sclerenchymatous or collenchymatous
3. Ground tissue	Chloroplasts are almost invariably absent.	A few outer cells of the ground tissues may contain chloroplasts.
4. Cortex	Cortex is broad	Cortex is narrow
5. Endodermis	Well developed	Absent or poorly developed
6. Vascular bundle	Radial	Conjoint, collateral or bicollateral
7. Xylem	Exarch	Endarch

Table : Differences between monocot root and dicot root

Characters	Monocot root	Dicot root
1. Cortex	Cortex is very wide.	Cortex is comparatively narrow.
2. Endodermis	Casparian strips are visible only in young root. The endodermal cells later become highly thickened.	Endodermis is less thickened and Casparian strips are more prominent.
3. Vascular bundle	Polyarch <i>i.e.</i> more than 6 vascular bundles.	Diarch to hexarch <i>i.e.</i> 2 - 6 vascular bundles.
4. Conjunctive tissue	Parenchymatous or sclerenchymatous	Parenchymatous
5. Cambium	Absent	Present, so secondary growth occurs
6. Pith	Well developed large pith	Poorly developed
7. Activity of pericycle	Gives rise to lateral roots only.	Gives rise to lateral roots, cork cambium and part of the vascular cambium.

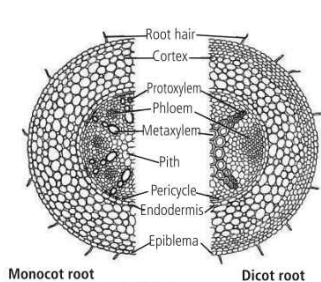


Fig.: Comparison of the T.S. of monocot and dicot roots

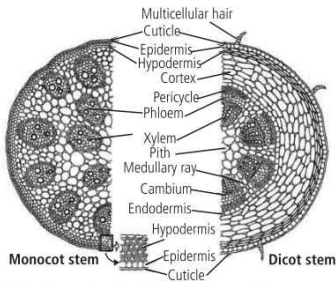


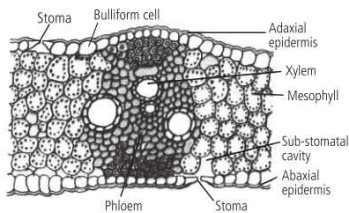
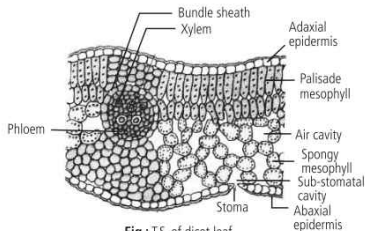
Fig.: Comparison of the T.S. of monocot and dicot stems

Table : Differences between monocot stem and dicot stem

	Characters	Monocot stem	Dicot stem
1.	Epidermis	Single layered, without epidermal hair.	Single layered with multicellular hair and trichomes.
2.	Hypodermis	Sclerenchymatous	Collenchymatous
3.	Ground tissue	Not differentiated.	Differentiated into cortex, endodermis, pericycle, pith etc.
4.	Endodermis	Absent	Present with starch grains, Casparian strips are generally absent.
5.	Pericycle	Absent	Few layered thick.
6.	Medullary rays	Absent	Parenchymatous, found in between vascular bundles
7.	Pith	Absent	Centrally placed with parenchymatous or occasionally sclerenchymatous cells.
8.	Vascular bundles	(a) Scattered (b) Conjoint, collateral, closed. (c) Sclerenchymatous bundle sheath usually present.	(a) Vascular bundles in a ring. (b) Conjoint, collateral or bicollateral and open. (c) Bundle sheath absent.
9.	Phloem parenchyma	Absent	Present
10.	Xylem vessel	Y or V shaped due to disintegration of protoxylem. Lysigenous water cavity is formed.	Polygonal in outline
11.	Secondary growth	Usually absent	Usually present

Table : Differences between monocot leaf and dicot leaf

	Characters	Monocot leaf	Dicot leaf
1.	Symmetry	Isobilateral	Dorsiventral
2.	Stomata distribution	Amphistomatic <i>i.e.</i> , stomata equally distributed on both the surfaces.	Hypostomatic <i>i.e.</i> , stomata present largely on lower surface of leaf.
3.	Bulliform cells	Present on upper epidermis.	Usually absent
4.	Mesophyll	Mesophyll is undifferentiated. Only spongy parenchyma is present which has very small intercellular spaces.	Made up of two types of tissues : (a) Palisade parenchyma (b) Spongy parenchyma with large intercellular spaces.
5.	Bundle sheath	Made of parenchyma. Bundle sheath extensions are sclerenchymatous.	Made up of parenchyma. Bundle sheath extensions are parenchymatous.

**Fig.:** T.S. of monocot leaf**Fig.:** T.S. of dicot leaf

SECONDARY GROWTH

- Secondary tissues are formed by two types of lateral meristems - **vascular cambium** (formed from conjunctive parenchyma and pericycle) and **cork cambium** or **phellogen** (formed from pericycle). Cork cambium produces phellem (cork cells) on the outer side and phelloderm (secondary cortex) on the inner side. Phellem, phellogen and phelloderm together constitute the **periderm**. There are certain loosely arranged areas in the periderm formed due to rapid activity of phellogen, called **lenticels**. Lenticels help in gaseous exchange and transpiration.
- Vascular cambium cells are of two types – **fusiform initials** and **ray initials**. Fusiform initials give rise to secondary **xylem** and **phloem**. Ray initials give rise to **medullary rays** in secondary tissue.
- The activity of cambium is not uniform throughout the year. Due to differential activity of xylem, annual rings are formed consisting of **spring** or **early wood** and **autumn** or **late wood**.
- Spring wood contains larger and wider elements. Autumn wood is formed of smaller and narrower elements. With time the tracheids and vessels of inner part of wood get plugged by ingrowth of adjacent parenchyma cells (**tyloses**) into their cavities through the pits. This wood becomes non-functional and is called **heartwood** (duramen). The outer functional wood is called **sapwood** (alburnum).
- Wood of gymnosperms** is called **nonporous** or **soft wood** (absence of vessels and fewer fibres) and that of **dicots** is called **porous** or **hard wood** (contains vessels and abundant fibres).

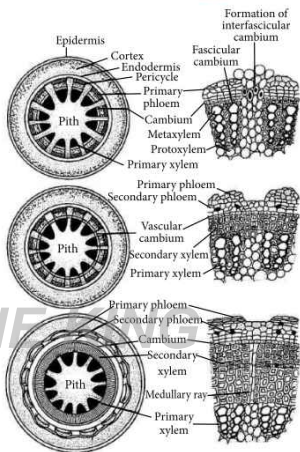
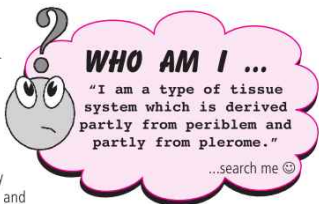


Fig.: Diagrammatic representation of various stages of secondary growth in dicot stem

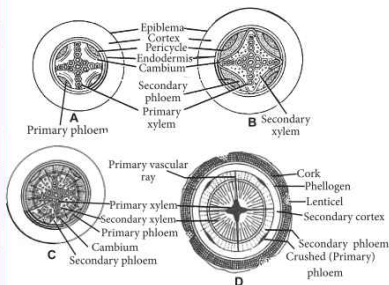


Fig.: Diagrammatic representation of different stages of secondary growth in dicot roots.




Table : Differences between sapwood or alburnum and heartwood or duramen

	Sapwood (Alburnum)	Heartwood (Duramen)
(i)	It is outer wood of an old stem.	It is the central wood of an old stem.
(ii)	It is light coloured.	It is dark coloured.
(iii)	Living cells are present.	Living cells are absent.
(iv)	Sapwood is the functional part of the secondary xylem or wood.	Heartwood is the non-functional part of secondary xylem or wood.
(v)	The tracheary elements are not plugged by tyloses.	The tracheary elements are plugged by tyloses.
(vi)	Tracheary elements do not possess any deposition in their lumen.	Tracheary elements have deposition of tannins, resins, gums, etc.
(vii)	Sapwood is lighter.	Heartwood is heavier.
(viii)	It is less durable because it is susceptible to attack by pathogens and insects.	It is more durable due to its little susceptibility to the attack of pathogens and insects.

Check Your Vitals for **NEET**

Exam on
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Maximise your chance of success in medical entrance exams by reading this article. This section is specially designed to optimise your preparation by practising more and more. It is a unitwise series having chapterwise question bank, allowing you to prepare systematically and become more competent.

-  Recall question or single concept question – indicated by a single finger.
-  Application question or question which requires 2 or 3 concepts - indicated by 2 fingers.
-  Application question or question which requires 3 or more concepts - indicated by 3 fingers.

UNIT-X : ECOLOGY

CHAPTER-13 : ORGANISMS AND POPULATIONS

Multiple Choice Questions

-  1. Which of the following are examples of hygrophytes?
- Ranunculus, Rumex, Euphorbia*
 - Casuarina, Aplyda, Rumex*
 - Aplyda, Rumex, Ranunculus*
 - Capparis, Nerium, Ranunculus*
-  2. Read the following statements and find out the correct option.
- Conformers have a narrow range of distribution.
 - In summer, the larvae of pink cotton bollworm enter a state of diapause.
 - Rhizophora* plants have water storage tissues to dilute salts.
 - In phreatophytes, the roots are very deep.
- (a) I and III are incorrect. (b) I and IV are incorrect.
(c) II, III and IV are incorrect. (d) Only II is incorrect.
-  3. Loamy soil is best for plant growth because
- it is porous and loose
 - it has abundant capillary pores and is compact
 - it consists of 40% clay, 40% sand and 20% silt
 - it is rich in aeration, mineral nutrition and hydration.
-  4. Endotherms of colder regions have smaller feet, tail and ears, as compared to endotherms of warmer regions. This law was proposed by
- Odum
 - Allen
 - Gloger
 - Bergman.
-  5. Which of the following is most likely to be found in the benthic region of a lake?
- Red algae
 - Brown algae
 - Phytoplanktons
 - Crustaceans
-  6. Select the correct statement from the following.
- Immigration is the number of individuals of the same species that have left a habitat during a given time period.
 - Population size can only be measured accurately by calculating total number of individuals.
 - Emigration is the number of individuals of the same species that have entered a new habitat in a given time period.
 - Growth rate of a population will be zero if the various age groups are evenly balanced.
-  7. The logistic population growth is expressed by the equation
- $dN / dt = rN \left(\frac{N-K}{N} \right)$
 - $dt / dN = Nr \left(\frac{K-N}{N} \right)$
 - $dN / dt = rN \left(\frac{K-N}{K} \right)$
 - $dN/dt = rN$.
-  8. The population of *Anopheles* mosquito shows an explosive increase during the rainy season followed by rapid decrease by the end of the season. This rapid decrease is attributed to
- exponential rise in the predator population for *Anopheles* mosquito
 - rapid decrease in food resources by the end of the season

- (c) population crossing the carrying capacity of ecosystem resulting in increased mortality rate
 (d) mass emigration of the mosquito population.

9. Which of the following is an incorrect statement about age pyramids?

- (a) In triangular age pyramid, the population is growing.
 (b) In bell shaped age pyramid, the population is growing initially and later diminishing.
 (c) In urn shaped age pyramid, population is declining with negative growth.
 (d) All of these

10. Select the mismatched pair.

- (a) Hibernation - Northern ground squirrel
 (b) Batesian mimicry - Queen butterfly
 (c) Echolocation - Horseshoe bat
 (d) Camouflage - Praying Mantis

11. Refer to the given statements regarding plant adaptations and select the correct option stating which ones are true (T) and which ones are false (F).

- I. Plants such as *Atriplex* have chalk glands to secrete excess salts.
 II. Palisade parenchyma is more developed in sciophytes.
 III. In hydrophytes, the root caps are replaced by root pockets.
 IV. Proline and sorbitol act as osmoregulators in *Eichhornia*.

- | | | | |
|-------|----|-----|----|
| I | II | III | IV |
| (a) F | T | T | F |
| (b) T | F | T | F |
| (c) T | T | F | F |
| (d) F | T | T | T |

12. The kind of adaptation shown by *Phyllium frondosum* to protect itself from predators is

- (a) cryptic appearance mimicry
 (b) warning colouration
 (c) camouflage
 (d) both (a) and (c).

13. An ecologist was studying the population dynamics of wild boar in a forest. He calculated that total number of the boars in the previous year was 150. In the current year, the emigrants were 10, immigrants were 25, average natality was 160 and mortality was 150. So, net increase was

- (a) 50 (b) 10 (c) 15 (d) 25.

14. Read the given statements.

- (i) *Calotropis* weed produces highly poisonous cardiac glycosides to make herbivores sick.
 (ii) Female mosquitoes are intermittent parasites.
 (iii) Epiphytes show amensalism with their host.
 (iv) Sea lamprey show catadromous spawning.

The correct statements is/are

- (a) (i), (ii) and (iv) (b) (i) and (ii)
 (c) (i) only (d) (ii), (iii) and (iv).

15. Select the option that correctly matches with the following population interactions.

- I. Interaction between two species in which both are mutually benefitted but can survive without each other.
 II. Interaction where both species are benefitted but neither of them can survive without each other.
 III. Relationship between two organisms of different species in which one is benefitted and the other is not effected.

- | | | | |
|-----|------------------|------------|--------------|
| | I | II | III |
| (a) | Amensalism | Symbiosis | Commensalism |
| (b) | Protocooperation | Mutualism | Commensalism |
| (c) | Commensalism | Symbiosis | Amensalism |
| (d) | Symbiosis | Amensalism | Mutualism |

Match The Columns

16. Match Column I with Column II.

- | | |
|--------------------------------|---------------------------|
| Column I | Column II |
| A. Tropical rain forest | (i) <i>Shorea</i> |
| B. Tropical deciduous forest | (ii) <i>Quercus</i> |
| C. Temperate deciduous forest | (iii) <i>Cedrus</i> |
| D. Temperate coniferous forest | (iv) <i>Dipterocarpus</i> |

17. Match Column I with Column II. (There can be more than one match for items in column I).

- | | |
|---------------------|----------------------------|
| Column I | Column II |
| A. <i>Drosera</i> | (i) Regulator |
| B. <i>Sterna</i> | (ii) Hemiparasite |
| C. <i>Loranthus</i> | (iii) Migration |
| D. Dart frog | (iv) Insectivorous |
| | (v) Ectotherm |
| | (vi) Phytoparasite |
| | (vii) Predator |
| | (viii) Warning colouration |

Passage Based Questions

18.(A) Complete the given passage with appropriate words or phrases.

There are different light zones in deep lakes and oceans. The shallow coastal region is called (i). Light is able to pass through this region, therefore producers are abundant but they cease to occur beyond a depth of (ii) in the ocean. The open water zone where water is very deep is called (iii), which is further divided into three parts : (iv), aphotic zone and (v). The upper part of (iv) is called (vi), which receives light more than the compensation point and has a depth of (vii). The lower part of (iv) called (viii), which receives light below the compensation point. The aphotic zone is in perpetual darkness where only (ix) are found. Deep sea animals lack (x) and may show luminescence.

- (B) Read the given passage and correct the errors, wherever present.

The useful morphological, physiological or behavioural change that occur in an organism to make it more fit in their environment is called homeostasis. Plants adapt themselves to the amount of light they receive. The plants growing in bright light are called sciophytes. These plants have thicker cuticle and emerged stomata. The shade plants have stomata on both the surfaces of leaf and osmotic pressure is higher compared to sun plants. Plants that grow in dry habitats are called halophytes. Non-succulents have fleshy organs and perform special type of photosynthesis called crassulacean acid metabolism.

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

- (a) if both A and R are true and R is the correct explanation of A
 (b) if both A and R are true but R is not the correct explanation of A
 (c) if A is true but R is false
 (d) if both A and R are false.

19. **Assertion :** Different seasons and variable amount of annual precipitation leads to formation of major biomes.

Reason : Different seasons and variable annual precipitation give rise to a biosystem which is characterised by a major vegetation type and its associated fauna.

20. **Assertion :** Very small animals are rarely found in polar regions.

Reason : Small animals have a larger surface area relative to their volume and they tend to lose body heat very fast in cold environment.

21. **Assertion :** Competition always occurs between closely related species as they compete for same limiting resources.

Reason : Competition between totally unrelated species does not occur because they have different adaptations and belong to different trophic levels.

22. **Assertion :** Cuckoo lays its eggs in the nest of its host and the host incubates them.

Reason : Brood parasitism is common in cuckoos.

23. **Assertion :** Immigration is a permanent inward movement of some individuals into a local population.

Reason : Immigration is caused by the occurrence of deficiencies and calamities.

24. **Assertion :** Logistic growth is more realistic for animal population as compared to exponential growth.

Reason : Logistic growth is more common in nature because resources are limited and population rarely grows beyond the carrying capacity of the ecosystem.

25. **Assertion :** Antarctic fish remains active in extreme cold sea water.

Reason : Antarctic fish develop cold hardiness by developing extra solutes and special ice nucleating proteins in their body to lower freezing point of body fluids.

26. **Assertion :** Termites and *Trichonympha* show proto-cooperation.

Reason : Termites harbour cellulose digesting flagellate, *Trichonympha* in their gut that can live independently.

27. **Assertion :** Ecophenes are formed in a population due to changes in environment.

Reason : Ecophenes show genotypic adaptations with variable environmental conditions.

28. **Assertion :** Desert rat fulfills its water requirement by producing metabolic water from respiratory breakdown of fats.

Reason : Desert rat reduces water loss by producing nearly solid faeces and urine.

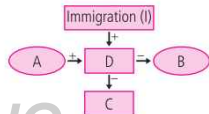
Figure Based Questions

29. Answer the given question based on the following figure.

- (a) Identify A, B, C and D.

- (b) What is the definition of D?

- (c) Briefly describe the effect of A and B on D.

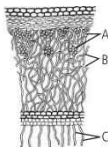


30. Study the given figure and answer the following questions.

- (a) Identify A, B and C.

- (b) What kind of population interaction is shown by the given structure?

- (c) Mention the important roles of A and B.



CHAPTER-14 : ECOSYSTEM

Multiple Choice Questions

1. Read the following statements and select the correct option. Stating which ones are true (T) and which ones are false (F).

P. Producers are able to synthesise inorganic food from organic raw materials.

Q. Consumers are also called phagotrophs.

R. Wild cat is an example of second order consumer.

S. Decomposer organisms consume the organic matter and digest it internally.

- | | P | Q | R | S |
|-----|---|---|---|---|
| (a) | F | T | F | T |
| (b) | F | T | T | F |
| (c) | T | T | F | F |
| (d) | T | T | F | T |

2. A wooden log represents
- microecosystem
 - anthropogenic ecosystem
 - nanoecosystem
 - mesoecosystem.
3. Which of the following statements is incorrect about food chains?
- Auxiliary food chain usually begins with a host and ends with a parasite.
 - Isolated food chains make the ecosystem more stable.
 - Transducers have the ability to change the light energy into chemical form.
 - Food chains add to competitiveness of the organism.
4. Mean net primary productivity of _____ is maximum which is approximately _____ tons/ha/yr.
- tropical rain forest, 25
 - temperate deciduous forest, 20
 - tropical rain forest, 20
 - temperate coniferous forests, 22
5. Select the incorrect statement from the following.
- Stratification is the formation of vertical layers where vegetation is dense.
 - Gross primary productivity is the total amount of organic matter synthesised by producers per unit time and area.
 - Standing state is the amount of inorganic nutrients found in an ecosystem.
 - The net productivity of a highly productive ecosystem is about 1-2 kg/m²/yr.
6. Which group of plants grow during the reed swamp stage in a hydrosere?
- Lemna, Wolffia, Scirpus, Juncus*
 - Typha, Scirpus, Phragmites, Sagittaria*
 - Lemna, Najas, Typha, Juncus*
 - Scirpus, Typha, Sagittaria, Najas*
7. In carbon cycle, lithosphere acts as (i) _____ and oceans function as (ii) _____.
- (i) cycling pool, (ii) reservoir
 - (i) global pool, (ii) recycling sink
 - (i) reservoir pool, (ii) global pool
 - (i) reservoir pool, (ii) global sink
8. In a tree ecosystem, if the tertiary consumer is a carnivorous bird, the pyramid of numbers will be
- upright
 - inverted
 - spindle-shaped
 - both (b) and (c).
9. How many of the following statements is/are correct?
- About 2-10% PAR is captured by the producers.
 - 10% law was proposed by Lindeman.
 - Respiration of herbivores consume about 60% of assimilated energy.
 - 50% of ecosystem service cost is for protection and formation of soil.
10. In the equation, $A = \frac{\text{Net primary productivity}}{\text{Gross primary productivity}} \times 100$
- Here, A stands for
- assimilation efficiency
 - net production efficiency
 - photosynthetic efficiency
 - secondary productivity.
11. Select the mismatched pair with respect to decomposition process.
- Leaching - Release of inorganic substances from organic matter in the soil.
 - Fragmentation - Increase in surface area of detritus by detritivores.
 - Humification - Simplified detritus is changed into dark coloured amorphous substance that is resistant to microbial action.
 - Catabolism - Decomposers release extracellular enzyme in their surroundings to breakdown detritus into simple organic compounds and inorganic substances.
12. Which of the options correctly depicts the sequence of biotic communities appearing in a newly formed lake?
- Floating stage
 - Woodland stage
 - Plankton stage
 - Sedge stage
 - Climax forest
 - Submerged stage
 - Reed swamp stage
- (a) (iii) → (vi) → (i) → (iv) → (vii) → (ii) → (v)
 (b) (vi) → (iii) → (iv) → (i) → (vii) → (v) → (ii)
 (c) (iii) → (vi) → (iv) → (i) → (vii) → (v) → (ii)
 (d) (iii) → (vi) → (i) → (vii) → (iv) → (ii) → (v)
13. Pyramid of biomass is upright if
- the carnivores outnumber the herbivores
 - the reproductive potential of primary consumers is more than the producers
 - 10-20% of biomass is transferred to next trophic level in a food chain
 - small standing crop of primary consumers supports large standing crop of secondary consumers.
14. In a food chain, there is no fixed trophic level of
- decomposers
 - parasites
 - top carnivore
 - both (a) and (b).
15. The biological succession that occurs in sand is known as
- lithosere
 - xerosere
 - psammosere
 - halosere.

Match The Columns

16. Match Column I with Column II.

Column I

- Aristida*
- Cymbopogon*
- Ziziphus*
- Hypnum*

Column II

- Shrub stage
- Annual grass stage
- Perennial grass stage
- Moss stage

17. Match Column I with Column II. (There can be more than one match for items in column II).

Column I

- A. Grazing food chain
B. Carbon cycle
C. Detritus food chain
D. Phosphorus cycle

Column II

- (i) Perfect cycle
(ii) Saprotrophs
(iii) Imperfect cycle
(iv) Transducers
(v) Carrion beetle
(vi) Guano
(vii) Predator food chain
(viii) Gaseous cycle

Passage Based Questions

- 18.(A) Complete the given passage with appropriate words or phrases.

Phosphorus takes part in metabolic reactions and in various functions of the body. It is mostly used as (i). In phosphorus cycle, (ii) are the reservoir pool while (iii) functions as cycling pool for terrestrial ecosystem. (i) are present in (iii) as combined form with (iv), (v) and (vi). Some of the (i) combine with cations and settle at the bottom of water bodies through the process of (vii). To increase the availability of (i), (viii) are added to the soil. In aquatic system, phosphorus is taken from water by (ix). High concentration of (i) in natural water causes (x).

- (B) Read the given passage and correct the errors, wherever present.

Primary productivity is the rate of synthesis of organic matter by the producers which can be measured by weight in tons/yr. The amount of organic matter synthesised by producers per unit time and per unit area is termed as net primary productivity. It can be calculated by adding rate of respiration and other losses to gross primary productivity. Secondary productivity is the rate of synthesis of inorganic matter by the consumers and increases with each trophic level. In water, maximum productivity occurs in sugarcane fields and on land it is found in tropical deciduous forest.

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

- (a) if both A and R are true and R is the correct explanation of A
(b) if both A and R are true but R is not the correct explanation of A
(c) if A is true but R is false
(d) if both A and R are false.

19. **Assertion :** The climax community is a rain forest in a moist tropical area and a coniferous forest or deciduous forest in temperate area.

Reason : The type of climax community depends upon the climate.

20. **Assertion :** Homeostasis of the ecosystem is not static but fluctuates within certain limits.

Reason : Carrying capacity of the environment is one of the major limitation for homeostasis.

21. **Assertion :** In terrestrial ecosystem, upper layer of soil is the main site of decomposition.

Reason : Leaf litter, dried plant parts, animal remains, their dropping and excretions are the above-ground detritus.

22. **Assertion :** Pyramid of biomass is upright in aquatic habitats.

Reason : Number and biomass of phytoplanktons is higher than the zooplanktons in aquatic habitats.

23. **Assertion :** Energy travels in the ecosystem through a unidirectional pathway.

Reason : In successive trophic levels, some part of energy is lost in order to perform various life processes.

24. **Assertion :** Primary succession occurs in an area which is very hostile to pioneer community.

Reason : Primary succession occurs in an area which has been denuded recently.

25. **Assertion :** Carbon present in the atmosphere and hydrosphere is utilised by producers and changed into organic compounds.

Reason : Carbon present in the lithosphere can only be used by organisms after it is changed chemically.

26. **Assertion :** Detritus with larger amounts of chitin and lignin is rapidly decomposed by decomposers

Reason : Detritus rich in chitin and lignin is readily water soluble hence decomposes rapidly.

27. **Assertion :** In an ecosystem, regular input of energy is of utmost importance.

Reason : In an ecosystem, matter passes from one trophic level to another but energy is lost at each level.

28. **Assertion :** In a young and growing ecosystem, a lot of nutrients are retained by the growing biomass of biota.

Reason : In young ecosystems the amount of nutrient uptake is equal to the amount of nutrients recycled.

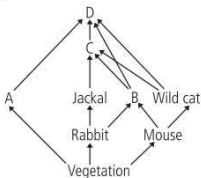
Figure Based Questions

29. Study the given pyramid of numbers related to pond ecosystem and answer the following questions.

- (a) Identify A, B, C and D.
(b) Briefly describe the significance of the pyramid.
(c) Why is the pyramid of biomass inverted for the same ecosystem?



30. Read the given terrestrial food web and answer the following questions.



- Identify A, B, C and D.
- How many food chains are associated with B and C?
- If the number of C suddenly increases in huge number what will be its effect on B?

CHAPTER-15 : BIODIVERSITY AND CONSERVATION

Multiple Choice Questions

- Which of the following options represent *ex-situ* conservation strategies?
 - Cryopreservation, arboreta, sanctuaries
 - Orchards, botanical gardens, wildlife safari parks
 - Zoological parks, cryopreservation, hotspots
 - Biosphere reserves, zoological parks, botanical gardens
- Biosphere reserves are different from national parks and wildlife sanctuaries because in the former
 - people are an integral part of the system
 - human beings are not allowed to enter
 - conservation of animals is the main aim
 - endangered organisms are brought from different places and preserved.
- Read the following statements and select the incorrect one.
 - Species diversity is the variety in the number and richness of the species of a region.
 - Eastern Ghats have greater diversity of endemic amphibian species as compared to Western Ghats.
 - Mangrove vegetation is found in swamp areas along the sea coasts.
 - Shannon index is the diversity index commonly used for ecological studies.
- According to IUCN red list, those species whose population is abundant but home range has been affected adversely so they may become endangered is the medium term future, come under
 - vulnerable species
 - endangered species
 - near threatened
 - lower risk species.
- The K-T boundary event marks the extinction of (i) that occurred (ii) Mya and is linked with the deposits of (iii).

(a) dinosaurs	(ii) 60	(iii) iridium
(b) dinosaurs	50	calcite
(c) giant sloth	80	calcite
(d) dodo	75	iridium
- Rivet popper hypothesis, proposed by Paul Ehrlich, signifies the
 - effect of higher productivity on biodiversity
 - effect of decrease in biodiversity on the ecosystem
 - species area relationship of an ecosystem
 - effect of latitudinal and altitudinal gradients on biodiversity in an ecosystem.
- Red Data Book was initiated in _____ and is maintained by _____.

(a) 1964, IUCN	(b) 1971, CITES
(c) 1971, WWF	(d) 1963, WWF
- Which fish variety from Africa has been introduced illegally in Indian aquaculture that threatened native catfishes?
 - Clarias gariepinus*
 - Clarias batrachus*
 - Anguilla*
 - Blatta orientalis*
- Find out the mismatched pair.
 - Cryopreservation - Preservation of biological material at - 196°C in liquid nitrogen
 - Indo-Burma hotspot - Rich in biodiversity of primitive angiospermic families
 - Earth summit - Held in 2002 in Johannesburg to lay down new strategies to reduce biodiversity loss
 - Ramsar site-Rann of Kutch as a site for breeding for flamingos.
- Which of the following species are native to India?

(i) Sugarcane	(ii) Banana
(iii) Zebu	(iv) Tobacco
(v) Water buffalo	(vi) Yak

 - (i), (iii), (iv) and (vi)
 - (ii), (iii), (iv) and (v)
 - (i), (ii), (iii) and (v)
 - (i), (ii), (iii), (iv) and (v)

12. Loss of biodiversity will drastically decrease
- ecosystem productivity
 - susceptibility to extinction
 - disease cycles
 - environmental perturbations.
13. The endangered species is well protected from all adverse factors in
- ex-situ* conservation
 - biosphere reserve core zone
 - in-situ* conservation
 - both (a) and (c).
14. International cooperation for certain species of wild fauna and flora against over exploitation through international trade is the aim of
- WWF
 - CITES
 - MAB
 - IUCN.
15. Quagga, Dodo and Tasmanian wolf have undergone recent extinction due to
- environmental catastrophes
 - human activities
 - alien species invasion
 - background extinction.

Match The Columns

16. Match Column I with Column II.
- | Column I | Column II |
|----------------------------------|-----------------------------|
| A. <i>Berberis nilghiriensis</i> | (i) Endangered |
| B. <i>Allurus fulgens</i> | (ii) Least concerned |
| C. <i>Neofelis nebulosa</i> | (iii) Critically endangered |
| D. <i>Antilope cervicapra</i> | (iv) Vulnerable |
17. Match Column I with Column II. (There can be more than one match for items in column I).
- | Column I | Column II |
|-----------------------|--------------------------|
| A. Gene banks | (i) Arboreta |
| B. Biosphere reserve | (ii) Cryopreservation |
| C. Sacred forest | (iii) Orthodox seeds |
| D. Offsite collection | (iv) Sarguja |
| | (v) Khasi hills |
| | (vi) Orchards |
| | (vii) Restoration region |
| | (viii) Manipulation zone |

Passage Based Questions

18. (A) Complete the given passage with appropriate words or phrases.
- The number of species per unit area is called (i). Number of individuals of different species represents (ii). Communities where species are represented by more or less equal number of individuals exhibit (iii). In other communities where one or more species have more individuals than other show (iv). Alexander von Humboldt while exploring the wilderness of (v) jungles found that (i) within a region (vi) with increasing area but upto a certain limit. The relationship between (i) and area turned out to be (vii) for a wide variety of taxa while on a logarithmic scale it is a (viii).

- (B) Read the given passage and correct the errors, wherever present.
- In the last one hundred years, the rate of decline of wildlife has been exceptionally high. This has caused slow exploitation of species which is complete elimination of wild species from the face of earth. A species becomes more prone to disappearance due to drastic genetic changes and population characteristics. Equador rain forest was once called the lungs of the planet but now it is being cut and cleared for cultivation of sugarcane. This has resulted in displacement of unaccountable endemic species and habitat eutrophication. Besides total profit, the degradation of many habitats by pollution also threatens the survival of many species.

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

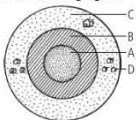
- if both A and R are true and R is the correct explanation of A
 - if both A and R are true but R is not the correct explanation of A
 - if A is true but R is false
 - if both A and R are false.
19. **Assertion** : Species richness and evenness influences alpha diversity.
Reason : A lot of competition, adjustments and inter-relationships amongst members of the same community occurs in alpha diversity.
20. **Assertion** : Over-exploitation is one of the major cause of biodiversity loss.
Reason : Over-exploitation of a species reduces the size of its population eventually leading to its extinction.
21. **Assertion** : Ivory-billed woodpecker is considered as an endangered species.
Reason : Population of it is facing a high risk of extinction in near future due to decrease in its habitat.
22. **Assertion** : Temperate areas show greater biodiversity.
Reason : There are no unfavourable seasons in temperate regions.
23. **Assertion** : Species with low genetic variability are generally at higher risk of extinction than the species with more genetic variability.
Reason : Species with low genetic variability are more vulnerable to diseases, predators or other environmental as challenges.
24. **Assertion** : A decrease in species diversity occurs as the altitude increases.
Reason : There is a lapse in temperature of 10°C for every 1000 m increase in altitude.
25. **Assertion** : Species diversity is the trait of a species.
Reason : Species diversity influences adaptability and distribution of species in diverse habitats.

26. **Assertion** : In national park, cultivation of land and grazing is not permitted.
Reason : National park is meant for protection of both flora and fauna.
27. **Assertion** : Identification and characterisation of microbial species is difficult with the current conventional methods.
Reason : The knowledge about protists, bacteria and viruses is very fragmented.
28. **Assertion** : The status of blackbuck in IUCN red list has changed from vulnerable to least concerned category.
Reason : Bishnois of Rajasthan protect blackbuck religiously and keep them in sacred forests.
4. Read the following statements and select the correct option.
- (i) Acid rain is rainfall and other forms of precipitation with a pH of less than 5.
(ii) Sewage, industrial effluents and wastewaters are non-point source pollutants.
(iii) Benzene hexachloride degrades fast and becomes part of biogeochemical cycles.
(iv) Green muffler is maintained to serve as noise absorbers.
- | (i) | (ii) | (iii) | (iv) |
|-------|------|-------|------|
| (a) T | F | T | F |
| (b) T | T | F | F |
| (c) T | F | F | F |
| (d) T | F | F | T |

Figure Based Questions

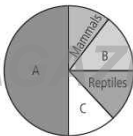
29. Answer the given questions based on following figure.

- (a) Identify the figure and the zones labelled as A, B, C and D in it.
(b) Describe the role of A and B.
(c) Why is it included under MAB programme?



30. Study the following pie chart regarding global diversity of vertebrates and answer the following question.

- (a) Identify A, B and C from the given pie chart.
(b) What is the number of species of B in India and in Amazon rain forest?
(c) Name two global projects dealing with new species discovery.



CHAPTER-16 : ENVIRONMENTAL ISSUES

Multiple Choice Questions

1. Due to acid rain, metal, marble, painted surfaces, etc. are being corroded. This phenomenon is called
(a) wet corrosion (b) stone leprosy
(c) acid leprosy (d) etching.
2. The colloidal constituents of domestic sewage are
(a) pathogens (b) phosphates and nitrates
(c) clay and silt (d) all of these.
3. The high biological oxygen demand (BOD) in a particular segment of a river indicates that
(a) the segment is free from pollution
(b) the segment is highly polluted
(c) aquatic life has started to flourish
(d) the river has less pathogenic contamination.
5. The effect of today's radioactive fallout will probably be more harmful to children of future generation than to present day children because
(a) infants are more susceptible to radiations
(b) susceptibility to radiations increases with age
(c) mutated genes are usually recessive
(d) none of these.
6. Which of the following are the correct approaches to reduce air pollution caused by automobiles?
(i) Use of combustion technique
(ii) Use of catalytic converters in four-stroke engines
(iii) Use of wet scrubbers
(iv) Use of multipoint fuel injection engines
(a) (i) and (ii) (b) (iii) and (iv)
(c) (ii) and (iv) (d) (i) and (iii)
7. *Escherichia coli* is used as an indicator organism to determine pollution of water with
(a) heavy metals (b) organic colloidal particles
(c) industrial effluents (d) excess phosphate.
8. Infrasonic vibrations are felt when body parts resonate at a frequency of X. Identify X.
(a) Below 50 Hz (b) Above 100 Hz
(c) Above 15000 Hz (d) Below 100 Hz
9. Joint forest management involves
(a) conservation of forest and agricultural land by the government
(b) conservation of forests and wildlife by the local communities
(c) government working in close association with the local communities for protecting and managing forests.
(d) conservation of over-exploited flora only.
10. Increasing skin cancer and high mutation rates are the result of
(a) heavy metal toxicity (b) ozone depletion
(c) CO pollution (d) CO₂ pollution.
11. Which of the following is/are the correct strategies to deal with global warming?

- (a) Increasing the vegetation cover
- (b) Using minimum nitrogen fertiliser in agriculture
- (c) Replacement of CFCs by developing its substitutes
- (d) All of these

12. Which of the following pollutant causes irritation of eyes and respiratory diseases?

- (a) Carbon monoxide
- (b) Hydrogen sulphide
- (c) Photochemical smog
- (d) Sulphur dioxide

13. Agricultural crops are grown in between the rows of sal and teak. This is known as

- (a) urban forestry
- (b) taungya system
- (c) shifting cultivation
- (d) social forestry.

14. Uliso, belesu and balasu are the aim of

- (a) Chipko movement
- (b) Joint forest movement
- (c) Appiko movement
- (d) Van mahotsava.

15. The incomplete burning of carbohydrates produces.

- (a) soot
- (b) flyash
- (c) smoke
- (d) smog.

Match The Columns

16. Match Column I with Column II.

Column I (Source of pollution)	Column II (Example)
A. Point source pollution	(i) Mining area
B. Fixed source pollution	(ii) Fertilisers
C. Area source pollution	(iii) Electrical power plants
D. Diffuse source pollution	(iv) Chimney

17. Match Column I with Column II. (There can be more than one match for items in column I).

Column I	Column II
A. PAN	(i) Snow blindness
B. Mercury	(ii) Testicular atrophy
C. UV-B	(iii) Biomagnification in fishes
D. Cadmium	(iv) Necrosis in leaves
	(v) Itai-itai
	(vi) Secondary pollutant
	(vii) Skin cancer
	(viii) Minamata

Passage Based Questions

18. (A) Complete the given passage with appropriate words or phrases.

Ozone layer is present in the stratosphere which is also called (i). (ii) percent of atmospheric ozone is present in (i). Thickness of ozone is measured in (iii). In stratosphere ozone is being formed and (iv), to dissipate the energy of UV radiations. Depletion of ozone layer over a restricted area such as Antarctica is called (v). Certain substances called (vi), react with ozone and destroy the same. Thinning of ozone shield increases the amount of (vii) reaching the earth. Chlorofluorocarbon has the maximum ozone depleting potential due to release of (viii).

(B) Read the given passage and correct the errors, wherever present.

Eutrophication is the deficiency of nutrients in a water body. Natural eutrophication is a fast process which may not be detectable in human lifetime. During cultural eutrophication, pollutants from man's activities decelerate the ageing process. *Eichhornia crassipes* is a plant that chokes ponds, lakes and rivers resulting in balance of ecosystem of water bodies. Salination is a natural stage in the change of lake into dry land.

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

- (a) if both A and R are true and R is the correct explanation of A
- (b) if both A and R are true but R is not the correct explanation of A
- (c) if A is true but R is false
- (d) if both A and R are false.

19. **Assertion :** During an integrated waste water treatment in the town of Arcata, the process was designed in two steps.
Reason : In the first step, dissolved heavy metals were removed and in the second step conventional sedimentation, filtration and chlorine treatments were given.

20. **Assertion :** Chlorinated hydrocarbons such as DDT can undergo biological magnification.

Reason : DDT accumulated by an organism cannot be metabolised or excreted.

21. **Assertion :** Run off from fertilised fields and streams draining in water bodies encourages growth of aquatic organisms.

Reason : Run off from fertilised fields and streams draining contain nitrogen and phosphorus.

22. **Assertion :** Afforestation decreases carbon dioxide concentration in the atmosphere.

Reason : Afforestation restores the forest cover over an area where forests existed before but were cut down in the past.

23. **Assertion :** Noise pollution affects both hearing and general health of man.

Reason : Noise may cause altered breathing patterns resulting in stress.

24. **Assertion :** Radiation given off by nuclear waste is extremely damaging to organisms.

Reason : Radiation causes mutations at a very high rate.

25. **Assertion :** Montreal Protocol was signed at Montreal (Canada) in 1987.

Reason : Montreal Protocol agreed to limit the production of CFCs to one fourth the level of 1986.

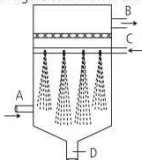
26. **Assertion :** Desertification is the removal and deterioration of forest cover of an area.

Reason : Moderation of temperature and decrease of rainfall to minor extent leads to desertification.

27. **Assertion** : Incinerators are fitted with scrubbers and electrostatic precipitators in order to control solid wastes.
Reason : Scrubbers and electrostatic precipitators prevent release of smoke and toxic chemicals.
28. **Assertion** : Acid rain is caused by large scale emission of acidic gases into the atmosphere from industries and automobiles.
Reason : Acid rain causes leaching of essential minerals from soil.

Figure Based Questions

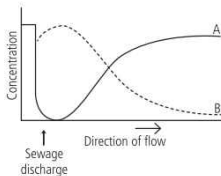
29. Study the given figure and answer the following questions.



CHAPTER-13 : ORGANISMS AND POPULATIONS

1. (c) 2. (d) 3. (d) 4. (b) 5. (d)
 6. (d) 7. (c) 8. (c) 9. (b) 10. (b)
 11. (b) 12. (d) 13. (d) 14. (c) 15. (b)
16. A-(iv); B-(i); C-(ii); D-(iii)
 17. A-(iv),(vii); B-(i),(iii); C-(ii),(vi); D-(v),(viii)
18. (A) (i) littoral zone (vi) euphotic zone
 (ii) 200 m (vii) 20-80 m
 (iii) limnetic zone (viii) disphotic zone
 (iv) photic zone (ix) consumers
 (v) benthic zone (x) air sacs
- (B) The useful morphological, physiological or behavioural change that occur in an organism to make it more fit in their environment is called **homeostasis** adaptation. Plants adapt themselves to the amount of light they receive. The plants growing in bright light are called **sciophytes** heliophytes. These plants have thicker cuticle and **emerged** sunken stomata. The shade plants have stomata on both the surfaces of leaf and osmotic pressure is **higher** lower compared to sun plants. Plants that grow in dry habitat are called **halophytes** xerophytes. **Non-succulents** Succulents have fleshy organs and perform special type of photosynthesis called crassulacean acid metabolism.
19. (a) 20. (a) 21. (d) 22. (b) 23. (c)
 24. (a) 25. (a) 26. (d) 27. (c) 28. (b)
 29. (a) In the given figure, A-Natality, B-Mortality, C-Emigration, D-Population density.

- (a) Identify A, B, C and D in the given figure.
 (b) Briefly describe the function of the given figure.
 (c) How does it differs from cyclonic separators?
30. Refer to the given graph and answer the following questions.



- (a) Why there is a rise in B at the point of sewage disposal?
 (b) Briefly explain the effect of sewage disposal on A.
 (c) What is the indication of river water recovery from sewage pollution?

SOLUTIONS

- (b) D represents population density. The population density (D) is the number of individuals (N) of a species per unit area/space (S) at a given time. It can also be represented as $D = \frac{N}{S}$
- (c) The density of a population in a habitat during a given period can be changed due to change in four basic processes, i.e. natality, mortality, immigration and emigration. Natality refers to the number of births in the population during a given period. Mortality is the number of deaths in the population during a given period. Population density increases due to natality whereas it decreases with mortality.
30. (a) The given figure is a section of lichen. A represents the algal cells, B represents fungal hyphae and C represents rhizoids.
 (b) Lichen shows mutualism between an alga (phycobiont) and a fungus (mycobiont). This interaction allows the lichen to grow in highly hostile environment.
 (c) The algal cells manufacture food by photosynthesis and provides nutrition to the fungal part. The main body of lichen is formed of fungal cells provide fixation, absorbs water and minerals and shelter to the alga.

CHAPTER-14 : ECOSYSTEM

1. (b) 2. (c) 3. (b) 4. (c) 5. (d)
 6. (b) 7. (d) 8. (c) 9. (a) 10. (b)
 11. (a) 12. (d) 13. (c) 14. (b) 15. (c)
 16. A-(ii); B-(iii); C-(i); D-(iv)

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

18. (A) (i) phosphates (vi) aluminium
(ii) Phosphate rocks (vii) sedimentation
(iii) soil (viii) fertilisers
(iv) calcium (ix) phytoplanktons
(v) iron (x) eutrophication

(B) Primary productivity is the rate of synthesis of organic matter by the producers which can be measured by weight in ~~tons~~ tons/ha/yr. The amount of organic matter synthesised by producers per unit time and per unit area is termed as ~~net~~ gross primary productivity. It can be calculated by adding rate of respiration and other losses to ~~gross~~ net primary productivity. Secondary productivity is the rate of synthesis of ~~inorganic~~ organic matter by the consumers and ~~increases~~ decreases with each trophic level. In water, maximum productivity occurs in ~~sugarcane~~ fields coral reefs and on land it is found in tropical ~~deciduous~~ rain forest.

19. (a) 20. (b) 21. (a) 22. (d) 23. (b)

24. (c) 25. (b) 26. (d) 27. (a) 28. (c)

29. (a) In the given diagram, A is Phytoplankton, B is Zooplankton, C is Small fish and D is Large fish.

(b) The upright pyramid of number in a pond ecosystem signifies a large number of phytoplanktons (e.g., diatoms) that support comparatively smaller number of zooplanktons (e.g., copepods). Zooplanktons further support fewer number of smaller fishes which in turn become food for even lesser larger fishes such as pike.

(c) The pyramid of biomass is inverted in aquatic ecosystem because the biomass of a trophic level depends upon reproductive potential and longevity of its members. Thus, the phytoplankton may be smaller than that of zooplanktons and that of latter lesser than the primary carnivores.

30. (a) In the given figure, A is Deer/Antelope, B is Fox, C is Wolf and D is Tiger.

(b) There are four separate food chains associated with fox (B) are :

- (i) Vegetation → Rabbit → Fox → Tiger
- (ii) Vegetation → Rabbit → Fox → Wolf → Tiger
- (iii) Vegetation → Mouse → Fox → Tiger
- (iv) Vegetation → Mouse → Fox → Wolf → Tiger

The other four food chains associated with wolf (C) are:

- (i) Vegetation → Rabbit → Jackal → Wolf → Tiger
- (ii) Vegetation → Rabbit → Fox → Wolf → Tiger
- (iii) Vegetation → Mouse → Fox → Wolf → Tiger
- (iv) Vegetation → Mouse → Wild cat → Wolf → Tiger

(c) If there is a sudden increase in number of wolf in the food web, the population of fox will decrease adversely as the wolf and fox are in a predator-prey relationship respectively.

CHAPTER-15: BIODIVERSITY AND CONSERVATION

1. (b) 2. (a) 3. (b) 4. (a) 5. (a)

6. (c) 7. (b) 8. (a) 9. (a) 10. (c)

11. (c) 12. (a) 13. (a) 14. (b) 15. (b)

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

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

18. (A) (i) species richness (v) South American
(ii) species equitability (vi) increases
(iii) evenness (vii) rectangular hyperbola
(iv) dominance (viii) straight line

(B) In the last one hundred years, the rate of decline of wildlife has been exceptionally high. This has caused slow ~~exploitation~~ extinction of species which is complete elimination of wild species from the face of earth. A species becomes more prone to disappearance due to drastic ~~genetic~~ environmental changes and population characteristics. ~~Equador~~ Amazon rain forest was once called the lungs of the planet but now it is being cut and cleared for cultivation of ~~sugarcane~~ soybeans. This has resulted in displacement of unaccountable endemic species and habitat ~~eutrophication~~ fragmentation. Besides total ~~profit~~ loss, the degradation of many habitats by pollution also threatens the survival of many species.

19. (b) 20. (a) 21. (a) 22. (d) 23. (a)

24. (c) 25. (d) 26. (b) 27. (b) 28. (a)

29. (a) Given figure is the zonation in terrestrial biosphere reserve. Here, A is core area, B is buffer zone, C is transition zone and D is human settlement.

(b) The area under core or natural zone (A) in undisturbed and legally protected ecosystem where human activities are not allowed. Buffer zone (B) surrounds the core area and limited human activities like resource use strategies, research and education is allowed here.

(c) Man and biosphere programme (MAB) is an international biological programme of UNESCO, that was started in 1971 (introduced in India in 1986). It has been initiated to study the impact of human interference and pollution on biotic and abiotic environments and conservation strategies for the present as well as for future. Under MAB programme, a number of biosphere reserves have been established by UNESCO for dealing with the conservation of ecosystems and genetic resources they contain.

30. (a) In the given pie-chart, A is Fishes, B is Birds and C is Amphibians.

(b) There are more than 1200 species of birds in India whereas in tropical Amazon rainforest, the number of bird species is around 1300.

- (c) New species are being discovered at faster rate due to the projects such as Global Biodiversity Information Facility and Species 2000.
- (b) Scrubbers are employed in removing gaseous pollutants. Particulate matters are also separated by scrubbers by passing through dry or wet packing materials.

CHAPTER - 16 : ENVIRONMENTAL ISSUES

1. (b) 2. (a) 3. (b) 4. (d) 5. (c)
6. (c) 7. (b) 8. (a) 9. (c) 10. (b)
11. (d) 12. (d) 13. (b) 14. (c) 15. (a)

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

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

18. (A) (i) ozonosphere (v) ozone hole
(ii) 90 (vi) ODS
(iii) Dobson units (vii) UV-B radiations
(iv) photodissociated (viii) active chlorine

(B) Eutrophication is the deficiency enrichment of nutrients in a water body. Natural eutrophication is a fast slow process which may not be detectable in human lifetime. During cultural eutrophication, pollutants from man's activities decelerate accelerate the ageing process. *Eichhornia crassipes* is a plant that chokes ponds, lakes and rivers resulting in balance imbalance of ecosystem of water bodies. Salination desalination is a natural stage in the change of lake into dry land.

19. (c) 20. (a) 21. (a) 22. (c) 23. (b)

24. (a) 25. (c) 26. (d) 27. (b) 28. (b)

29. (a) The given figure represents scrubber. A, directs the flow of dirty gas, B directs the flow of clean gas, C is the flow of liquid and D is the flow of dissolved gases.

(c) In cyclonic separators particulate rich air is passed into a chamber where it is rotated and centrifugal force causes settling of particulates. While in scrubbers gaseous pollutants are removed through dry and wet techniques.

30. (a) In the given graph, B represents biological oxygen demand (BOD). Discharge of domestic sewage into river causes rise of BOD because decomposer organisms consume a lot of oxygen.

(b) In the given graph, A represents dissolved oxygen. Dissolved oxygen is consumed greatly by the decomposers, so it is reduced at the point of sewage discharge.

(c) Fish and other clean water organisms which were reduced due to increased BOD, reappear when BOD is much less thereby, indicating recovery of river.



ANSWERS

WHO AM I ...

- | | |
|-------------------------|--------|
| 1. Cladode | Pg. 20 |
| 2. Parthenocarp | Pg. 21 |
| 3. Ground tissue system | Pg. 31 |

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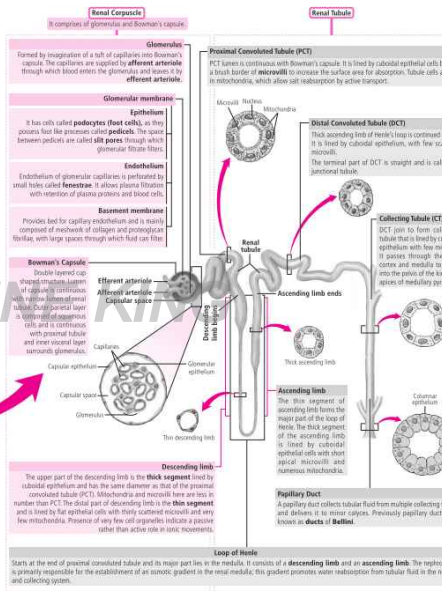
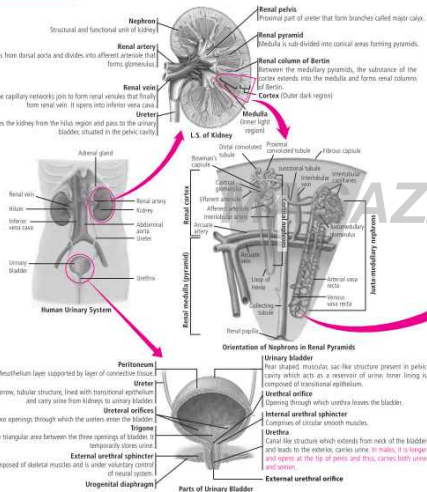


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CONCEPT MAP

ANATOMY OF HUMAN KIDNEY

Kidney is a part of human excretory system. Kidneys, bean-shaped organs are present in upper dorsal region of abdominal cavity, on either side of vertebral column. Each kidney has about 1-1.3 million nephrons, the basic functional unit of kidney. The main function of the kidney is to filter the blood and reject its waste products in dissolved form in the urine.



PRACTICE PAPER

NEET

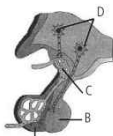
Exam on
26th July 2020

- A group of organisms is considered as one single species due to
 - their morphological similarities inspite of their diverse genetic contents
 - their certain correlated characters
 - their ability to interbreed freely and produce fertile offsprings
 - all of these.
- Middle Palaeozoic Era is also called
 - age of ferns
 - age of gymnosperms
 - age of algae
 - age of flowering plants.
- Consider the following statements regarding chlorophyll structure and choose the incorrect one.
 - The porphyrin head is made up of four pyrrole rings which are linked by methine bridges.
 - A non-ionic magnesium atom is held in the centre of porphyrin head.
 - Phytol, the long chain of alcohol, anchors the chlorophyll molecule into thylakoid membrane.
 - Without the Mg-core it is termed as phaeophytin which is white in colour.
- Identify the mismatched pair.
 - Aerobic respiration – Aerobic breakdown of organic food
 - Fermentation – Anaerobic breakdown of carbohydrates
 - Putrefaction – Aerobic breakdown of proteins
 - Decay – Aerobic breakdown of organic compound
- In rose and peach,
 - flowers are hypogynous
 - flowers are zygomorphic and bracteate
 - flowers are perigynous
 - flowers are epigynous.
- In a mycelia of club fungi, cells are with haploid nuclei. It is called
 - clamp connection
 - secondary mycelium
 - primary mycelium
 - sclerotia.
- In gymnosperm life cycle, the haploid phase is represented by
 - male and female cone
 - microsporophyll and megasporophyll
 - microspores and megaspores
 - all of these.
- Alexander Fleming in 1928 discovered the first antibiotic penicillin from a mould *Penicillium notatum*, while working on
 - Streptococcus*
 - Staphylococcus*
 - Streptomyces*
 - Salmonella*.
- Identify the correctly matched pair.
 - NADP reductase – Outer surface of thylakoid membrane
 - Light harvesting complex II – P₇₀₀
 - Cytochrome c – Thylakoid lumen
 - Ubiquinone – Inter-membrane space of mitochondria
- Which of the following structure is absent in the given embryo?
 - Single celled suspensor
 - Coleorhiza - a covering of root cap
 - Triploid endosperm and pericarp
 - Meristematic cells
- If the intraocular pressure is continuously increased due to the blocked canal of Schlemm, it may cause
 - hypermetropia
 - glaucoma
 - myopia
 - presbyopia.
- Which of the following parts of mouth of cockroach bears the organ of taste?
 - Mandibles
 - Maxillae
 - Hypopharynx
 - Labrum
- In Bowman's capsule very minute filtration slits are present formed by the special cells. These special cells are the modification of
 - simple squamous epithelium
 - simple cuboidal epithelium
 - simple columnar epithelium
 - transitional epithelium.



14. Select the correct order of plant succession in hydrosere.
- Typha* → *Lemna* → *Hydrilla* → *Carex*
 - Hydrilla* → *Typha* → *Lemna* → *Carex*
 - Typha* → *Hydrilla* → *Lemna* → *Carex*
 - Hydrilla* → *Lemna* → *Typha* → *Carex*
15. Consider the given statements and choose the correct option accordingly.
- Statement A** - When gall bladder is operated and removed from GI tract of a person, it resulted in poor digestion of fats.
- Statement B** - Gall bladder synthesises, stores and concentrates bile.
- Both statements A and B are correct and B is the correct explanation of A.
 - Both statements A and B are correct but B is not the correct explanation of A.
 - Statement A is correct but statement B is incorrect.
 - Both statements A and B are incorrect.

16. Identify A, B, C and D in the given diagram and select incorrect statement.



- A is anterior pituitary and its functioning is controlled by hypothalamus.
 - B is posterior pituitary and it does not synthesise any hormone.
 - C is portal circulation and it controls the functioning of B.
 - D are neurosecretory cells in the hypothalamus that secrete two hormones oxytocin and vasopressin.
17. Function of LNG-20 is associated with
- inhibition of ovulation
 - suppressing sperm motility
 - decreasing fertilising capacity of sperm
 - making uterus unsuitable for implantation.
18. Sexual reproduction is mostly absent in dinoflagellates except in
- Ceratium*
 - Blastodinium*
 - Glenodinium*
 - Astasia*.
19. Plants show many mechanisms to ensure cross pollination in the given options, except
- dichogamy
 - dicliny
 - herkogamy
 - homogamy.
20. Anal cerci are present on _____ of cockroach.
- 8th abdominal segment
 - 9th abdominal segment
 - 10th abdominal segment
 - 10th abdominal segment of male only

21. Read the following statements and select the correct option.
- Statement A** - Colchicine induces polyploidy which is useful in raising several varieties of agricultural and horticultural plants.
- Statement B** - Colchicine does not allow the formation of mitotic spindle but has no effect on chromosome replication.
- Both statements A and B are correct and B is the correct explanation of A.
 - Both statements A and B are correct but B is not the correct explanation of A.
 - Statement A is correct but statement B is incorrect.
 - Both statements A and B are incorrect.

22. Sprinkling salt on leeches would cause the immediate death of the organism because of
- hypotonic condition
 - endosmosis
 - plasmolysis
 - skin ruptures due to turgidity.

23. Which one of the following is not correct about DHU loop of tRNA?
- It is the largest loop which contains 7-10 bases.
 - It contains dihydrouridine.
 - It is the binding site for aminoacyl synthetase enzyme.
 - None of these

24. Coelacanth, a living fossil caught from the eastern coast of South Africa, is a connecting link between
- amphibians and reptiles
 - reptiles and birds
 - birds and mammals
 - fishes and amphibians.

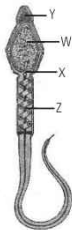
25. Which one of the following is not a characteristic feature of the Class Reptilia?
- Skin bears epidermal scales or scutes.
 - Respiration takes place through lungs.
 - Skull is dicondylic.
 - Kidneys are metanephric.

26. An undifferentiated, unorganised nucleus without any limiting membrane is not observed in
- E. coli*, *Salmonella*, *Nostoc*
 - Salmonella*, *Staphylococcus*, *Micrococcus*
 - E. coli*, *Staphylococcus*, *Rivularia*
 - Trichomonas*, *Leishmania*, *Trypanosoma*.

27. Match the column I with column II and select the correct option.

Column I	Column II
A. Terminalisation	(i) Pachytene
B. Short thick chromosome	(ii) New genetic recombination
C. End result of meiosis	(iii) Prophase-I
D. Longest period of meiosis	(iv) Diakinesis
	(v) Telophase-II
(a) A-(i), B-(iv), C-(ii), D-(iii)	(b) A-(iv), B-(i), C-(ii), D-(iii)
(c) A-(i), B-(iv), C-(ii), D-(v)	(d) A-(iv), B-(i), C-(ii), D-(v)

28. In the process of dense and bushy hedge making, the gardener should
- spray synthetic auxin on the plants
 - remove the apical bud of the main shoot
 - remove the tip of the plant and then apply auxin
 - supply auxin through the roots of the plants.
29. Select the incorrect one from the given statements.
- The contraction of atria is initiated by SA-node.
 - Auricular contraction stimulates the AV-node.
 - Bundle of His originates from the SA-node
 - Heart beat originates from the SA-node.
30. The α -helix of a polypeptide chain is coiled spirally in right handed manner and is stabilised by
- electrostatic interactions
 - hydrogen bonds
 - disulphide bridges
 - hydrophobic interactions.
31. The epithelium present in parotid glands and urethra of human male
- consists of columnar cells
 - consists of columnar cells with cilia
 - consists of cuboidal cells with cilia
 - consists of simple cuboidal cells.
32. A person suffering from degenerative changes in cartilages of joints, making them stiff and causing severe pain, is most probably suffering from
- rheumatoid arthritis
 - gouty arthritis
 - osteoarthritis
 - myasthenia gravis.
33. Hydroponics
- conserves water but cannot regulate pH optimum for a particular crop
 - is being used to raise flowers and vegetables but cannot produce out of season vegetables
 - requires soil setup and testing hassles.
 - is useful in the areas having infertile and dry soils.
34. Blue eye colour in human is recessive to brown eye colour. A blue-eyed woman gets married to a brown-eyed man, who had a blue-eyed mother. The children are likely to be
- all blue-eyed
 - three blue-eyed one brown-eyed
 - three brown-eyed one blue-eyed
 - one blue-eyed and one brown-eyed.
35. *Adiantum caudatum* is called walking fern because its
- root tips form new plants when they come in contact with soil
 - leaf tips form new plants when they come in contact with soil
 - cones contain spores which can germinate even in very harsh conditions
 - antherozoids can reach the mouth of archegonium only through the agency of water.
36. Ammocoete larva of lamprey resembles the adult form of *Amphioxus*. This is justified by
- progressive metamorphosis
 - larval resemblance
 - retrogressive metamorphosis
 - temporary embryonic resemblance.
37. Carcinoma is a type of cancer where cancerous growth is derived from
- muscular and connective tissues
 - blood plasma
 - epithelial tissues
 - glial cells of CNS.
38. In which of the following techniques nucleic acid hybridisation does not take place?
- Polymerase chain reaction
 - Separation of DNA fragments by gel electrophoresis
 - DNA fingerprinting
 - Western blotting
39. The diverse landscape of India that includes deserts, rain forests, mangroves, coral reefs, wet lands, etc., are considered under
- alpha diversity
 - point diversity
 - gamma diversity
 - beta diversity.
40. Contamination with radioactive pollutants is very dangerous as it may cause
- biomagnification
 - gene mutation
 - ozone destruction
 - eutrophication.
41. Identify the organelle marked W, X, Y and Z with its correct associated function from the given structure of sperm.



- W-Nucleolus – Controls all activities of sperm
- X-Proximal centriole – Plays a role in 1st cleavage of zygote
- Y-Acrosome – Provides sperm motility necessary for fertilisation
- Z-Mitochondria – Energy source for fusion of sperm and egg

42. Match the column I with column II and choose the correct option.

Column I	Column II
A. Ovulation	(i) Attachment of zygote to endometrium
B. Parturition	(ii) Release of egg from Graafian follicle
C. Gestation	(iii) Delivery of baby from uterus
D. Implantation	(iv) Ovulation and menstruation cease
	(v) Duration between pregnancy and birth

- (a) A-(ii), B-(iii), C-(v), D-(i)
 (b) A-(ii), B-(iii), C-(iv), D-(i)
 (c) A-(ii), B-(iv), C-(iii), D-(i)
 (d) A-(ii), B-(v), C-(iv), D-(i)
43. Which of the following statements is incorrect regarding species-area relationship?

- (i) Within a region, species richness increases with increasing explored area, without any limit.
 (ii) The relation between species richness and area for a wide variety of taxa (angiosperms, birds, bats, freshwater fishes) turns out to be rectangular parabola.
 (iii) Value of regression co-efficient lies in the range of 0.1 to 0.2.
 (iv) If species-area relationship is analysed among very large areas, the regression coefficient lies in the range of 0.6 to 1.2.
- (a) (i) and (ii) (b) (iii) and (iv)
 (c) (i), (ii) and (iii) (d) (ii), (iii) and (iv)

44. The given figure is of a

- (a) natural alkaloid obtained from coca plant
 (b) synthetic drug commonly called pep pills
 (c) crystalline amidated alkaloid obtained from ergot on rye plant
 (d) hallucinogenic chemical obtained from the dried flower of *Cannabis sativa*.



45. The most important features of entomophilous flowers are
- (a) scented, inconspicuous and without nectar
 (b) presence of only perianth
 (c) scented, colourful and having nectar
 (d) odourless and without colour.

46. Which of the following is true for RNA processing?

- (a) Exons are excised before the mRNA is translated.
 (b) Primary transcript is often smaller than the functional RNAs.
 (c) Additional nucleotides are added to the ends of RNAs for specific functions.
 (d) Introns are brought together and ends are sealed by RNA ligase.

47. Select the correct statement regarding sickle cell anaemia.

- (a) It follows the same inheritance pattern as that of haemophilia.
 (b) It follows the same inheritance pattern as that of colourblindness.
 (c) It is a sex-linked disease.
 (d) It occurs due to a single recessive point mutation leading to the substitution of a single amino acid in the β -chain of haemoglobin.

48. Law of independent assortment is most directly related to the _____ of meiosis.

- (a) anaphase II (b) prophase II
 (c) metaphase I (d) metaphase II

49. Mycoplasma is not affected by penicillin as it lacks

- (a) cell wall (b) ribosomes
 (c) DNA (d) RNA.

50. Ozone depletion can cause higher rates of

- (i) skin cancer (ii) meningitis
 (iii) snow-blindness (iv) lung cancer.
 (a) (i) and (ii) (b) (i) and (iii)
 (c) (iii) only (d) (ii) and (iii)

51. An ecosystem is composed of only three trophic levels. How much energy will be conserved at the third trophic level?

- (a) 30% of the second trophic level
 (b) 10% of the first trophic level
 (c) 10% of the second trophic level
 (d) 0.1% of the second trophic level

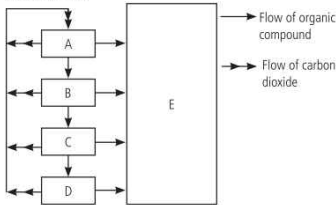
52. The interaction between Red-billed Ox Pecker and Yellow-billed Ox Pecker with Black Rhinoceros is a kind of

- (a) mutation (b) amensalism
 (c) protooperation (d) parasitism.

53. Which one of the following is incorrect regarding age pyramids of human population?

- (a) If pre-reproductive group is larger the population shows positive growth.
 (b) The population is declining when post-reproductive group is larger and pre-reproductive individuals are lesser.
 (c) Pyramid is urn shaped when pre-reproductive and reproductive individuals are almost same.
 (d) All of these

54. CO is a harmful pollutant because it
 (a) causes smog (b) combines with oxygen
 (c) combines with Hb (d) inhibits growth.
55. A typical biome getting 100-250 cm mean annual rainfall and 3-5 dry months is
 (a) tropical rain forest
 (b) tropical deciduous forest
 (c) temperate broad leaved forest
 (d) temperate needle leaved forest.
56. The diagram represents the flow of materials within a balanced ecosystem where the boxes represents various trophic levels.



- Which box represents herbivores?
 (a) E (b) B (c) C (d) A
57. The vaccines produced for hepatitis-B and herpes virus are
 (a) first generation vaccine
 (b) second generation vaccine
 (c) third generation vaccine
 (d) edible vaccine.
58. Which one of the following is not involved in the formation of butter milk?
 (a) *Streptococcus cremoris*
 (b) *Lactobacillus acidophilus*
 (c) *Acetobacter*
 (d) Both (b) and (c)
59. Introduction of foreign gene for improving genotype is
 (a) tissue culture (b) vaccination
 (c) genetic engineering (d) molecular farming.
60. Which one is incorrect about Lambda phage vector?
 (a) The genome remains linear in the phage head.
 (b) It allows cloning of DNA fragments upto 30 Kb length.
 (c) Genome forms a circular molecule within host cell.
 (d) It can be easily detected at the time of cloning experiments.
61. Select the mismatched pair of recombinant protein with their respective therapeutic uses.
 (a) Reopro – Prevention of blood clots
 (b) Humulin – Treatment of diabetes mellitus
 (c) Blood clotting Factor-VIII – Treatment of haemophilia B
 (d) Hirudin – Anticoagulant
62. Down's syndrome is related to
 (a) increase in chromosome number of 21st pair
 (b) decrease in chromosome number of 21st pair
 (c) increase in chromosome number of 18th pair
 (d) decrease in chromosome number of 18th pair.
63. Recessive allele present on X chromosome
 (a) expresses in heterozygous form in females
 (b) does not express singly in males
 (c) shows criss-cross inheritance
 (d) affects females more than males.
64. Epididymis is
 (a) network of sinuses between seminiferous tubules and vasa efferentia
 (b) intermediate structure between rete testis and vasa efferentia
 (c) a long coiled tube between vasa efferentia and vas deferens
 (d) connection between vas deferens and seminal vesicle.
65. Epiblast present in certain monocot embryo represents
 (a) rudimentary leaves
 (b) scutellum
 (c) hypocotyl
 (d) rudimentary second cotyledon.
66. Identify the correct sequence of egg layers from outside to inside in human females.
 (a) Perivitelline space → Zona pellucida → Corona radiata
 (b) Zona pellucida → Perivitelline space → Corona radiata
 (c) Corona radiata → Zona pellucida → Perivitelline space
 (d) Corona radiata → Perivitelline space → Zona pellucida
67. Test tube baby technique is associated with
 (a) external fertilisation and internal embryo formation
 (b) internal fertilisation and external embryo formation
 (c) both external fertilisation and external embryo formation
 (d) both internal fertilisation and internal embryo formation.
68. Prokaryotes which can live in very harsh habitat like extreme salty areas are
 (a) methanogens
 (b) thermoacidophiles
 (c) halophiles
 (d) mycoplasmas.
69. Which one of the following is not correct about arthropods?
 (a) They are mostly dioecious and oviparous.
 (b) Fertilisation is external.
 (c) Development may be direct or indirect.
 (d) All of these
70. Select the incorrect statement.
 (a) Phylloclades are photosynthetic in function.
 (b) Pitcher of *Nepenthes* is a modification of stem.
 (c) Bulb of onion have greatly reduced stem.
 (d) Cladode is found in *Asparagus*.

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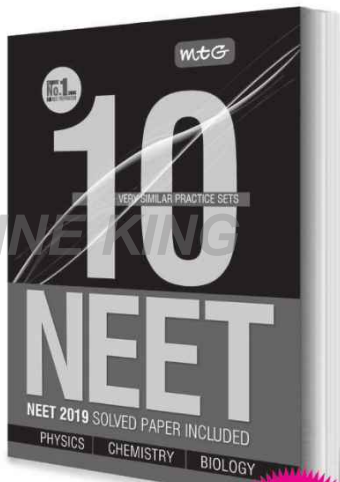
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71. Y-shaped arrangement of xylem vessels is found in

- (a) monocot stem (b) dicot stem
(c) monocot root (d) dicot root.

72. Aril part in the fruit of litchi is

- (a) an outgrowth developed from chalaza
(b) an additional integument developed from the funiculus of the ovule
(c) the region between exocarp and pericarp
(d) non-edible part.

73. Emerson effect has clearly shown the existence of

- (a) photorespiration
(b) photophosphorylation
(c) light and dark reaction in photosynthesis
(d) concept of two photosystems.

74. Which of the following substance acts as electron acceptor in photosystem - I to produce NADPH during light reaction?

- (a) Cytochrome (b) Ferredoxin
(c) Plastocyanin (d) Pheophytin

75. Which type of enzyme action is seen in the given figure?



- (a) Lock and key model
(b) Competitive inhibition
(c) Irreversible inhibition
(d) Induced fit model

76. The main difference between active and passive transport across cell membrane is that

- (a) passive transport is non-selective
(b) active transport occurs more rapidly than passive transport
(c) passive transport is gradient based, while active transport is energy based against concentration gradient
(d) passive transport is confined to anions, while active transport is for cations only.

77. Number of base pairs present in one spiral of B-DNA is

- (a) 5 (b) 10 (c) 20 (d) 25.

78. 'P'-wave of ECG occurs before the

- (a) onset of ventricular ejection
(b) end of atrial contraction
(c) beginning of atrial contraction
(d) none of these.

79. The factors responsible for shifting of oxygen dissociation curve to right is/are

- (i) increased body temperature

(ii) high pH

(iii) increase in $p\text{CO}_2$

- (a) (i) and (ii) (b) (ii) and (iii)
(c) (i) and (iii) (d) (i), (ii) and (iii)

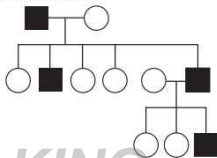
80. The factor which regulates the absorption of digested food by intestinal villi is

- (a) peristalsis (b) osmosis
(c) emulsification (d) differential absorption.

81. Basidiocarp of mushroom

- (a) is made up of primary mycelium
(b) produce exogenously meiospores
(c) has upper part stipe and lower part pileus
(d) has many vertically hanging gills which bears paraphyses only at their tips.

82. Given below is a pedigree chart showing the inheritance of a certain trait in humans.



The best possible explanation of trait traced in the above chart is

- (a) autosomal recessive (b) autosomal dominant
(c) X-linked dominant (d) Y-linked.

83. Read the following statements and select the correct one.

- (a) The narrow end of castor seed bears a bilobed white spongy caruncle.
(b) Female receptacle of *Funaria* is covered by a whorl of perigonial leaves.
(c) Young leaves of *Eucalyptus* show circinate ptyxis.
(d) *Chondrus* is one of the sources of bromine.

84. ANDI is first transgenic monkey. The meaning of its name is

- (a) artificial nuclear DNA incubation
(b) Arber and Nathan DNA insert
(c) inserted DNA (d) invented DNA.

85. Which of the following feature is common for both mitosis and meiosis?

- (a) Both have pairing of homologous chromosomes.
(b) Both are preceded by DNA replication.
(c) Both occur in all kinds of cells.
(d) Both include separation of paired chromosomes.

86. In human beings, rib cage and sternum move upwards and outwards during

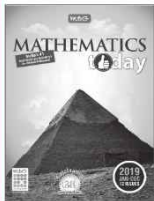
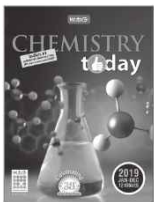
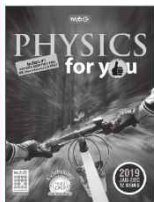
- (a) exercise (b) hypoxia
(c) expiration (d) inspiration.
87. An organism is living in the intestine of man and consuming undigested food without causing any harm, such relationship is called
(a) parasitism (b) mutualism
(c) commensalism (d) amensalism.
88. Which is not correct according to T.R. Malthus regarding theory of human population growth?
(a) Population grows geometrically when unchecked whereas food grows only arithmetically.
(b) Imbalance will never occur in such condition.
(c) Catastrophic control of population occurs due to positive checks.
(d) None of these
89. Stamens fused by both the filaments as well as the anthers throughout their whole length are present in (i) and the cohesion is called (ii).
(a) (i)-*Cucurbita*, (ii)-diadelphous
(b) (i)-*Helianthus*, (ii)-syngenesious
(c) (i)-*Cucurbita*, (ii)-synandrous
(d) (i)-*Ricinus*, (ii)-synandrous

90. Helper T-cells stimulate B-cells to mature and increase their
(a) interferon production
(b) immunosuppressant production
(c) antibody production
(d) all of these.

ANSWER KEY

1. (c) 2. (c) 3. (d) 4. (c) 5. (c)
6. (c) 7. (c) 8. (b) 9. (a) 10. (c)
11. (b) 12. (d) 13. (a) 14. (d) 15. (c)
16. (c) 17. (d) 18. (a) 19. (d) 20. (c)
21. (a) 22. (c) 23. (a) 24. (d) 25. (c)
26. (d) 27. (b) 28. (b) 29. (c) 30. (b)
31. (a) 32. (c) 33. (d) 34. (d) 35. (b)
36. (a) 37. (c) 38. (a) 39. (c) 40. (b)
41. (b) 42. (a) 43. (a) 44. (c) 45. (c)
46. (c) 47. (d) 48. (c) 49. (a) 50. (b)
51. (c) 52. (c) 53. (c) 54. (c) 55. (c)
56. (b) 57. (b) 58. (c) 59. (c) 60. (b)
61. (c) 62. (a) 63. (c) 64. (c) 65. (d)
66. (c) 67. (c) 68. (c) 69. (b) 70. (b)
71. (a) 72. (b) 73. (d) 74. (b) 75. (b)
76. (c) 77. (b) 78. (c) 79. (c) 80. (d)
81. (b) 82. (d) 83. (a) 84. (c) 85. (b)
86. (d) 87. (c) 88. (b) 89. (c) 90. (c)

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MONTHLY TEST DRIVE



This specially designed column enables students to self analyse their extent of understanding of specified chapters. Give yourself four marks for correct answer and deduct one mark for wrong answer. Self check table given at the end will help you to check your readiness.

MOLECULAR BASIS OF INHERITANCE

Total Marks : 160

Time Taken : 40 Min.

- Polyadenylation at 3' end of hnRNA through post transcriptional processing is mediated by
(a) RNA polymerase II (b) Poly A polymerase
(c) DNA polymerase II (d) RNA polymerase III.
- Read the given statements and select the correct option.
(i) DNA replication produces double stranded replicas of DNA.
(ii) In prokaryotes, splicing is required for removing introns during transcription.
(iii) RNA primer is essential for transcription of DNA.
(iv) DNA replication in eukaryotes is catalysed by DNA polymerase III.
(a) (i), (ii) and (iv) are incorrect.
(b) (i) and (ii) are incorrect.
(c) (ii), (iii) and (iv) are incorrect.
(d) (i) and (iv) are incorrect.
- (i) first reported that dsRNA of (ii) operates a reversed central dogma.
(i) (ii)
(a) Beadle and Tatum *E. coli*
(b) Bishop and Varmus TMV
(c) Temin and Baltimore Rous Sarcoma virus
(d) Hershey and Chase Bacteriophage
- DNA fingerprinting is based on the concept that
(a) the hypervariable minisatellite DNA sequences of each individual are distinct
(b) single nucleotide polymorphism is responsible for most genetic variations in a population
(c) VNTRs at same loci in the genome show variations in the position of repeating units between individuals of a population
(d) all of these.
- RNA is labile and easily degradable majorly because of the presence of
(a) methylated cap at 5' end
(b) 2' - OH group at every nucleotide
(c) phosphodiester bonds
(d) thymine instead of uracil.
- Which of the following enzymes has topoisomerase activity in prokaryotes?
(a) DNA gyrase
(b) DNA helicase
(c) DNA polymerase I
(d) DNA polymerase III
- DNA duplex has two types of alternate grooves. Length of the major and minor grooves are respectively
(a) 20 Å and 14 Å (b) 22 Å and 12 Å
(c) 34 Å and 22 Å (d) 3.4 Å and 2.2 Å.
- Read the given statements and select the correct option stating which one is true (T) or false (F).
(i) Heterochromatin stains darkly and is transcriptionally active.
(ii) According to Chargaff, the purines and pyrimidines are always equal in amount, i.e., $A + G = T + C$.
(iii) The concept of central dogma of molecular biology was proposed by Crick in 1958.
(iv) Sense strand has no role in transcription.
(i) (ii) (iii) (iv)
(a) T F T F
(b) F T T T
(c) T F F F
(d) F F T T

9. Which of the following is not required for transcription?

- RNA polymerase enzyme
- DNA template
- RNA primer
- Divalent metal ions Mg^{2+} or Mn^{2+} as a cofactor

10. During translation, amino acids bind to the

- 5' end of tRNA
- 3' end of tRNA
- TΨC loop of tRNA
- codon of mRNA.

11. In eukaryotes, TATA box is present within

- promoter
- enhancer
- structural genes
- terminator.

12. Read the given statements and select the correct option.

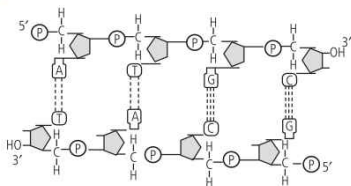
- rRNAs bind protein molecules and give rise to ribosomes.
 - 5' end of 18S rRNA has complementary nucleotides to the cap region of mRNA.
 - In eukaryotes, rRNA is transcribed in the form of a longer chain of 45S.
 - rRNA is the most abundant RNA.
- (i) and (ii) are incorrect.
 - (ii), (iii) and (iv) are incorrect.
 - (iii) and (iv) are incorrect.
 - Only (ii) is incorrect.

13. Match the Column I with Column II.

Column I	Column II
A. GUU	(i) Trp
B. AGU	(ii) Val
C. UGG	(iii) Ser
D. UUA	(iv) Leu

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

14. Which of the following is incorrect for the given figure?



- One strand is new whereas another strand is old (parental).
- The two strands are held together by hydrogen bonds between their bases.
- The backbone is formed by deoxyribose sugar only.
- A is equal to T and C is equal to G.

15. The complementarity of nucleotides is essential for

- transcription of DNA template
- duplication of polynucleotides
- translation of mRNA
- all of these.

16. Which of the following is incorrect about codons?

- Some triplets are identified by more than one tRNAs.
- They are non-overlapping.
- Functioning of GUC is ambiguous.
- UGA can stop the protein synthesis.

17. Read the given statements and select the correct option.

Statement A : mRNA from chick oviduct introduced in *E. coli* will produce ovalbumin in the bacterium similar to one formed in chick.

Statement B : mRNA codons are universal.

- Both statements A and B are correct and B is the correct explanation of A.
- Both statements A and B are correct but B is not the correct explanation of A.
- Statement A is correct but B is incorrect.
- Both the statements A and B are incorrect.

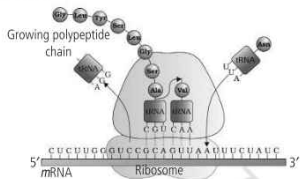
18. DNA fingerprinting is not helpful in distinguishing one human being from another, in case of

- monozygotic twins
- persons with hereditary diseases
- individuals with same origin and historical migration
- biological father and son.

19. In *Paramecium*, termination codons UAA and UGA code for

- glutamine
- valine
- tryptophan
- arginine.

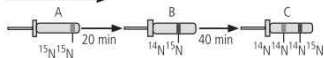
20. With respect to the given figure, which of the following is incorrect?



- Polypeptide must have methionine at first position.
- The ribosome moves from codon to codon in direction 3' → 5'.
- At the end of translation, the completed polypeptide is released in the presence of release factor.
- At a time, ribosome provides the site of attachment to more than one loaded tRNA molecules.

21. Which of the following is not a true feature of double helix model described by Watson and Crick?
- The two chains of DNA are antiparallel.
 - Both the chains are coiled in a right handed fashion.
 - Backbone is constituted by nitrogen bases only which project outwards.
 - Nitrogen bases of opposite strands are bound to each other with H-bonds.
22. The experiment of Hershey and Chase proved that
- bacteria, that were infected with viruses containing radioactive proteins, also became radioactive.
 - bacteria that were infected with viruses containing radioactive DNA, did not become radioactive.
 - proteins did not enter the bacteria from the viruses.
 - all of these.
23. In a double stranded fragment of B-DNA, the pitch of helix per turn is
- 34 Å
 - 46 Å
 - 25 Å
 - 24 Å
24. In eukaryotes, nu body is formed of
- H₁, H₂A, H₂B, H₃
 - H₂A, H₂B, H₃ and H₄ in pairs
 - H₂A, H₂B, H₃, H₄ and 200 bp of DNA
 - H₂A, H₂B, H₃, H₄ and linker DNA.
25. Select the correct statement from the following regarding transcription.
- Only a segment of a single strand of DNA is copied into RNA.
 - Intervening sequences appear in processed RNA.
 - In bacteria, translation can begin much before the mRNA is fully transcribed.
 - Terminator is located upstream of the structural gene.
- (i) and (ii)
 - (i) and (iii)
 - (ii) and (iv)
 - (iii) and (iv)
26. With respect to the figure given below, which of the following can be incorrect?

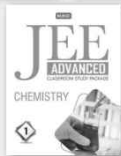
Gravitational force →



- In figure A, DNA is double stranded and both the strands are heavy.
 - All the DNA molecules are hybrid in figure B.
 - 75% strands are light in figure C.
 - All of these
27. Select the correct order of DNA replication from the given option.
- Formation of replication fork → Formation of RNA primer → Activation of nucleotides → Base pairing → New strand formation → Proof reading

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- (b) Activation of nucleotides → Formation of replication fork → Formation of RNA primer → Base pairing → New strand formation → Proof reading
- (c) Formation of RNA primer → Formation of replication fork → Activation of nucleotides → Base pairing → New strand formation → Proof reading
- (d) Formation of replication fork → Formation of RNA primer → Activation of nucleotides → Base pairing → Proof reading → New strand formation
28. Okazaki fragments' length in eukaryotes are
(a) 1000-2000 nucleotides (b) 100-200 nucleotides
(c) 10-20 nucleotides (d) 1000-1200 nucleotides.
29. Which of the following part of tRNA is not single stranded?
(a) AA-binding site (b) DHU loop
(c) Anticodon stem (d) TΨC loop
30. Translation in prokaryotes need three initiation factors. These are
(a) eIF1, eIF2 and eIF3 (b) eIF4A, eIF4B and eIF4C
(c) IF1, IF2 and IF3 (d) IF4A, IF4B and IF4C.
31. Leader Attenuator Complex, in *lac* operon is present
(a) in between operator and structural gene
(b) just before the regulator gene
(c) in between regulator and operator gene
(d) at the end of structural genes.
32. Read the given statements and select the correct option.
Statement A : Lactose, if provided in the growth medium of *E.coli*, will be transported into the cells through the action of permease.
Statement B : In the presence of lactose, the repressor is inactivated by its interaction.
(a) Both statements A and B are correct and B is the correct explanation of A.
(b) Both statements A and B are correct but B is not the correct explanation of A.
(c) Statement A is correct but B is incorrect.
(d) Both the statements A and B are incorrect.
33. Which of the following form of RNA carries coding message for only one amino acid?
(a) mRNA (b) rRNA
(c) tRNA (d) hnRNA
34. Which pair of codons function as stop signals in human mitochondria?
(a) UAG, UGA (b) UAA, UGA
(c) AGG, AGA (d) UGA, AUA
35. Work of Taylor *et.al.* on roots of *Vicia faba* proved that
(a) genetic material in viruses is RNA
(b) replication of DNA is semi-conservative in eukaryotes
(c) each gene is responsible for a specific enzyme
(d) DNA is more stable than RNA.
36. Why does thymine make pair with adenine and not with guanine?
(a) T-G pair would be very much unstable.
(b) T and G both are polar.
(c) The functional groups that form H-bond are not complementary between T and G.
(d) All of these.
37. The haploid content of human DNA consists of
(a) 3.3×10^9 bp (b) 3.3×10^6 bp
(c) 4.6×10^6 bp (d) 48502 bp.
38. If the mRNA sequence is UUUACGGCUAU, what would be the sequence of antisense strand of the DNA producing it?
(a) TTTACGGCTAT
(b) AAATGCCGATA
(c) UUUACCTUGUUAU
(d) AAAUGGUACAUA
39. If the first base of a given DNA sequence gets mutated on the left side, the coding of this DNA segment will result in
(a) complete changed sequence of the amino acids in polypeptide
(b) change in one amino acid in the polypeptide
(c) one amino acid less in the polypeptide
(d) no change in the polypeptide sequence.
40. Which of the following is not considered as a defect in 'one gene one enzyme' hypothesis?
(a) All genes do not produce enzymes.
(b) Some RNAs also exhibit enzyme activity.
(c) Monocistronic genes synthesise one type of polypeptide.
(d) An enzyme may consist of one or more types of polypeptides.



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Fire - Revision

1. Vertebral formula of human is
(a) $C_7 T_{11} L_5 S_{(5)} C_{(4)}$ (b) $C_5 T_{12} L_7 S_{(5)} C_{(4)}$
(c) $C_7 T_{12} L_5 S_{(5)} C_{(4)}$ (d) $C_7 T_{10} L_5 S_{(5)} C_{(4)}$
2. Which theory of evolution supports the evolution of short necked giraffe to long necked giraffe?
(a) Lamarck's theory of inheritance of acquired characters
(b) Darwin's theory of natural selection
(c) Hugo de Vries mutation theory
(d) Neo - Darwinism
3. Match the Column I with Column II and select the correct option.
- | Column I | Column II |
|----------------|---|
| A. Sphaerosome | (i) Glycolate metabolism |
| B. Mesosome | (ii) Lipid storage |
| C. Peroxisome | (iii) RNA synthesis |
| D. Nucleolus | (iv) Replication of nucleoid
(v) Respiration |
- A B C D
(a) (ii) (v) (i) (iv)
(b) (ii) (iv) (i) (iii)
(c) (v) (ii) (i) (iv)
(d) (ii) (v) (iii) (i)
4. Which of the following processes takes place during diplotene stage of meiosis?
(a) Recombination nodules are formed.
(b) The chromatids become more distinguishable.
(c) Tractile fibril formation occur in the region of the centromere.
(d) The chromosomes move towards the spindle poles along the path of their tractile fibrils.
5. Sting of bee is a modification of its ovipositor while that of scorpion is modified last abdominal segment but both have same function of defence. It is due to
(a) homologous organs showing adaptive radiation
(b) retrogressive metamorphosis
(c) analogous organs showing convergent evolution
(d) atavism.
6. Enzyme succinate dehydrogenase is found in _____ of mitochondria in eukaryotes.
(a) inner membrane
(b) inner chamber
(c) outer membrane
(d) outer chamber
7. Presence of different types of beaks in Darwin's finches, modified according to food habits exhibit
(a) adaptive radiation
(b) convergent evolution
(c) parallel evolution
(d) adaptive convergence.
8. Read the following statements and select the correct option.
(i) Amylopectin contains a large number of glucose units.
(ii) Inulin is used in testing of kidney function, especially glomerular filtration.
(iii) Husk of *Plantago ovata* contains mucilage which is used as stabilising and emulsifying agent in the laboratory.
(a) (i) and (iii) are correct but (ii) is incorrect.
(b) (i) and (ii) are correct but (iii) is incorrect.
(c) (ii) and (iii) are correct but (i) is incorrect.
(d) (i), (ii), (iii) and (iv) are correct.
9. Pits help in rapid translocation between two adjacent cells because
(a) pit membrane consists of secondary wall
(b) pit membrane is selectively permeable
(c) pit membrane is permeable with minute submicroscopic pores
(d) they generally occur in pairs.

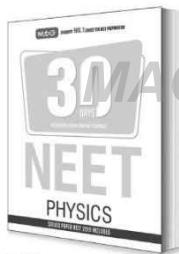
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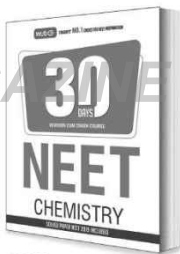
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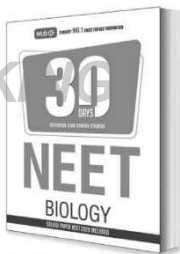
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10. Cavity into which the head of longest and strongest bone of human body fits is
 (a) glenoid
 (b) clavicular notch
 (c) obturator foramen
 (d) acetabulum.
11. Read the given differences between plant and animal mitosis and select the correct option.

	Plant mitosis	Animal mitosis
(i)	The cell do not change shape prior to division.	The cell often becomes spherical prior to division.
(ii)	Cell plate grows centripetally.	Cleavage proceeds centrifugally.
(iii)	Microfilaments do not have much role in cytokinesis.	Microfilaments bring about cleavage.
(iv)	Spindle is anastral.	Spindle is astral.

- (a) (ii) and (iii) are correct.
 (b) (i), (ii) and (iv) are correct.
 (c) Only (ii) is incorrect.
 (d) Only (iii) is incorrect.
12. Proteinoids are described as
 (a) organic macromolecules surrounded by film of water
 (b) simple organic compounds formed in Miller's experiment
 (c) inorganic compounds present in hot dilute soup
 (d) thermal polymers of amino acids.
13. Name the scientist who proposed that an organism repeats its arcestral history during its development.
 (a) Von Baer
 (b) Ernst Haeckel
 (c) Charles Darwin
 (d) Lamarck
14. Which of the following statements is incorrect?
 (a) 70S ribosomes are found in prokaryotes and eukaryotes.
 (b) Free ribosomes synthesise structural and enzymatic proteins.
 (c) 80S ribosomes are synthesised in the cytoplasm.
 (d) Ribosomes provide enzyme peptidyl transferase.
15. Match the following and select the correct option.

Column I

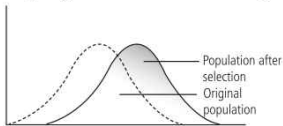
- A. Forelimb
 B. Skull
 C. Sternum
 D. Hindlimb

Column II

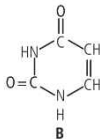
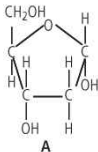
- (i) Palatine bone
 (ii) Calcaneum
 (iii) Capitate bone
 (iv) Manubrium

- (a) A-(ii), B-(iii), C-(iv), D-(i)
 (b) A-(iii), B-(i), C-(iv), D-(ii)
 (c) A-(iv), B-(ii), C-(i), D-(iii)
 (d) A-(iii), B-(iv), C-(ii), D-(i)

16. Which period was dominated by plants with naked seeds?
 (a) Carboniferous period
 (b) Triassic period
 (c) Cenozoic period
 (d) Mesozoic period
17. Which of the following is a sign of parturition?
 (a) Fully swollen vulva
 (b) Mucus discharge
 (c) Bloated abdomen
 (d) All of these
18. Identify the type of natural selection shown in the given graph.



- (a) Balancing selection
 (b) Progressive selection
 (c) Disruptive selection
 (d) Diversifying selection
19. Identify the pair of vertebrochondral ribs.
 (a) 8th and 9th (b) 7th and 8th
 (c) 11th and 12th (d) 10th and 11th
20. Which organism possesses mammary glands but lays eggs?
 (a) *Tachyglossus* (b) *Peripatus*
 (c) *Neoplina* (d) *Protopterus*
21. Which is correctly identified along with its feature?



- (a) A - macromolecule present in cell membrane
 (b) B - component of nucleic acid in retrovirus
 (c) A - component of principal energy carrier
 (d) B - phosphoric acid esters of nucleosides.

22. Select the correct statement.
- During dilation, the cervix gradually forces open to a diameter of approximately 5 cm.
 - Expulsion causes the baby to emerge out.
 - The umbilical vessels and placenta become non-functional before the delivery of baby.
 - None of these
23. Identify the meiotic stage in which a nucleolus is formed by the satellite chromosome followed by the appearance of nucleoplasm and nuclear envelope.
- Telophase I
 - Metaphase II
 - Anaphase I
 - Anaphase II
24. Which among the following is considered as true man in human evolution?
- Neanderthal man
 - Java ape man
 - Peking man
 - Heidelberg man
25. Storage proteins are
- ovalbumin, ferritin and keratin
 - glutelin, casein and collagen
 - casein, glutelin and ferritin
 - elastin, ferritin and casein.
26. A species developed in adjacent geographical area with no specific extrinsic barrier but does not mate randomly is
- allopatric
 - sympatric
 - parapatric
 - monotypic.
27. Select the incorrect match.
- Aromatic amino acids – Phenylalanine and tryptophan
 - Acidic amino acids – Glutamic acid and asparagine
 - Neutral amino acids – Alanine and lysine
 - Heterocyclic amino acids – Histidine and proline
28. Which of the following enzymes is/are added to partially pre-digest baby foods?
- Amylase and trypsin
 - Sucrase and amylase
 - Amylase only
 - Trypsin only
29. Projection in temporal bone of human skull is
- odontoid process
 - mastoid process
 - coracoid process
 - olecranon process.
30. Mitotic poison(s) is/are
- chalone
 - colchicine
 - cyanide
 - all of these.

ANSWER KEY

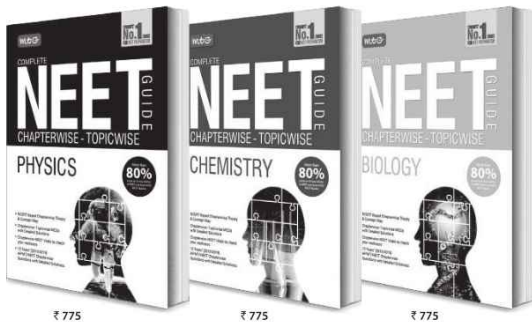
1. (c) 2. (a) 3. (b) 4. (b) 5. (c)
 6. (a) 7. (a) 8. (b) 9. (c) 10. (d)
 11. (c) 12. (d) 13. (b) 14. (c) 15. (b)
 16. (d) 17. (d) 18. (b) 19. (a) 20. (a)
 21. (b) 22. (b) 23. (a) 24. (a) 25. (c)
 26. (c) 27. (e) 28. (d) 29. (b) 30. (d)

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