

**NEET II 2016
SOLVED BIOLOGY PAPER**

1. A non-proteinaceous enzyme is

- | | |
|------------------------|---------------|
| (1) ribozyme. | (2) ligase. |
| (3) deoxyribonuclease. | (4) lysozyme. |

Solution:

In living cells, most catalysts are protein molecules called enzymes which catalyze numerous biochemical reactions occurring in a cell. Some can also be nucleic acids that behave like enzymes such as ribozymes. They are species of RNA molecules having enzymatic activity. For example, ribosomal RNA that catalyzes the formation of peptide bonds between amino acids during protein synthesis.

Hence, the correct option is (1).

2. Select the **mismatch**.

- (1) Large central vacuoles—Animal cells
- (2) Protists—Eukaryotes
- (3) Methanogens—Prokaryotes
- (4) Gas vacuoles—Green bacteria

Solution:

Vacuoles are membrane-bound organelles in all fungal and plant cells. Plant cell vacuoles are cellular organelles bound by membranes containing an aqueous solution. The solution contains carbohydrates and proteins. Adult cells are mostly occupied by large central vacuole while young plant cells are filled with many small vacuoles. The vacuoles occupy about 90% of the plant cell

Hence the correct answer is (1).

3. Select the **wrong** statement.

- (1) Pili and fimbriae are mainly involved in motility of bacterial cells.
- (2) Cyanobacteria lack flagellated cells.
- (3) *Mycoplasma* is a wall-less microorganism.
- (4) Bacterial cell wall is made up of peptidoglycan.

Solution:

Pili are elongated hollow projections. They are essentially used as external appendages for attachment to surfaces rather than movement. Bacteria can have two kinds of pili:

- (a) Long conjugation pili or F pili: Some groups of bacteria engage in a process called conjugation which involves transfer of genetic material from one bacterial cell to the other, and hence is called sex pili.
- (b) Short attachment pili, or fimbriae: These bristle-like protein projections enable the bacteria to stick to each other, or any stable surfaces (e.g., rocks in streams) or to host cells.

Hence, the correct answer is (1).

4. A cell organelle containing hydrolytic enzymes is

- | | |
|----------------|---------------|
| (1) microsome. | (2) ribosome. |
| (3) mesosome. | (4) lysosome. |

Solution:

Being the waste disposal system of a cell, understandably, the lysosome consists of at least 50 different hydrolytic enzymes which are active at a low pH and are thus called acid hydrolases.

Hence, the correct answer is (4).

5. During cell growth, DNA synthesis takes place in
- (1) G₁ phase.
 - (2) G₂ phase.
 - (3) M phase.
 - (4) S phase.

Solution:

During the S stage of interphase, the DNA of the cell is replicated in the nucleus in preparation for cell division and its amount doubles. The chromosome number, however, remains the same. The cell synthesizes the additional histones that will be needed as the cell doubles the number of nucleosomes (-repeating subunits of DNA and histones) in its chromosomes. The centriole present in the cytoplasm also duplicates. By the end of S phase chromosome changes from monad (single-stranded) form to dyad (double-stranded) form.

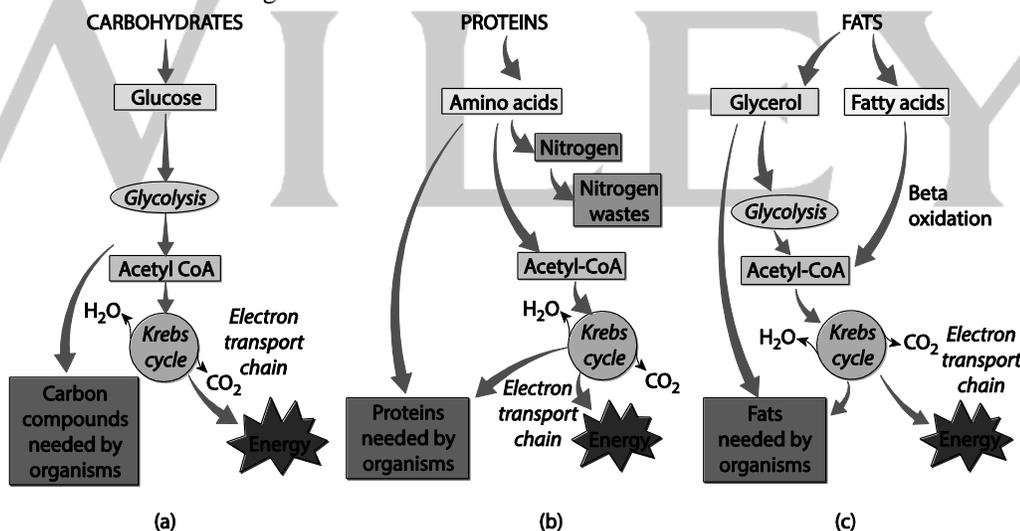
Hence, the correct answer is (4).

6. Which of the following biomolecules is common to respiration-mediated breakdown of fats, carbohydrates and proteins?

- (1) Fructose 1,6-bisphosphate
- (2) Pyruvic acid
- (3) Acetyl CoA
- (4) Glucose-6-phosphate

Solution:

Acetyl CoA is the first common intermediate respiration mediated breakdown of carbohydrate, fat and protein metabolism as shown in figure below.



Hence, the correct answer is (3).

7. A few drops of sap were collected by cutting across a plant stem by a suitable method. The sap was tested chemically. Which one of the following test results indicates that it is phloem sap?

- (1) Alkaline
- (2) Low refractive index
- (3) Absence of sugar
- (4) Acidic

Solution:

Phloem sap consists of water, sucrose, other sugars, hormones, amino acids, etc. It is alkaline in nature with pH ranging from 8.0 to 8.4. Xylem sap is acidic in nature.

Hence, the correct answer is (1).

8. You are given a tissue with its potential for differentiation in an artificial culture. Which of the following pairs of hormones would you add to the medium to secure shoots as well as roots?

- (1) Auxin and cytokinin
- (2) Auxin and abscisic acid
- (3) Gibberellin and abscisic acid
- (4) IAA and gibberellin

Solution:

Cytokinins promote cell division in tissue culture provided auxins are present. They have a direct role in regulating progression through the cell cycle. Both auxin and cytokinin should be proportionate in order to allow shoot and root development. If both these PGRs are present in roughly equal concentrations, callus or undifferentiated tissue will be formed. If auxin is higher than cytokinin, then roots will form while if cytokinin is higher than auxin, shoots will form.

Hence, the correct answer is (1)

9. Phytochrome is a

- (1) glycoprotein.
- (2) lipoprotein.
- (3) chromoprotein.
- (4) flavoprotein.

Solution:

Phytochrome comprises a family of receptors that mediate red and far-red light responses in plants. Chemically, it is a chromoprotein. The chromophore consists of a linear tetrapyrrole as in phycocyanin. Phytochrome pigment plays an important role in each stage of plant development. They regulate dormancy, seed germination, photomorphogenesis and photoperiodism in plants. It exists in two forms:

- (a) Pr, a red light-absorbing form.
- (b) Pfr, a far-red light absorbing form.

Hence, the correct answer is (3)

10. Which is essential for the growth of root tip?

- (1) Fe
- (2) Ca
- (3) Mn
- (4) Zn

Solution:

Calcium is important in cell division for two reasons. It plays a role in the mitotic spindle formation during cell division and it forms calcium pectates in the middle lamella of the cell plate that forms between daughter cells. In solution cultures, calcium deficiency results in poor root growth. The roots become discolored and may become gelatinous because of the deterioration of the middle lamella.

Hence, the correct answer is (2).

11. The process which makes major difference between C_3 and C_4 plants is

- (1) Calvin cycle.
- (2) photorespiration.
- (3) respiration.
- (4) glycolysis.

Solution:

Under high light intensity and high temperature (30–40°C), C_4 plants show 2–3 times higher rate of photosynthesis than C_3 plants. At high temperatures in C_3 plants, the rate of photosynthesis decreases more rapidly as compared to photorespiration. In C_4 plants, because of absence of or suppressed photorespiration and stability of C_4 pathway enzymes, photosynthesis continues to occur at the same pace even if temperature is high. High light intensity does not saturate a C_4 plant as it does to a C_3 plant.

Hence, the correct answer is (2).

12. Which one of the following statements is **not** correct?

- (1) Microscopic, motile asexual reproductive structures are called zoospores.
- (2) In potato, banana and ginger, the plantlets arise from the *internodes* present in the modified stem.
- (3) Water hyacinth, growing in the standing water, drains oxygen from water that leads to the death of fishes.
- (4) Offspring produced by the asexual reproduction are called clone.

Solution:

Potato, banana and ginger have tubers as their modified underground stems. Tubers are underground modifications of stem. The underground branches are round or oval in shape. Since the branch growth is retarded so food accumulates and the tips become swollen. They do not bear adventitious roots. Each tuber has many spirally arranged depressions called eyes. Each eye represents a node which has scale leaf in the form of a ridge and a bud is present in the depression. These axillary buds grow into new plants under favorable conditions. A piece of a tuber with at least one eye can be used for vegetative propagation.

Hence, the correct answer is (2).

13. Which one of the following generates new genetic combinations leading to variation?

- (1) Parthenogenesis
- (2) Sexual reproduction
- (3) Nucellar polyembryony
- (4) Vegetative reproduction

Solution:

Asexually produced generation does not have any variations and are true to type of that parent. Sexually reproducing organisms exhibit genetic variability that helps them tide over unfavourable conditions.

Hence, the correct answer is (2).

14. Match Column I with Column II and select the **correct** option using the codes given below:

Column I	Column II
(a) Pistils fused	(i) Gametogenesis together
(b) Formation of	(ii) Pistillate gametes
(c) Hyphae of higher	(iii) Syncarpous Ascomycetes
(d) Unisexual female	(iv) Dikaryotic flower

Codes:

- | | | | |
|-----------|-------|------|-------|
| (a) | (b) | (c) | (d) |
| (1) (ii) | (i) | (iv) | (iii) |
| (2) (i) | (ii) | (iv) | (iii) |
| (3) (iii) | (i) | (iv) | (ii) |
| (4) (iv) | (iii) | (i) | (ii) |

Solution:

- In syncarpous condition, the carpels of the gynoecium must fuse, while the carpels of style and stigma are free.
- Formation of spores is the first phase of gametogenesis while formation of gametophyte containing the gametes is the second phase.
- Unisexual female flowers are called pistillate and unisexual male flowers are called staminate.
- Hyphae of higher ascomycetes are dikaryotic.

Hence, the correct answer is (3).

15. In majority of angiosperms

- (1) there are numerous antipodal cells.
- (2) reduction division occurs in the megaspore mother cells.

20. The equivalent of a structural gene is

- | | |
|--------------|-------------|
| (1) cistron. | (2) operon. |
| (3) recon. | (4) muton. |

Solution:

Cistron is a segment of DNA consisting of some base sequences that code for one polypeptide chain, one transfer RNA, ribosomal RNA molecule or performs any other specific function in connection with transcription. It also controls the functioning of other cistrons.

Hence, the correct answer is (1)

21. A true breeding plant is

- (1) produced due to cross-pollination among unrelated plants.
- (2) near homozygous and produces offspring of its own kind.
- (3) always homozygous recessive in its genetic constitution.
- (4) one that is able to breed on its own.

Solution:

A true-breeding plant is one which gives rise to the same kind of offspring on self-pollination for any number of generations. As the garden pea plant undergoes self-fertilization, the individual pea strains became highly inbred, showing little genetic variation from one generation to another. Such strains are called true-breeding.

Hence, the correct answer is (2).

22. Which of the following rRNAs acts as structural RNA as well as ribozyme in bacteria?

- | | |
|----------------|---------------|
| (1) 18 S rRNA | (2) 23 S rRNA |
| (3) 5.8 S rRNA | (4) 5 S rRNA |

Solution:

The larger ribosomal subunit consists of ribozyme that catalyzes the formation of peptide bond.

- In prokaryotes, 23S rRNA is the enzyme ribozyme.
- In eukaryotes, 28S rRNA is the enzyme ribozyme.

Hence, the correct answer is (2).

23. Stirred-tank bioreactors have been designed for

- (1) addition of preservatives to the product.
- (2) availability of oxygen throughout the process.
- (3) ensuring anaerobic conditions in the culture vessel.
- (4) purification of product.

Solution:

Stirred-tank bioreactors are the most commonly used bioreactors. It consists of a vessel with a vertical rotating shaft with agitator blades. The design of agitator blades is also crucial for proper mixing and oxygen transfer. The Stirred tank reactor's offer excellent mixing and reasonably good mass transfer rates.

Hence, the correct answer is (2).

24. A foreign DNA and plasmid cut by the same restriction endonuclease can be joined to form a recombinant plasmid using

- | | |
|----------------------------|---------------------|
| (1) <i>Taq</i> polymerase. | (2) polymerase III. |
| (3) ligase. | (4) <i>Eco</i> RI. |

Solution:

In the process, the antibiotic resistance gene from the plasmid is removed by cutting it at specific locations using molecular scissors or a restriction endonuclease (an enzyme that cuts DNA at specific nucleotide sequences). A particular restriction endonuclease always produces the same complementary ends. These DNA segments are then incorporated into a vector by an enzyme called DNA ligase, which joins the ends of nucleotide chains. Thus, the vector contains the entire original DNA plus a new segment of DNA with antibiotic resistance.

Hence, the correct answer is (3).

25. Which of the following is not a component of downstream processing?

- | | |
|------------------|------------------|
| (1) Purification | (2) Preservation |
| (3) Expression | (4) Separation |

Solution:

Downstream processing (DSP) refers to the recovery and purification of products that are produced by fermentation or other industrial processes. The steps in DSP are:

- Separation of particles: The cells are generally separated from the medium by filtration, centrifugation and flocculation.
- Disintegration of cells: The disintegration of cells is required to release the product present in the cell. It can be done using mechanical cell disruption, drying and lysis.
- Extraction: It is the process by which the desired compounds are extracted into the solvent phase from a mixture. It takes place by liquid-liquid extraction, whole broth extraction and aqueous multi-phase extraction.
- Concentration: The extracted product is concentrated by evaporation, membrane filtration and resins.
- Purification: The concentrated product is then purified so that a highly pure product can be obtained. It is done by chromatographic methods or by crystallization.
- Drying: The purified products are then dried and preserved.

Hence, the correct answer is (3).

26. Which of the following restriction enzymes produces blunt ends?

- | | |
|-------------------|------------------|
| (1) <i>Eco</i> RV | (2) <i>Xho</i> |
| (3) Hind III | (4) <i>Sal</i> I |

Solution:

Two types of ends result from cuts made by restriction enzymes:

- Blunt or flush end: A simple double stranded cut is made in the middle of the recognition sequence. For example, *Pvu*II and *Alu*I
 - Recognition and cutting site for *Eco* RV
 - GAT – ATC
 - CTA –TAG
- Sticky or cohesive end: The two DNA strands are not cut at the same position but the cleavage is staggered by two or four nucleotides leading to formation of short single-stranded overhangs at each end. For example, *Eco* RI, *Xho*I, *Sal* I and Hind III.

Hence, the correct answer is (1).

27. Which kind of therapy was given in 1990 to a four-year-old girl with adenosine deaminase (ADA) deficiency?

- | | |
|-----------------------|-------------------|
| (1) Chemotherapy | (2) Immunotherapy |
| (3) Radiation therapy | (4) Gene therapy |

Solution:

The first clinical gene therapy was given in 1990 to a four-year old girl Ashanthi DeSilva who was suffering from the rare genetic disorder adenosine deaminase-deficient severe combined immunodeficiency disease (ADA-SCID). By removing some blood cells and infecting them with a

weakened retrovirus spliced with a copy of the gene that controlled ADA production, the re-injected cells would theoretically carry the gene to the DNA of neighboring cells and hence the production of ADA would occur naturally.

Hence, the correct answer is (4)

28. How many hot spots of biodiversity in the world have been identified till date by Norman Myers?

- | | |
|--------|--------|
| (1) 25 | (2) 34 |
| (3) 43 | (4) 17 |

Solution:

A biodiversity hotspot is a biogeographic region that is both a significant reservoir of biodiversity and is threatened with destruction. The term biodiversity hotspot was coined by Dr. Norman Myers in 1988 who defined two criteria for an area to qualify as a biodiversity hotspot.

- (i) It must contain at least 0.5% or 1,500 endemic species (species confined to that region).
- (ii) It should have lost at least 70% of its primary vegetation.

A total of 34 biodiversity hotspots have been identified.

Hence, the correct answer is (2)

29. The primary producers of the deep-sea, hydrothermal vent ecosystem are

- | | |
|------------------------------|-----------------------|
| (1) chemosynthetic bacteria. | (2) blue-green algae. |
| (3) coral reefs. | (4) green algae. |

Solution:

Volcanic activity causes hydrothermal vents in deep marine waters. The water is heated to around 400°C and is rich in sulphides. These vents are able to sustain vast amounts of life because vent organisms depend on chemosynthetic bacteria for food. The water from the hydrothermal vent is rich in dissolved minerals and supports a large population of chemoautotrophic bacteria. The chemosynthetic bacteria grow into a thick mat which attracts other organisms that graze upon the bacteria directly.

Hence, the correct answer is (1)

30. Which of the following is **correct** for *r*-selected species?

- (1) Large number of progeny with large size.
- (2) Small number of progeny with small size.
- (3) Small number of progeny with large size.
- (4) Large number of progeny with small size.

Solution:

The production of number of small offspring trailed by the exponential population growth is the significant characteristic of all *r*-selected species. They need very short gestation periods, they mature quickly as they practically require little or no parental care at all and have very short life spans. Unlike *k*-selected species, members of this group are capable of reproduction at a relatively young age; however, many offspring die before they even reach their reproductive age.

Hence, the correct answer is (4)

31. If '+' sign is assigned to beneficial interaction, '-' sign to detrimental and '0' sign to neutral interaction, then the population interaction represented by '+' '-' refers to

- | | |
|-----------------|-------------------|
| (1) amensalism. | (2) commensalism. |
| (3) parasitism. | (4) mutualism. |

Solution:

Parasitism is an association in which one (parasite) is living at the expense of the other (host). Parasite derives its nourishment from its host, which is an organism that is harmed or at least loses its energy or

materials in the process. During the intimate relationship between parasite and host, the parasite derives nourishment and benefits from the relationship; the host is harmed.

Hence, the correct answer is (3).

32. Which of the following is **correctly** matched?

- (1) Age pyramid—Biome
- (2) *Parthenium hysterophorus*—Threat to biodiversity
- (3) Stratification—Population
- (4) Aerenchyma— *Opuntia*

Solution:

Parthenium weed (*Parthenium hysterophorus*) is an invasive alien species whose mode of introduction is uncertain, although it was first recorded in Ethiopia in 1968. Since then it has been colonizing disturbed sites very aggressively, impacting pastures, croplands and forests by outcompeting native species and has become a major threat to the natural environment.

Hence, the correct answer is (2).

33. Red list contains data or information on

- (1) plants whose products are in international trade.
- (2) threatened species.
- (3) marine vertebrates only.
- (4) all economically important plants.

Solution:

Founded in 1948, IUCN or World Conservation Union (WCU) encourages the preservation of natural environment and wildlife. The IUCN Red List or Red Data List, was created in 1963. The red data book of IUCN lists those species of plants and animals that are critically endangered and under the threat of extinction.

Hence, the correct answer is (2).

34. Which one of the following is **wrong** for fungi?

- (1) All fungi possess a purely cellulosic cell wall.
- (2) They are heterotrophic.
- (3) They are both unicellular and multicellular.
- (4) They are eukaryotic.

Solution:

Fungi are eukaryotic. They can be unicellular or multicellular. They exhibit heterotrophic mode of nutrition. The cell walls of a few fungi contain cellulose, but those of most of the fungi contain the polysaccharide chitin. Chitin is also found in the exoskeletons of arthropods.

Hence, the correct answer is (4).

35. Methanogens belong to

- (1) archaeobacteria.
- (2) dinoflagellates.
- (3) slime moulds.
- (4) eubacteria.

Solution:

Based on physiological characteristics, three major groups of archaeobacteria are commonly recognized: methanogens, extreme halophiles and extreme thermophiles. Methanogens bacteria produce methane, or marsh gas, by reducing carbon-containing compounds to the gas methane. Hence, they are called so.

Hence, the correct answer is (1).

36. Select the **wrong** statement.

- (1) Diatomaceous earth is formed by the cell walls of diatoms.
- (2) Diatoms are chief producers in the oceans.
- (3) Diatoms are microscopic and float passively in water
- (4) The walls of diatoms are easily destructible.

Solution:

Diatoms are unicellular and have two overlapping cell walls and look like fancy microscopic glass boxes of various shapes with shells composed of silica known as frustule. It is indestructible. They are the chief producers in oceans as they contain chlorophyll *a* and *c* for photosynthesis. Fossil deposits of diatoms are known as diatomaceous earth. They are free floating on water.

Hence, the correct answer is (4).

37. The label of a herbarium sheet **does not** carry information on

- (1) name of collector.
- (2) local names.
- (3) height of the plant.
- (4) date of collection.

Solution:

A herbarium is a collection of pressed, dried and preserved plants mounted on paper sheets properly labeled, systematically arranged and available for reference study. Herbarium is used for identification, education and training, research and preserving specimens. The label of herbarium sheet carries information about date and place of collection, local and botanical names, family and collector's name. Height of plant is not considered in herbarium sheet.

Hence, the correct answer is (3).

38. Conifers are adapted to tolerate extreme environmental conditions because of

- (1) superficial stomata.
- (2) thick cuticle.
- (3) presence of vessels.
- (4) broad hardy leaves.

Solution:

Conifers are dominant in temperate regions. The conifers remain evergreen throughout the year. Due to their xerophytic characteristics, conifers can survive in conditions of water scarcity arising from frozen soil in winters. They are adapted to tolerate extreme environmental condition because of thick cuticle, sunken stomata and needle like leaves.

Hence, the correct answer is (2).

39. Which one of the following statements is **wrong**?

- (1) Algin is obtained from red algae, and carrageenan from brown algae
- (2) Agar-agar is obtained from *Gelidium* and *Gracilaria*.
- (3) *Laminaria* and *Sargassum* are used as food.
- (4) Algae increase the level of dissolved oxygen in the immediate environment.

Solution:

Algin (phycocolloid) is obtained from the outer coating of brown algae. Carrageenan is obtained from the cell wall of red algae.

Hence, the correct answer is (1)

40. The term polyadelphous is related to

- (1) androecium.
- (2) corolla.
- (3) calyx.
- (4) gynoecium.

Solution:

Androecium or stamen is the male reproductive whorl. When the stamens are fused by their filaments and the anthers remain free, they are called adelphous. It is of three types:

- Monoadelphous: Stamens are united in one bunch or bundle through fusion of their filaments with anthers remaining free, e.g., China rose, *Athaea*.
- Diadelphous: Stamens are united in two bundles through fusion of their filaments with anthers remaining free, e.g., pea.
- Polyadelphous: Stamens are united in more than two bundles through fusion of their filaments with anthers remaining free, e.g., *Citrus*, *Bombax*, etc.

Hence, the correct answer is (1).

41. How many plants among *Indigofera*, *Sesbania*, *Salvia*, *Allium*, *Aloe*, mustard, groundnut, radish, gram and turnip have stamens with different lengths in their flowers?

- | | |
|----------|-----------|
| (1) Four | (2) Five |
| (3) Six | (4) Three |

Solution:

Generally, the filaments are of equal length. However, in some species, they may be different. Based on difference in length of filaments, the stamens can be of following types:

- Tetradynamous: Out of six stamens, the inner four are long and inserted into the inner whorl; while the outer two are short, and inserted into the outer whorl. For example, plants of family Brassicaceae such as mustard, turnip, radish.
- Didynamous: Out of the four stamens, two are long while two are short. For example, *Ocimum*, *Salvia*.

Hence, the correct answer is (1).

42. Radial symmetry is found in the flowers of

- | | |
|------------------------|-----------------------|
| (1) <i>Trifolium</i> . | (2) <i>Pisum</i> . |
| (3) <i>Cassia</i> . | (4) <i>Brassica</i> . |

Solution:

Actinomorphic flowers exhibit radial symmetry. It can be cut into two equal radial halves in any radial plane that passes through the centre. It is also known as a regular flower. For example, *Brassica*, *Datura*, *Solanum*, China rose, etc. *Cassia*, *Trifolium* and *Pisum* have zygomorphic flowers that exhibit bilateral symmetry.

Hence, the correct answer is (4).

43. Free-central placentation is found in

- | | |
|-----------------------|-----------------------|
| (1) <i>Argemone</i> . | (2) <i>Brassica</i> . |
| (3) <i>Citrus</i> . | (4) <i>Dianthus</i> . |

Solution:

In free central type of placentation, the central axis bears ovules and the septa are absent. The ovary is unilocular with ovules present on the central axis. For example, *Dianthus*, *Stellaria*, *Primrose*, etc.

Hence, the correct answer is (4).

44. Cortex is the region found between

- (1) pericycle and endodermis.
- (2) endodermis and pith.
- (3) endodermis and vascular bundle.
- (4) epidermis and stele.

Solution:

Cortex lies between epidermis or hypodermis and the endodermis. The inner tissues of the endodermal cells constitute the stele. The cells of cortex are usually parenchymatous with intercellular spaces. Large intercellular spaces are present as in aerenchyma. Chloroplast is also present in these cells in aerial parts.

Starch grains, oils, tannins and crystals of various types, resin ducts, oil ducts, laticiferous cells and laticiferous ducts are also found in cells of cortex. Its main functions are to help in storage, photosynthesis and protection. It assists in pumping the water to the inner part of plants in roots.

Hence, the correct answer is (4).

45. The balloon-shaped structures called tyloses

- (1) characterize the sapwood.
- (2) are extensions of xylem parenchyma cells into vessels.
- (3) are linked to the ascent of sap through xylem vessels.
- (4) originate in the lumen of vessels.

Solution:

Xylem element of many woody trees are blocked by bladder-like in growth of neighbouring parenchymatous cells and blocking the continuity of these conducting elements, such bladder-like in growths are called tyloses. Due to blocking, conducting elements become non-functional and surrounding parenchyma cell also dies which results in darkening of cell wall, therefore central core of non-functional wood appear dark. Such a modified and nonfunctional secondary xylem is called heartwood or duramen.

Hence, the correct answer is (2).

46. Match the stages of meiosis in Column I to their characteristic features in Column II and select the **correct** option using the codes given below:

Column I	Column II
(a) Pachytene	(i) Pairing of homologous chromosomes
(b) Metaphase I	(ii) Terminalization of chiasmata
(c) Diakinesis	(iii) Crossing-over takes place
(d) Zygotene	(iv) Chromosomes align at equatorial plate

Codes:

- | | | | |
|-----------|-------|-------|-----|
| (a) | (b) | (c) | (d) |
| (1) (i) | (iv) | (ii) | (i) |
| (2) (ii) | (iv) | (iii) | (i) |
| (3) (iv) | (iii) | (ii) | (i) |
| (4) (iii) | (iv) | (ii) | (i) |

Solution:

Zygotene is the second stage of prophase I and is also known as the synaptonemal stage. It is marked by the visible association of homologous chromosomes with one another. This process of chromosome pairing is called synapsis.

- During pachytene, the homologues are held closely together along their length by the synaptonemal complex. The DNA of sister chromatids is extended into parallel loops. These structures are called recombination nodules because they correspond to the sites where crossing over (exchange of genetic material) is taking place between non-sister chromatids of the homologous chromosomes.
- Diakinesis is the final stage of meiotic prophase I. The chiasmata terminalize, the meiotic spindle is assembled, the chromosomes become recompact and they are prepared for separation.
- The prophase I is followed by metaphase I. In this, the two homologous chromosomes of each bivalent are connected to the microtubules from opposite poles. The bivalent chromosomes get aligned on the equatorial plate.

Hence, the correct answer is (4).

47. Which hormones do stimulate the production of pancreatic juice and bicarbonate?

- (1) Gastrin and insulin
- (2) Cholecystokinin and secretin

- (3) Insulin and glucagon
- (4) Angiotensin and epinephrine

Solution:

Three types of enteroendocrine cells are found in the intestinal glands of the small intestine that secrete hormones into the bloodstream:

Cell	Hormone	Actions
S-cells	Secretin	Stimulates secretion of pancreatic juice and bile that are rich in.
K cells	Entergastrone or gastric inhibitory peptide (GIP)	Reduce peristalsis and stop secretion of gastric juices
CCK cells	Cholecystokinin (CCK) or pancreozymin	Stimulates secretion of pancreatic juice rich in digestive enzymes, causes ejection of bile from gall bladder and opening of sphincter of Oddi, induces satiety (feeling full to satisfaction).

Hence, the correct answer is (2).

48. The partial pressure of oxygen in the alveoli of the lungs is

- (1) more than that in the blood.
- (2) less than that in the blood.
- (3) less than that of carbon dioxide.
- (4) equal to that in the blood.

Solution:

Alveolar p_{O_2} must be higher than blood p_{O_2} for oxygen to diffuse from alveolar air into the blood. The rate of diffusion is faster when the difference between p_{O_2} in alveolar air and pulmonary capillary blood is larger; diffusion is slower when the difference is smaller. Normal p_{O_2} in alveoli is 104 mmHg and that in oxygenated blood is 95 mm Hg.

Hence, the correct answer is (1).

49. Choose the correct statement.

- (1) Meissner's corpuscles are thermo-receptors.
- (2) Photoreceptors in the human eye are depolarized during darkness and become hyperpolarized in response to the light stimulus.
- (3) Receptors do not produce graded potentials.
- (4) Nociceptors respond to changes in pressure.

Solution:

A photoreceptor, either a rod cell or a cone in shining light leads to membrane hyperpolarization. In the dark, the receptor is in a depolarized state, with membrane potential of roughly -40 mv. Further increase in the intensity of light cause the potential difference across the receptor membrane to become more negative (-65 mV).

- Sensory receptor is an afferent neuron and responds to a specific stimulus by producing a graded potential called a generator potential. If a generator potential reaches the threshold level of depolarization, it will trigger one or more nerve impulses in the sensory neuron.
- Nociceptors respond to painful stimuli resulting from physical or chemical damage to tissue.
- Meissner corpuscles or corpuscles of touch: They are touch receptors that are located in the dermal papillae of hairless skin.

Hence, the correct answer is (2).

50. Grave's disease is caused due to

- (1) hypersecretion of thyroid gland.
- (2) hyposecretion of adrenal gland.
- (3) hypersecretion of adrenal gland.
- (4) hyposecretion of thyroid gland.

Solution:

Graves' disease is an autoimmune disorder in which the person produces antibodies that mimic the action of thyroid-stimulating hormone (TSH). The antibodies continually stimulate the thyroid gland to grow and produce thyroid hormones. A primary sign is an enlarged thyroid, which may be two to three times its normal size. These patients often have a peculiar oedema behind the eyes, called exophthalmos, which causes protruding of eyes.

Hence, the correct answer is (1).

51. Name the ion responsible for unmasking of active sites for myosin for cross-bridge activity during muscle contraction.

- (1) Magnesium
- (2) Sodium
- (3) Potassium
- (4) Calcium

Solution:

In relaxed muscle, myosin is blocked from binding to actin because strands of tropomyosin cover the myosin-binding sites on actin. The tropomyosin strands in turn are held in place by troponin molecules. When calcium ions (Ca^{2+}) bind to troponin, it undergoes a change in shape. This change moves tropomyosin away from myosin-binding sites on actin and muscle contraction subsequently begins as myosin binds to actin.

Hence, the correct answer is (4).

52. Name the blood cells, whose reduction in number can cause clotting disorder, leading to excessive loss of blood from the body.

- (1) Leucocytes
- (2) Neutrophils
- (3) Thrombocytes
- (4) Erythrocytes

Solution:

Platelets or thrombocytes granules contain chemicals that, once released, promote blood clotting. Platelets help stop blood loss from damaged blood vessels (muscular tubes that carry blood) by forming a platelet plug. Different types of haemophilia are due to deficiencies of different blood clotting factors and exhibit varying degrees of severity, ranging from mild to severe bleeding tendencies.

Hence, the correct answer is (3).

53. Name a peptide hormone which acts mainly on hepatocytes, adipocytes and enhances cellular glucose uptake and utilization.

- (1) Glucagon
- (2) Secretion
- (3) Gastrin
- (4) Insulin

Solution:

High blood glucose (hyperglycemia) stimulates secretion of insulin by beta cells of the pancreatic islets. Insulin acts on various cells in the body to accelerate facilitated transport of glucose into cells; and to increase the rate of conversion of glucose into glycogen (glycogenesis); to increase uptake of amino acids by cells and to increase protein synthesis; to speed synthesis of fatty acids (lipogenesis); to slow the conversion of glycogen to glucose (glycogenolysis); and to slow the formation of glucose from lactic acid and amino acids (gluconeogenesis) liver cells and adipose tissue. It also reduces the rate of catabolism of proteins and hence can be considered as an anabolic hormone. As a result, blood glucose level falls.

Hence, the correct answer is (4).

54. Osteoporosis, an age-related disease of skeletal system, may occur due to

- (1) high concentration of Ca^{++} and Na^+ .
- (2) decreased level of estrogen.
- (3) accumulation of uric acid leading to inflammation of joints.
- (4) immune disorder affecting neuro-muscular junction leading to fatigue.

Solution:

Osteoporosis is literally a condition of porous bones. Older women suffer from osteoporosis more often than men for two reasons:

- Women's bones are less massive than men's bones.
- Production of estrogens in women declines dramatically at menopause, while production of the main androgen, testosterone, in older men wanes gradually and only slightly.

Hence, the correct answer is (2).

55. Serum differs from blood in

- (1) lacking albumins.
- (2) lacking clotting factors.
- (3) lacking antibodies.
- (4) lacking globulins.

Solution:

When the formed elements are removed from blood, a straw-coloured liquid called blood plasma is left. Blood plasma constitutes about 90–92% water and 6–8% proteins. The plasma devoid of clotting factors is known as serum. The straw coloured fluid left after clotting of blood is called serum. It is different from blood as it is without cells and fibrinogen. The serum cannot be coagulated as it lacks fibrinogen.

Hence, the correct answer is (2).

56. Lungs do not collapse between breaths and some air always remains in the lungs which can never be expelled because

- (1) there is a negative intrapleural pressure pulling at the lung walls.
- (2) there is a positive intrapleural pressure.
- (3) pressure in the lungs is higher than the atmospheric pressure.
- (4) there is a negative pressure in the lungs.

Solution:

Even after the expiratory reserve volume is expired, considerable air remains in the lungs because the sub-atmospheric intrapleural pressure keeps the alveoli slightly inflated, and some air also remains in the non-collapsible airways. This volume is called the residual volume. It amounts to about 1100 mL to 1200 mL.

Hence, the correct answer is (1).

57. The posterior pituitary gland is **not** a true endocrine gland because

- (1) it only stores and releases hormones.
- (2) it is under the regulation of hypo-thalamus.
- (3) it secretes enzymes.
- (4) it is provided with a duct.

Solution:

The posterior pituitary or neurohypophysis does not synthesize hormones, it does store and release two hormones and this secretion is known as pituitrin. It consists of axons and axon terminals of more than 10,000 hypothalamic neurosecretory cells.

Hence, the correct answer is (1).

58. The part of nephron involved in reabsorption of sodium is

- (1) proximal convoluted tubule.
- (2) Bowman's capsule.
- (3) descending limb of Henle's loop.
- (4) distal convoluted tubule.

Solution:

Epithelial cells all along the renal tubule and duct carry out reabsorption, but proximal convoluted tubule (PCT) cells make the largest contribution. Solutes that are reabsorbed by both active processes include glucose, amino acids, urea and ions such as Na^+ , K^+ , Ca^{2+} , Cl^- , HCO_3^- and HPO_4^{2-} . The nitrogenous wastes are absorbed by passive transport. The water is reabsorbed passively in the starting regions of the nephron.

Hence, the correct answer is (1).

59. Which of the following is releasing IUD?

- | | |
|-------------------|-----------------|
| (1) Multiload 375 | (2) Lippes loop |
| (3) Cu7 | (4) LNG-20 |

Solution:

The Intra uterine devices (IUDs) can be non-medicated such as Lippes loop, copper-releasing such as CuT, Cu7, Multiload 375 and hormone releasing such as Progestasert, LNG-20 (Levonorgestrel – 20 mg) which are used as contraceptive.

Hence, the correct answer is (4).

60. Which of the following is **incorrect** regarding vasectomy?

- (1) No sperm occurs in epididymis
- (2) Vasa deferentia is cut and tied
- (3) Irreversible sterility
- (4) No sperm occurs in seminal fluid

Solution:

In vasectomy, a portion of each vas deferens is removed. Although sperm production continues in the testes, sperm can no longer reach the exterior. The sperms degenerate and are destroyed by phagocytosis. Because the blood vessels are not cut, testosterone levels in the blood remain normal.

Hence, the correct answer is (1).

61. Embryo with more than 16 blastomeres formed due to *in vitro* fertilization is transferred into

- | | |
|---------------------|---------------|
| (1) fallopian tube. | (2) fimbriae. |
| (3) cervix. | (4) uterus. |

Solution:

The zygote having up to 8 blastomeres are implanted in the woman's fallopian tube by a process known as zygote intra fallopian transfer (ZIFT). If it has more than 8 blastomeres, it is transferred to the uterus by a process known as intra uterine transfer (IUT).

Hence, the correct answer is (4).

62. Which of the following depicts the **correct** pathway of transport of sperms?

- (1) Rete testis → Epididymis → Efferent ductules → Vas deferens
- (2) Rete testis → Vas deferens → Efferent ductules → Epididymis
- (3) Efferent ductules → Rete testis → Vas deferens → Epididymis
- (4) Rete testis → Efferent ductules → Epididymis → Vas deferens

Solution:

The straight tubules lead to a network of ducts in the testes called the rete testis (network). From the rete testis, sperms move into epididymis through vasa efferentia. They move into a series of coiled efferent

ducts in the epididymis that empty into a single tube called the ductus epididymis. Within the tail of the epididymis, the ductus epididymis becomes less convoluted, and its diameter increases. Beyond this point, the duct is known as the ductus deferens or vas deferens.

Hence, the correct answer is (4).

63. Match Column I with Column II and select the correct option using the codes given below :

Column I	Column II
(a) Mons pubis	(i) Embryo formation
(b) Antrum	(ii) Sperm
(c) Trophoctodem	(iii) Female external
(d) Nebenkern	(iv) Graafian follicle

Codes:

- | | | | |
|-----------|------|-------|------|
| (a) | (b) | (c) | (d) |
| (1) (iii) | (iv) | (i) | (ii) |
| (2) (iii) | (i) | (iv) | (ii) |
| (3) (i) | (iv) | (iii) | (ii) |
| (4) (iii) | (iv) | (ii) | (i) |

Solution:

- Anterior to the vaginal and urethral openings is the mons pubis.
- In secondary follicle there are small accumulations of fluid in intracellular spaces called follicular fluid. These generally coalesce to form an antrum or cavity and it transforms into a tertiary follicle.
- The trophoctodem is the outer covering of cells that eventually forms the placental interface between mother and offspring.
- The Nebenkern is a mitochondrial formation in the sperm cells.

Hence, the correct answer is (1).

64. Several hormones like hCG, hPL, estrogen, progesterone are produced by

- | | |
|----------------|---------------------|
| (1) placenta. | (2) fallopian tube. |
| (3) pituitary. | (4) ovary. |

Solution:

The placenta is an organ that develops in the mother's uterus during pregnancy. The principal hormones secreted by placenta are as follows:

- Human chorionic gonadotropin (hCG): Stimulates the corpus luteum in the ovary to continue the production of estrogens and progesterone to maintain pregnancy.
- Estrogens and progesterone: Maintain pregnancy and help prepare mammary glands to secrete milk.
- Human chorionic somatomammotropin (hCS): Hormone produced by the chorion of the placenta stimulates breast tissue for lactation, enhances body growth and regulates metabolism. It is also called human placental lactogen (hPL).
- Relaxin: Increases flexibility of pubic symphysis during pregnancy; helps dilate uterine cervix during labor and delivery.

Hence, the correct answer is (1).

65. If a colour-blind man marries a woman who is homozygous for normal colour vision, the probability of their son being colour-blind is

- | | |
|---------|----------|
| (1) 0.5 | (2) 0.75 |
| (3) 1 | (4) 0 |

Solution:

A cross between a colour-blind man (X^cY) and a woman who is homozygous for normal colour vision (XX) is:

	X^c	Y
X	X^cX	XY
X	X^cX	XY

Thus, probability of their son being colour blind = 0%

Hence, the correct answer is (4).

66. Genetic drift operates in

- (1) large isolated population.
- (2) non-reproductive population.
- (3) slow reproductive population.
- (4) small isolated population.

Solution:

Genetic drift refers to the alteration in the frequencies of alleles in the gene pool of a finite population due to chance events. It takes place in one or over a few generations. If the change in the allele frequencies is very drastic, then new species are formed. If a small population is separated from a large population and settles in a different location, results in a genetic drift.

Hence, the correct answer is (4).

67. In Hardy–Weinberg equation, the frequency of heterozygous individual is represented by

- (1) $2pq$
- (2) pq
- (3) q^2
- (4) p^2

Solution:

Hardy–Weinberg equation explains the basic principle of population genetics. It is an expression of Hardy–Weinberg equilibrium, which states that the amount of genetic variation in a population will remain constant from one generation to the next if the disturbing factors are absent. The binomial expansion of $(p + q)^2$ is

$$p^2 + 2pq + q^2 = 1$$

where p = frequency of the A allele in the population; q = frequency of the a allele in the population;
 p^2 = frequency of the homozygous genotype AA ; q^2 = frequency of the homozygous genotype aa and
 $2pq$ = frequency of the heterozygous genotype Aa .

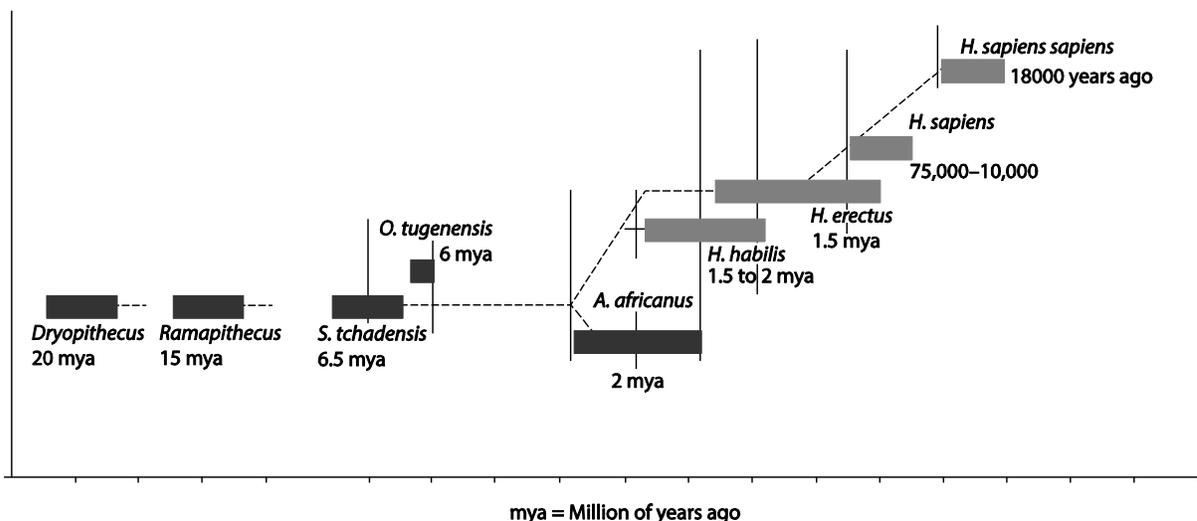
Hence, the correct answer is (1).

68. The chronological order of human evolution from early to the recent is

- (1) *Ramapithecus* → *Australopithecus* → *Homo habilis* → *Homo erectus*
- (2) *Ramapithecus* → *Homo habilis* → *Australopithecus* → *Homo erectus*
- (3) *Australopithecus* → *Homo habilis* → *Ramapithecus* → *Homo erectus*
- (4) *Australopithecus* → *Ramapithecus* → *Homo habilis* → *Homo erectus*

Solution:

The discovery of fossils and careful analysis helped in gathering information about the evolution of humans. These studies have been shown in figure given below:



Hence, the correct answer is (1).

69. Which of the following is the **correct** sequence of events in the origin of life?

- I. Formation of protobionts
- II. Synthesis of organic monomers
- III. Synthesis of organic polymers
- IV. Formation of DNA based genetic systems

- (1) I, III, II, IV
- (3) II, III, IV, I

- (2) II, III, I, IV
- (4) I, II, III, IV

Solution:

There are mainly four main stages that explain how life came from non-living things:

- The first step is the formation of small monomers of organic molecules – such as amino acids and nucleotides from inorganic compounds.
- The second step is joining of these small organic molecules called monomers to form larger molecules called polymers. For example, amino acids join to form proteins and nucleotides join to form RNA and DNA.
- The third step involves grouping of different polymers to form protobionts. The name protobionts means ‘early form of life,’ but they are basically small droplets with membranes that are able to maintain a stable internal environment.
- The fourth step is that these simple protobionts evolved to pass on genetic information

Hence, the correct answer is (2).

70. A molecule that can act as a genetic material must fulfill the traits given below, **except**

- (1) it should be able to generate its replica.
- (2) it should be unstable structurally and chemically.
- (3) it should provide the scope for slow changes that are required for evolution.
- (4) it should be able to express itself in the form of Mendelian characters.

Solution:

In order to act as genetic material, a molecule must fulfill the following conditions:

- Replication.
- Chemical and structural stability with age, stages of life cycle and changes in physiology.
- Should be able to undergo mutation to produce variations that allow organisms to adapt to modifications in the environment so that evolution can take place.
- Expression of the genetic message in the form of Mendelian characters.

Hence, the correct answer is (2).

71. DNA dependent RNA polymerase catalyses transcription on one strand of the DNA which is called the
- | | |
|--------------------|----------------------|
| (1) coding strand. | (2) alpha strand. |
| (3) antistrand. | (4) template strand. |

Solution:

The DNA dependent-RNA polymerase also catalyzes polymerization only in 5' → 3' direction. Template strand has polarity 3' → 5'. It serves as a template for RNA synthesis. The mRNA molecules are coding strands of RNA. They are also called sense strands of RNA because their nucleotide sequences make sense as they specify sequences of amino acids in the protein gene products.

Hence, the correct answer is (4).

72. Interspecific hybridization is the mating of
- (1) two different related species.
 - (2) superior males and females of different breeds.
 - (3) more closely related individuals within same breed for 4-6 generations.
 - (4) animals within same breed without having common ancestors.

Solution:

When the parents of two different species of the same genus are crossed to produce a hybrid, it is called interspecific hybridization. For example: sugarcane: *Saccharum officinarum* × *Saccharum barberi* and cotton: *Gossypium arboreum* × *Gossypium hirsutum*.

Hence, the correct answer is (1).

73. Which of the following is **correct** regarding AIDS causative agent HIV?
- (1) HIV is enveloped virus that contains two identical molecules of single-stranded RNA and two molecules of reverse transcriptase
 - (2) HIV is unenveloped retrovirus.
 - (3) HIV does not escape but attacks the acquired immune response.
 - (4) HIV is enveloped virus containing one molecule of single-stranded RNA and one molecule of reverse transcriptase.

Solution:

HIV is classified as a retrovirus since its genetic information is carried in RNA instead of DNA. It consists of an inner core of two identical single stranded RNA and two molecules of reverse transcriptase covered by a protein coat (capsid). An envelope composed of a lipid bilayer that is penetrated by glycoproteins surrounds the HIV capsid.

Hence, the correct answer is (1).

74. Among the following edible fishes, which one is a marine fish having rich source of omega-3 fatty acids?
- | | |
|--------------|-------------|
| (1) Mangur | (2) Mrigala |
| (3) Mackerel | (4) Mystus |

Solution:

Marine fisheries refer to the organisms found in seas or oceans. Some marine edible fishes are *Hilsa ilisa* (Hilsa), *Anguilla* (Eel), *Harodon* (Bombay duck), *Stromateus* (Pomphret), *Sardinella* (Salmon), sardines, mackerels, etc.

Hence, the correct answer is (3).

75. Match Column I with Column II and select the **correct** option using the codes given below:

Column I	Column II
----------	-----------

(a) Citric acid	(i) <i>Trichoderma</i>
(b) Cyclosporin A	(ii) <i>Clostridium</i>
(c) Statins	(iii) <i>Aspergillus</i>
(d) Butyric acid	(iv) <i>Monascus</i>

Codes:

- | | | | |
|-----------|------|------|-------|
| (a) | (b) | (c) | (d) |
| (1) (iii) | (i) | (iv) | (ii) |
| (2) (i) | (iv) | (ii) | (iii) |
| (3) (iii) | (iv) | (i) | (ii) |
| (4) (iii) | (i) | (ii) | (iv) |

Solution:

- Citric acid is a weak organic acid commonly used to acidify and improve the flavour of foods. The mold *Aspergillus niger* makes citric acid when molasses is used as the fermentation substrate.
- Cyclosporin A is produced by the fungus *Trichoderma polysporum* and *Cylindrocarpon lucidum*. It is used as an immunosuppressive agent.
- Statins are produced by the yeast *Monascus purpureus*. They are used as agents that lower the blood-cholesterol.
- Butyric acid is found especially in milk of goat, sheep, buffalo and butter. Butyrate is produced as an end-product of a fermentation process solely generated by *Clostridium butyricum* and *C. kluyveri* and is used in the preparation of various butyrate esters.

Hence, the correct answer is (1).

76. Biochemical Oxygen Demand (BOD) may **not** be a good index for pollution for water bodies receiving effluents from
- | | |
|---------------------|-------------------------|
| (1) dairy industry. | (2) petroleum industry. |
| (3) sugar industry. | (4) domestic sewage. |

Solution:

Sewage discharged from petroleum industry is usually very high in organic pollutants which deplete the oxygen levels of water in which it is released. Hence, to prevent this, the biochemical oxygen demand (BOD) levels of sewage have to be brought within the acceptable range before it is discharged into the environment. BOD is the amount of oxygen that is required for biochemical decomposition of organic matter in one liter of water by bacteria.

Hence, the correct answer is (2).

77. The principle of competitive exclusion was stated by
- | | |
|-------------------------|----------------|
| (1) G. P. Cause. | (2) MacArthur. |
| (3) Verhulst and Pearl. | (4) C. Darwin. |

Solution:

About 70 years ago, the Russian scientist Georgii Frantsevich Gause formulated the competitive exclusion principle which states that if two species are competing with one another for the same limited resource in a specific location, the species which is able to use that resource most efficiently will eventually eliminate the competing species in that location.

Hence, the correct answer is (1).

78. Which of the following National Parks is home to the famous musk deer or hangul?
- (1) Bandhavgarh National Park, Madhya Pradesh
 - (2) Eaglenest Wildlife Sanctuary, Arunachal Pradesh
 - (3) Dachigam National Park, Jammu & Kashmir

(4) Keibul Lamjao National Park, Manipur

Solution:

Dachigam National Park is located close to Srinagar, Jammu and Kashmir. The park has been a protected area since 1910, first under the care of the Maharaja of Jammu and Kashmir and later under the observation of the concerned government authorities. The main animal species that Dachigam is most famous for is the hangul or musk deer, also known as the Kashmir stag.

Hence, the correct answer is (3).

79. A lake which is rich in organic waste may result in

- (1) drying of the lake due to algal bloom.
- (2) increased population of fish due to lots of nutrients.
- (3) mortality of fish due to lack of oxygen.
- (4) increased population of aquatic organisms due to minerals.

Solution:

The dissolved oxygen (DO) in water is used by the aquatic plant and animal life for breathing. Lake rich in organic waste leads to decrease in DO. The decay of dead organic matter in water bodies is also carried out by bacteria using dissolved oxygen. If there is enough bacterial activity, the oxygen in the water available to fish and other organisms can be reduced to levels so low that they may die.

Hence, the correct answer is (3).

80. The highest DDT concentration in aquatic food chain shall occur in

- (1) Seagull.
- (2) Crab.
- (3) Eel.
- (4) Phytoplankton.

Solution:

Seagull is a fish eating bird which is a tertiary consumer from all the given options. The polychlorinated biphenyls (PCBs) and other industrial pollutants, when discharged into the water bodies increase from a concentration of 0.000002 ppm in water to 4.83 ppm in fishes and 124 ppm in predator birds. In the same way, DDT, a chemical pesticide, accumulated from 0.000003 ppm in water to 25 ppm in birds of prey.

Water → Phytoplankton → Crab → Eel → Seagull
(0.000003 ppm) (0.04 ppm) (0.5 ppm) (2 ppm) (25 ppm)

Hence, the correct answer is (1).

81. Which of the following sets of diseases is caused by bacteria?

- (1) Typhoid and smallpox
- (2) Tetanus and mumps
- (3) Herpes and influenza
- (4) Cholera and tetanus

Solution:

Causative agent	Diseases
Bacterial	Tetanus (<i>Clostridium tetani</i>), Cholera (<i>Vibrio cholerae</i>), Typhoid (<i>Salmonella typhi</i>)
Viral	Influenza (Influenza virus), Mumps (Mumps virus), Smallpox (Variola virus), Herpes (Herpes simplex virus)

Hence, the correct answer is (4).

82. Match Column I with Column II for housefly classification and select the **correct** option using the codes given below:

Column I	Column II
(a) Family	(i) Diptera

(b) Order	(ii) Arthropoda
(c) Class	(iii) Muscidae
(d) Phylum	(iv) Insecta

Codes:

- | | | | |
|-----------|-------|------|-------|
| (a) | (b) | (c) | (d) |
| (1) (iii) | (ii) | (iv) | (i) |
| (2) (iv) | (iii) | (ii) | (i) |
| (3) (iv) | (ii) | (i) | (iii) |
| (4) (iii) | (i) | (iv) | (ii) |

Solution:

Following is the correct systemic position of housefly *Musca domestica*:

Phylum – Arthropoda
 Class – Insecta
 Order – Diptera
 Family – Muscidae
 Genus – *Musca*
 Species – *domestica*

Hence, the correct answer is (4).

83. Choose the **correct** statement.

- (1) All cyclostomes do not possess jaws and paired fins.
- (2) All reptiles have a three-chambered heart.
- (3) All pisces have gills covered by an operculum.
- (4) All mammals are viviparous.

Solution:

Cyclostomata gets its name from the round mouth of these jawless fishes. There are 6–15 pairs of gill slits. They have unpaired fins, cartilaginous endoskeleton, mesonephric kidneys, two chambered heart, 8–10 pairs of cranial nerves, e.g. lamprey and hagfish.

- In reptiles, the heart is three-chambered consisting of two atria and one incompletely divided ventricle. A partial partition called septum incompletely divides the ventricle.
- In bony fishes, a protective flap called operculum extends posteriorly from the head and protects the gills.
- Fertilization is internal in mammals. They are mostly viviparous. However, there are some exceptions that lay eggs with a leathery shell.

Hence, the correct answer is (4).

84. Study the four statements (A–D) given below and select the two **correct** ones out of them:

- (A) Definition of biological species was given by Ernst Mayr.
- (B) Photoperiod does not affect reproduction in plants
- (C) Binomial nomenclature system was given by R. H. Whittaker
- (D) In unicellular organisms, reproduction is synonymous with growth.

The two **correct** statements are

- | | |
|-------------|-------------|
| (1) C and D | (2) A and D |
| (3) A and B | (4) B and C |

Solution:

The credit for defining biological classification goes to Ernst Mayr (1942).

- In unicellular organisms like *Amoeba*, *Paramecium* and bacteria where cell division is a mode of reproduction, growth is synonymous with reproduction, as growth is permanent increase in number of cells (cell division) and amount of mass.

- The capacity of a plant to respond to the proportion of day/night in a 24-hour period is known as photoperiodism (light and duration). It plays an important role on other developmental processes such as leaf fall, dormancy, tuber development, etc., but its role in flowering and reproduction is the most crucial.
- Carolus Linnaeus, the Swedish botanist, established the system of binomial nomenclature in the mid-1700s.

Hence, the correct answer is (2).

85. In male cockroaches, sperms are stored in which part of the reproductive system?

- | | |
|---------------------|----------------------|
| (1) Mushroom glands | (2) Testes |
| (3) Vas deferens | (4) Seminal vesicles |

Solution:

In male cockroaches, mushroom-shaped gland or utricular gland is present in the 6th to 7th abdominal segments where both the vas deferens join, it functions as accessory reproductive gland. It consists of small and long tubules and seminal vesicles that store sperms that are glued together to form bundles called spermatophores which are released during copulation.

In male cockroaches, mushroom-shaped gland or utricular gland is present in the 6th to 7th abdominal segments where both the vas deferens join, it functions as accessory reproductive gland. It consists of small and long tubules and seminal vesicles that store sperms that are glued together to form bundles called spermatophores which are released during copulation.

Hence, the correct answer is (4).

86. Smooth muscles are

- (1) voluntary, multinucleate, cylindrical.
- (2) involuntary, cylindrical, striated.
- (3) voluntary, spindle-shaped, uninucleate.
- (4) involuntary, fusiform, non-striated.

Solution:

Smooth muscle fibre is a small spindle-shaped cell thickest in middle, tapering at each end (fusiform), and containing a single, centrally located nucleus. These fibres are under involuntary control, non-striated (hence the term smooth). Gap junctions connect many individual fibres in some smooth muscle tissues (e.g., in wall of intestines). The fibres are held together in connective tissue sheaths. They can produce powerful contractions as many muscle fibres contract in unison. They are present in airways to lungs, stomach, intestines, gall bladder, urinary bladder and uterus.

Hence, the correct answer is (4).

87. Oxidative phosphorylation is

- (1) oxidation of phosphate group in ATP.
- (2) addition of phosphate group to ATP.
- (3) formation of ATP by energy released from electrons, removed during substrate oxidation.
- (4) formation of ATP by transfer of phosphate group from a substrate to ADP.

Solution:

The oxidative phosphorylation involves synthesis of ATP driven by a proton gradient. It can also be defined as the ATP synthesis driven by energy release by electrons that are lost during substrate oxidation through a series of redox reactions that utilize the reducing power of NADH and FADH₂.

Hence, the correct answer is (3).

88. Which of the following is the least likely to be involved in stabilizing the three-dimensional folding of most proteins?

- (1) Electrostatic interaction

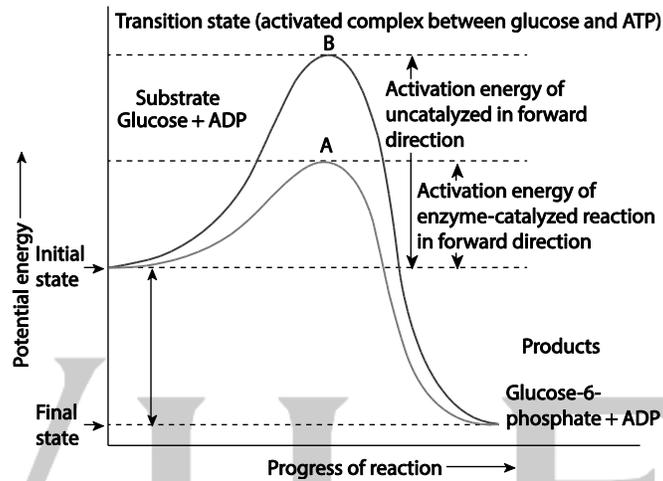
- (2) Hydrophobic interaction
- (3) Ester bonds
- (4) Hydrogen bonds

Solution:

The tertiary structure refers to the three-dimensional shape of a polypeptide chain including its side chains in which the chain is folded upon itself in form of a hollow sphere, rod or fibers. Several types of bonds can contribute to a protein's tertiary structure such as disulphide bridges, hydrogen bonds, ionic bonds and hydrophobic interactions. Ester bond (peptide bond) is required for the formation of primary structure.

Hence, the correct answer is (3).

89. Which of the following describes the given graph correctly?



- (1) Exothermic reaction with energy A in presence of enzyme and B in absence of enzyme
- (2) Endothermic reaction with energy A in absence of enzyme and B in presence of enzyme
- (3) Exothermic reaction with energy A in absence of enzyme and B in presence of enzyme
- (4) Endothermic reaction with energy A in presence of enzyme and B in absence of enzyme

Solution:

Graph shows the activation energies of catalyzed and uncatalyzed reactions demonstrated by the height of the curves. The y-axis shows the potential energy while the x-axis represents the course of reaction. A transition state is observed when the reactants are at the crest of the hump. At this state, they are ready to be converted to products. If the products are at a lower level (final state) than the reactants (initial state), the reaction is exothermic or spontaneous. In the reverse situation, it is endothermic and it requires energy.

Hence, the correct answer is (1).

90. When cell has stalled DNA replication fork which checkpoint should be predominantly activated?

- (1) G₂/M
- (2) M
- (3) G₂/M and M
- (4) G₁/S

Solution:

The transitions between different phases of the cycle (G₁, S, G₂ and M) are regulated at checkpoints. G₁ represents the time gap between the last cell division and the start of DNA replication. It is also known as first growth phase, post-mitotic phase and presynthetic phase. During the S stage of interphase, the DNA of the cell is replicated in the nucleus in preparation for cell division and its amount doubles.

Hence, the correct Answer is (4).