

Subject : BIOLOGY - Set B

Code : 304 E

Total Time Allowed : 45 minutes	Maximum Marks : 200	Total Questions : 50	Questions to be answered : 40
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Q1: The beetle used as a biocontrol agent for aphids and mosquitoes is:

1. *Trichoderma*
2. Dragonflies
3. Ladybird
4. Silver fish

Correct Answer: 3. Ladybird

Solution: Ladybirds, especially ladybird beetles, are effective biocontrol agents. They feed on aphids and other small pests, helping in pest management. This makes them a natural and eco-friendly alternative to chemical pesticides.

 Quick Tip

Ladybird beetles are famous biocontrol agents against aphids. Remember: "Ladybird for pest management."

Q2: Downstream processing method involves:

1. Identification
2. Amplification
3. Fermentation
4. Purification

Correct Answer: 4. Purification

Solution: Downstream processing refers to the steps in biotechnological processes that involve the recovery and purification of biosynthetic products, especially pharmaceuticals, from natural sources such as cells.

 Quick Tip

Downstream processing always ends with purification to ensure the product is in its final usable form.

Q3: Smack is chemically:

1. Diacetyl morphine
2. Cocaine
3. Benzodiazepine
4. Amphetamine

Correct Answer: 1. Diacetyl morphine

Solution: Smack is another name for heroin, which is chemically diacetyl morphine, a semi-synthetic opioid drug.

 Quick Tip

Diacetyl morphine is commonly called heroin and is categorized as an opioid.

Q4: Antibodies are secreted by:

1. T-Cells
2. B-Cells
3. α -Cells
4. β -Cells

Correct Answer: 2. B-Cells

Solution: B-cells, a type of white blood cell, are responsible for producing and secreting antibodies to fight infections.

 Quick Tip

Remember: B-cells = Antibodies, T-cells = Cell-mediated immunity.

Q5: In sewage treatment, flocs are:

1. The solids that settle during sedimentation.
2. The supernatant that is formed above the primary sludge.
3. The masses of bacteria associated with fungal filaments.
4. The bacteria which grow anaerobically and are also called anaerobic sludge digesters.

Correct Answer: 3. The masses of bacteria associated with fungal filaments.

Solution: In sewage treatment, flocs refer to the masses of bacteria and other microorganisms that grow together with fungal filaments, which help in the decomposition of organic matter.

 Quick Tip

Flocs are formed during secondary treatment and play a key role in breaking down organic matter.

Q6: Match List-I with List-II:

List-I (Products)	List-II (Organisms)
(A) Statin	(I) <i>Streptococcus</i>
(B) Clot buster	(II) <i>Trichoderma</i>
(C) Swiss cheese	(III) <i>Monascus</i>
(D) Cyclosporin-A	(IV) <i>Propionibacterium</i>

Choose the **correct answer** from the options given below:

1. (A) - (II), (B) - (I), (C) - (IV), (D) - (III)
2. (A) - (III), (B) - (I), (C) - (IV), (D) - (II)
3. (A) - (III), (B) - (IV), (C) - (I), (D) - (II)
4. (A) - (III), (B) - (I), (C) - (IV), (D) - (IV)

Correct Answer: 2. (A) - (III), (B) - (I), (C) - (IV), (D) - (II)

Solution:

Product	Organism/Explanation
(A) Statin	(III) <i>Monascus</i> - Lowers cholesterol.
(B) Clot buster	(I) <i>Streptococcus</i> - Produces enzymes (e.g., Streptokinase).
(C) Swiss cheese	(IV) <i>Propionibacterium</i> - Used in cheese fermentation.
(D) Cyclosporin-A	(II) <i>Trichoderma</i> - An immunosuppressant.

💡 Quick Tip

To remember: - Statin → *Monascus* (cholesterol control). - Clot buster → *Streptococcus* (streptokinase). - Swiss cheese → *Propionibacterium* (fermentation). - Cyclosporin-A → *Trichoderma* (antifungal, immunosuppressant).

Q7: Which of the following is **not** the correctly matched pair of organism and its respective cell wall degrading enzyme?

1. Fungi – Chitinase
2. Algae – Methylase
3. Plant cells – Cellulase
4. Bacteria – Lysozyme

Correct Answer: 2. Algae – Methylase

Solution: Methylase is not involved in degrading algal cell walls. Algal cell walls are typically degraded by cellulase or other specific enzymes. The other pairs are correctly matched:

- **Fungi:** Chitinase breaks down chitin in fungal cell walls.
- **Plant cells:** Cellulase degrades cellulose in plant cell walls.
- **Bacteria:** Lysozyme hydrolyzes peptidoglycan in bacterial cell walls.

💡 Quick Tip

- Fungi: Chitinase degrades chitin. - Bacteria: Lysozyme targets peptidoglycan.
- Plants: Cellulase works on cellulose. Methylase modifies nucleic acids, not cell walls.

Q8: Arrange the following steps involved in the transformation of bacteria in a sequence from initiation to end:

- (A) Incubation of rDNA with bacterial cell on ice

- (B) Treatment with divalent cations
 (C) Heat shock treatment
 (D) Selection on antibiotic-containing agar plate
 (E) Placed them again on ice

Options:

1. (A), (B), (D), (C), (E)
2. (B), (A), (C), (E), (D)
3. (B), (C), (D), (A), (E)
4. (A), (C), (B), (D), (E)

Correct Answer: 2. (B), (A), (C), (E), (D)

Solution:

Step	Explanation
(B) Treatment with divalent cations	Divalent cations (e.g., Ca^{2+}) make bacterial membranes permeable.
(A) Incubation of rDNA on ice	rDNA is mixed with bacterial cells for uptake.
(C) Heat shock treatment	Heat shock facilitates DNA entry into bacterial cells.
(E) Placed them again on ice	Stabilizes the membrane after heat shock.
(D) Selection on antibiotic plate	Identifies transformed cells with the desired trait.

💡 Quick Tip

The key sequence for bacterial transformation: Treat with divalent cations → Incubate → Heat shock → Ice stabilization → Selection.

Q9: Which of the following statements are **incorrect**?

- (A) Fragments of DNA can be separated by ELISA.
 (B) Transformation is a procedure through which a piece of DNA is introduced in a host bacterium.
 (C) Recombinant DNA technology does not involve isolation of a desired DNA fragment.
 (D) DNA ligases are used for stitching DNA fragments into a vector.

Options:

1. (A) and (C) only
2. (A) and (B) only
3. (B) and (C) only
4. (A), (C), and (D) only

Correct Answer: 1. (A) and (C) only

Solution:

- (A) is incorrect: ELISA is a technique used to detect antigens or antibodies, not for DNA fragment separation. DNA fragments are separated by techniques like gel electrophoresis.
- (C) is incorrect: Recombinant DNA technology does involve isolation of the desired DNA fragment as one of the initial steps.
- (B) and (D) are correct: Transformation introduces DNA into a host, and DNA ligases stitch DNA fragments into vectors.

 Quick Tip

- ELISA is for antigen/antibody detection, not DNA. - rDNA technology always includes isolation of the desired DNA fragment.

Q10: Which of the following statements are **true**?

- (A) Milk obtained from 'Rosie' is nutritionally more balanced for human babies than natural human milk.
 (B) Biopiracy refers to the use of bioresources without proper authorisation from MNCs.
 (C) GEAC is the decisive body for safety and validity of GMOs and GM research respectively.
 (D) Transgenic animals help us to understand the contribution of genes in the development of disease.

Options:

1. (A) and (C) only
2. (C) and (D) only
3. (B) and (C) only
4. (A), (B), and (C) only

Correct Answer: 2. (C) and (D) only

Solution:

- (A) is false: While 'Rosie' produces milk enriched with human proteins, it is not more balanced than natural human milk.
 - (B) is false: Biopiracy refers to the use of bioresources without proper authorisation, but it does not specifically involve MNCs.
 - (C) is true: GEAC (Genetic Engineering Appraisal Committee) is responsible for the safety and regulation of GMOs and GM research in India.
 - (D) is true: Transgenic animals are used to study genes and their role in diseases.

 Quick Tip

- GEAC handles GMO safety and research. - Transgenic animals are valuable for studying genes and diseases.

Q11: Match List-I with List-II:

List-I (Transgene)	List-II (Used for/Products)
(A) α -1-antitrypsin	(I) <i>Meloidogyne incognita</i>
(B) <i>cryIAc</i>	(II) Corn borer
(C) Antisense RNA	(III) Treat emphysema
(D) <i>cryIAb</i>	(IV) Cotton bollworms

Choose the correct answer from the options given below:

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

2. (A) - (I), (B) - (III), (C) - (III), (D) - (IV)
3. (A) - (III), (B) - (II), (C) - (I), (D) - (IV)
4. (A) - (I), (B) - (IV), (C) - (III), (D) - (II)

Correct Answer: 3. (A) - (III), (B) - (II), (C) - (I), (D) - (IV)

Solution:

- (A) α -1-antitrypsin: Used in the treatment of emphysema caused by genetic disorders.
- (B) *cryIAc*: A gene from *Bacillus thuringiensis*, effective against the corn borer pest.
- (C) Antisense RNA: Used to silence genes in *Meloidogyne incognita*, a nematode pest.
- (D) *cryIAb*: Another gene from *Bacillus thuringiensis*, targets cotton bollworms.

 Quick Tip

- *cryIAc*: Corn borer. - *cryIAb*: Cotton bollworms. - Antisense RNA: Gene silencing for nematodes. - α -1-antitrypsin: Treats genetic emphysema.

Q12: Expand “GEAC”:

1. Genetic and Environmental Advisory Committee
2. Gene Establishment Approval Committee
3. Genetic Engineering Advisory Committee
4. Genetic Engineering Approval Committee

Correct Answer: 4. Genetic Engineering Approval Committee

Solution: GEAC stands for **Genetic Engineering Approval Committee**, which is responsible for the approval of genetically modified organisms (GMOs) and research related to them in India.

 Quick Tip

GEAC regulates and approves GMOs and their applications in India. Think of “Approval” for official validation.

Q13: When an insect feeds on the *Bt* plant, the insect dies due to the conversion of inactive protein to active protein in:

1. Alkaline pH of the gut.
2. Acidic pH of the gut.
3. Acidic pH of saliva.
4. Alkaline pH of saliva.

Correct Answer: 1. Alkaline pH of the gut

Solution: The *Bt* toxin produced by *Bacillus thuringiensis* is an inactive protoxin. When ingested by an insect, it is activated in the insect’s gut due to the **alkaline pH**, which converts the protoxin into an active form. This active toxin binds to the gut cells, creating pores and eventually killing the insect.

💡 Quick Tip

The *Bt* toxin works at an alkaline pH, which is characteristic of insect guts. Remember: *Bt* → Alkaline gut → Toxin activation.

Q14: Match List-I with List-II:

List-I (Interspecies Relationships)	List-II (Features)
(A) Commensalism	(I) One species is benefitted at the expense of the other
(B) Mutualism	(II) One species is harmed and the other is unaffected
(C) Amensalism	(III) Both the species are benefitted
(D) Parasitism	(IV) One species benefits and other remains unaffected

Choose the correct answer from the options given below:

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

Correct Answer: 2. (A) - (IV), (B) - (III), (C) - (II), (D) - (I)

Solution:

- Commensalism: (IV) One species benefits while the other remains unaffected .
- Mutualism: (III) Both species benefit
- Amensalism: (II) One species is harmed while the other remains unaffected.
- Parasitism: (I) One species benefits at the expense of the other.

💡 Quick Tip

- Commensalism → Benefit, no harm.
- Mutualism → Mutual benefit.
- Amensalism → Harm, no effect.
- Parasitism → Benefit, harm.

Q15: In a country, at any time, the population has the same number of young and mature ones. What type of growth does it reflect?

- Expanding
- Declining
- Stable
- S-shaped

Correct Answer: 3. Stable

Solution: A stable population is characterized by an equal proportion of young and mature individuals, indicating that the birth and death rates are balanced, and the population size remains constant over time.

 Quick Tip

Stable population: Equal proportions of young and mature individuals indicate balanced growth.

Q16: Two closely related species can co-exist indefinitely and violate Gause's '*Competitive Exclusion Principle*' by:

1. eliminating the inferior species.
2. resource partitioning.
3. interacting with each other symbiotically.
4. changing the area of grazing.

Correct Answer: 2. Resource partitioning

Solution: Resource partitioning allows two closely related species to utilize different resources or the same resource in different ways, reducing direct competition and enabling their coexistence, thereby violating the Competitive Exclusion Principle.

 Quick Tip

Resource partitioning reduces competition and ensures coexistence of similar species.

Q17: The process of mineralisation by microorganisms helps in the release of:

1. inorganic nutrients from detritus and formation of humus.
2. organic nutrients from humus.
3. inorganic nutrients from humus.
4. organic and inorganic nutrients from detritus.

Correct Answer: 1. Inorganic nutrients from detritus and formation of humus

Solution: Mineralisation refers to the process by which microorganisms decompose organic matter in detritus, releasing inorganic nutrients into the soil while also forming humus, which is essential for soil fertility.

 Quick Tip

Mineralisation = Decomposition of detritus → Release of inorganic nutrients + Humus formation.

Q18: In which ecosystem is the biomass of primary consumers greater than producers?

1. Forests

2. Grassland
3. Desert
4. Sea

Correct Answer: 4. Sea

Solution: In aquatic ecosystems like the sea, the biomass of primary consumers (e.g., zooplankton) can be greater than that of producers (e.g., phytoplankton) due to the fast turnover rate of phytoplankton. They reproduce quickly, providing a continuous supply of food.

 Quick Tip

In the sea, rapid turnover of phytoplankton leads to a higher biomass of primary consumers.

Q19: Choose the correct statements with respect to decomposition from the following:

- (A) Decomposition is an anaerobic process.
- (B) Decomposition rate of detritus depends upon the chemical nature of it.
- (C) Water-soluble organic nutrients go into the soil and get precipitated in the process of leaching.
- (D) Humification follows mineralisation.

Options:

1. (B) and (D) only
2. (A) and (C) only
3. (B) and (C) only
4. (A) and (D) only

Correct Answer: 1. (B) and (D) only

Solution:

- (A) is incorrect: Decomposition is primarily an aerobic process, requiring oxygen for microbial activity.
- (B) is correct: The decomposition rate of detritus is influenced by its chemical composition, such as the ratio of lignin to nitrogen.
- (C) is incorrect: Water-soluble organic nutrients are leached into the soil, but they do not get precipitated.
- (D) is correct: Humification, the process of forming humus, follows mineralisation during decomposition.

 Quick Tip

- Decomposition is aerobic. - Humification (humus formation) comes after mineralisation. - Chemical composition affects decomposition rates.

Q20: Match List-I with List-II:

List-I (Concepts)	List-II (Explanation)
(A) Standing state	(I) Available biomass for the consumption of heterotrophs
(B) Secondary productivity	(II) Rate of formation of organic matter by consumers
(C) Standing crop	(III) Mass of living matter in a trophic level at a given time
(D) Net primary productivity	(IV) Amount of mineral nutrients in the soil at a given time

Options:

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

Correct Answer: 3. (A) - (IV), (B) - (II), (C) - (III), (D) - (I)

Solution:

- (A) Standing state: Refers to the amount of mineral nutrients present in the soil or environment at a specific time (IV).
- (B) Secondary productivity: Refers to the rate at which consumers convert organic matter into their own biomass (II).
- (C) Standing crop: Refers to the mass of living matter (e.g., plants, animals) in a trophic level at a particular time (III).
- (D) Net primary productivity: Refers to the biomass available for consumption by heterotrophs after respiration (I).

💡 Quick Tip

- Standing state: Minerals/nutrients.
- Secondary productivity: Consumer-level productivity.
- Standing crop: Living matter at a trophic level.
- Net primary productivity: Available biomass for consumers.

Read the passage carefully and answer the next five questions:

India was amongst the first countries in the world to initiate action plans and programmes at a national level to attain total reproductive health as a social goal. These programmes called 'family planning' were initiated in 1951 and were periodically assessed over the past decades. Improved programmes covering wider reproduction-related areas are currently in operation. Creating awareness among the people about various reproduction-related aspects and providing facilities and support for building up a reproductively healthy society are the major tasks under these programmes.

Q21: Which of the following is **not** a Sexually Transmitted Disease?

- Chlamydia
- Filariasis
- Genital herpes
- Trichomoniasis

Correct Answer: 2. Filariasis

Solution: Filariasis is caused by a parasitic worm and is transmitted through mosquito bites, not through sexual contact. On the other hand, Chlamydia, Genital herpes, and Trichomoniasis are sexually transmitted diseases (STDs).

 Quick Tip

STDs include infections spread via sexual contact, such as Chlamydia, herpes, and Trichomoniasis. Filariasis is vector-borne (mosquitoes).

Q22: Which of the following statements is **incorrect** with respect to Medical Termination of Pregnancy (MTP)?

1. They are considered safe during the first trimester.
2. It is legalised in India from 1971.
3. MTPs can be performed even after 24 weeks, but with the opinion of 2 registered medical practitioners on specific grounds.
4. About 20% of the total number of conceived pregnancies undergo MTP in a year globally.

Correct Answer: 4. About 20% of the total number of conceived pregnancies undergo MTP in a year globally.

Solution:

- (1) is correct: MTPs are considered safe during the first trimester (up to 12 weeks).
- (2) is correct: The Medical Termination of Pregnancy Act was enacted in India in 1971.
- (3) is correct: MTPs can be performed after 24 weeks under special conditions, such as health risks to the mother or fetus, with approval from two registered medical practitioners.
- (4) is incorrect: The percentage of pregnancies that undergo MTP globally is significantly lower than 20%.

 Quick Tip

MTP in India is legal under specific conditions, and the claim of 20% globally is exaggerated.

Q23: Match List-I with List-II:

List-I (Interspecies Relationships)	List-II (Features)
(A) Commensalism	(I) One species is benefitted at the expense of the other
(B) Mutualism	(II) One species is harmed and the other is unaffected
(C) Amensalism	(III) Both the species are benefitted
(D) Parasitism	(IV) One species benefits and the other remains unaffected

Options:

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

Correct Answer: 2. (A) - (III), (B) - (I), (C) - (IV), (D) - (II)

Solution: - (A) ZIFT (Zygote Intrafallopian Transfer): Fertilised egg up to 8 blastomeres is transferred into the fallopian tube. - (B) ICSI (Intracytoplasmic Sperm Injection): Embryo is formed by injecting sperm directly into the ovum. - (C) IUI (Intrauterine Insemination): Semen is transferred into the uterus artificially. - (D) IUT (Intrauterine Transfer): Embryos with more than 8 blastomeres are transferred into the uterus.

💡 Quick Tip

ZIFT: Early embryos (up to 8 blastomeres) → Fallopian tube.
 ICSI: Sperm injected into ovum.
 IUI: Semen transfer.
 IUT: Advanced embryos (8+ blastomeres) → Uterus.

Q24: Which of the following methods of contraception is **not** meant for females?

- IUDs
- Lactational amenorrhea
- Vasectomy
- Condoms

Correct Answer: 3. Vasectomy

Solution: Vasectomy is a permanent contraceptive method performed on males, involving the surgical cutting or sealing of the vas deferens to prevent sperm release.

💡 Quick Tip

Vasectomy is exclusive to males; other options (e.g., IUDs, lactational amenorrhea) are female contraceptive methods.

Q25: *Saheli*—an oral contraceptive pill, also known as the ‘Once a week’ pill, was developed by:

1. AIIMS
2. NBRI
3. CDRI
4. NBPGR

Correct Answer: 3. CDRI

Solution: The *Saheli* pill was developed by the Central Drug Research Institute (CDRI), Lucknow. It is unique because it is taken only once a week and is a non-steroidal contraceptive.

 Quick Tip

Saheli, a non-steroidal contraceptive, was developed by CDRI, Lucknow.

Read the passage carefully and give the answers to the next five questions:

Does the number of species in a community really matter to the functioning of the ecosystem? This is a question for which ecologists have not been able to give a definitive answer. For many decades, ecologists believed that communities with more species, generally, tend to be more stable than those with less species. According to the International Union for Conservation of Nature and Natural Resources (IUCN) (2004), the total number of plant and animal species described so far is more than 1.5 million.

Q26: Which of the following is **not** a characteristic of a stable biological community?

1. It must be resistant to invasions by alien species.
2. It should not show too much variation in productivity from year to year.
3. All the species are equally important in a stable community and absence of any one leads to its instability.
4. It is resilient to occasional disturbances, whether natural or man-made.

Correct Answer: 3. All the species are equally important in a stable community and absence of any one leads to its instability.

Solution: In a stable community, all species do not have equal importance. Some species, like keystone species, have a disproportionately large impact on the ecosystem, while others may have minor roles. The absence of all species does not lead to instability.

 Quick Tip

Key species play a critical role in community stability, but not all species are equally important.

Q27: In the ‘*rivet popper hypothesis*’, the ‘rivet’ signifies:

1. Key species

2. Endemic species
3. Community
4. Species

Correct Answer: 4. Species

Solution: The *rivet popper hypothesis* compares species in an ecosystem to rivets in an airplane. Each species (rivet) contributes to the stability of the ecosystem (airplane), and the loss of multiple species may cause a collapse.

 Quick Tip

Think of rivets as individual species—removing too many can destabilize the entire system.

Q28: The scientist who proved that species richness directly correlates with the stability of a community was -----.

1. Paul Ehrlich
2. David Tilman
3. Robert May
4. Edward Wilson

Correct Answer: 2. David Tilman

Solution: David Tilman demonstrated through experiments that ecosystems with greater species richness are more stable and resilient to environmental changes.

 Quick Tip

David Tilman: Species richness enhances stability in ecosystems.

Q29: Among the vertebrates, which of the following is the most species-rich group?

1. Reptiles
2. Fishes
3. Insects
4. Mammals

Correct Answer: 2. Fishes

Solution: Fishes are the most species-rich group among vertebrates, with over 33,000 known species. They are highly diverse and occupy a wide range of aquatic habitats.

 Quick Tip

Fishes are the most species-rich among vertebrates; insects dominate among invertebrates.

Q30: The following are the various hypotheses proposed in explaining the greatest biological diversity in tropics, **except**:

1. Temperate regions are subjected to glaciations, but tropical latitudes have remained relatively undisturbed.
2. Tropical environments have more humidity/moisture which helps the diversity to flourish.
3. Tropical environments are less seasonal and more constant.
4. There is more solar energy available in the tropics which contributes to higher productivity and hence, biodiversity.

Correct Answer: 2. Tropical environments have more humidity/moisture which helps the diversity to flourish.

Solution: While tropical environments are diverse, humidity/moisture alone does not explain the greatest biodiversity in the tropics. Factors like stability, solar energy, and historical undisturbance play more significant roles.

 Quick Tip

Tropical biodiversity is primarily due to stability, constant climate, and abundant energy.

Q31: Cells present in the mature pollen grains are -----.

1. Central cell and generative cell
2. Antipodal cell and vegetative cell
3. Vegetative cell and generative cell
4. Filiform cell and micropylar cell

Correct Answer: 3. Vegetative cell and generative cell

Solution: Mature pollen grains consist of two cells: a large vegetative cell and a smaller generative cell, which divides to form sperm cells during fertilization.

 Quick Tip

Remember: Mature pollen grains have a vegetative cell and a generative cell for reproduction.

Q32: Match List-I with List-II:

List-I (Structures)	List-II (Functions)
(A) Filiform apparatus	(I) Made up of sporopollenin
(B) Tapetum	(II) Attachment of ovule to the placenta
(C) Exine	(III) Guides pollen tube into the synergid
(D) Funicle	(IV) Nourishes the pollen grain

Options:

1. (A) - (IV), (B) - (I), (C) - (II), (D) - (III)
2. (A) - (III), (B) - (IV), (C) - (I), (D) - (II)
3. (A) - (II), (B) - (I), (C) - (III), (D) - (IV)

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

Correct Answer: 2. (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Solution:

- Filiform apparatus: Guides pollen tube to the synergid.
- Tapetum: Provides nourishment to the developing pollen grains.
- Exine: Made of sporopollenin, providing durability.
- Funicle: Connects the ovule to the placenta.

 Quick Tip

Filiform guides pollen, tapetum nourishes, exine protects, and funicle connects.

Q33: Primary Endosperm Nucleus is the product of:

1. Double fusion
2. Triple fusion
3. Parthenogenesis
4. Apomixis

Correct Answer: 2. Triple fusion

Solution: The primary endosperm nucleus is formed by the fusion of one sperm nucleus with the two polar nuclei in the embryo sac, a process called triple fusion.

 Quick Tip

Triple fusion = Sperm nucleus + Two polar nuclei $\rightarrow$ Primary Endosperm Nucleus.

Q34: In humans, mammary gland is divided into _____ lobes.

1. 10 – 12
2. 25 – 30
3. 30 – 35
4. 15 – 20

Correct Answer: 4. 15 – 20

Solution: The human mammary gland is divided into 15–20 lobes, each containing milk-producing alveoli.

 Quick Tip

Human mammary glands have 15–20 lobes for milk production.

Q35: Sex in human embryo is determined by:

1. 'X' chromosome of egg
2. 'X' or 'Y' chromosome of sperm

3. Only 'Y' chromosome of sperm
4. Health of mother

Correct Answer: 2. 'X' or 'Y' chromosome of sperm

Solution: Sex in human embryos is determined by the type of sperm that fertilizes the egg. Sperm carrying an X chromosome results in a female, while sperm carrying a Y chromosome results in a male.

 Quick Tip

Sperm determines sex: $X \rightarrow \text{Female}$, $Y \rightarrow \text{Male}$.

Q36: Arrange the following stages of oogenesis in order of their occurrence:

- (A) Ovum
- (B) Oogonia
- (C) Primary oocyte
- (D) Secondary oocyte

Options:

1. (C), (B), (D), (A)
2. (B), (C), (D), (A)
3. (D), (C), (A), (B)
4. (A), (D), (C), (B)

Correct Answer: 2. (B), (C), (D), (A)

Solution: The correct sequence of oogenesis is:

1. Oogonia (immature germ cells).
2. Primary oocyte (formed during fetal development).
3. Secondary oocyte (formed during meiosis I).
4. Ovum (formed after meiosis II and fertilization).

 Quick Tip

Oogonia $\rightarrow$ Primary oocyte $\rightarrow$ Secondary oocyte $\rightarrow$ Ovum.

Q37: Which of the following pair of contrasting traits was **not** studied by Mendel?

1. Pink and white flowers
2. Inflated and constricted pods
3. Axial and terminal flowers
4. Green and yellow pods

Correct Answer: 1. Pink and white flowers

Solution: Mendel studied traits like seed shape, seed color, flower position, and pod shape, but he did not study flower color as pink and white (he studied purple and white).

 Quick Tip

Mendel studied purple and white flowers, not pink and white.

Q38: Failure of chromatids to segregate during cell division cycle results in:

1. Polyploidy
2. Euploidy
3. Aneuploidy
4. Autopolyploidy

Correct Answer: 3. Aneuploidy

Solution: Aneuploidy occurs when there is an addition or loss of chromosomes due to improper segregation of chromatids during cell division. For example, Down syndrome results from an extra chromosome 21.

 Quick Tip

Aneuploidy: Improper segregation → Abnormal chromosome number.

Q39: Select the correctly matched pair about sickle cell anaemia:

Genotype : Phenotype

- (A) $Hb^A Hb^A$: Diseased phenotype
(B) $Hb^A Hb^S$: Diseased phenotype
(C) $Hb^S Hb^S$: Diseased phenotype
(D) $Hb^S Hb^A$: Carrier of disease

Options:

1. (C) and (D) only
2. (A) and (C) only
3. (B), (C) and (D) only
4. (A), (B), and (C) only

Correct Answer: 1. (C) and (D) only

Solution:

- $Hb^A Hb^A$: Normal phenotype (not diseased).
- $Hb^A Hb^S$: Carrier of sickle cell anaemia.
- $Hb^S Hb^S$: Diseased phenotype (sickle cell anaemia).
- $Hb^S Hb^A$: Carrier of disease.

 Quick Tip

Sickle cell anaemia: $Hb^S Hb^S$ = Diseased, $Hb^A Hb^S$ = Carrier.

Q40: Match List-I with List-II:

List-I (Scientists)	List-II (Discovery)
(A) Sutton and Boveri	(I) X-Body
(B) Sturtevant	(II) Chromosomal Theory of Inheritance
(C) Henking	(III) Transformation in bacteria
(D) Griffith	(IV) Genetic maps

Options:

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

Correct Answer: 1. (A) - (II), (B) - (IV), (C) - (I), (D) - (III)

Solution:

- Sutton and Boveri: Proposed the Chromosomal Theory of Inheritance.
- Sturtevant: Developed genetic maps.
- Henking: Discovered the X-Body, now known as the X chromosome.
- Griffith: Demonstrated bacterial transformation in his experiments.

💡 Quick Tip

Remember:

- Sutton and Boveri → Chromosomes.
- Sturtevant → Genetic maps.
- Henking → X-Body.
- Griffith → Transformation.

Q41: Which of the following statements are **incorrect** with respect to nucleotides?

- Purines and pyrimidines are nitrogenous bases.
- Nucleotides are non-enzymatic molecules.
- Phosphate group is linked to -OH of 5' C of a nucleoside through phosphoester linkage.
- In RNA, every nucleotide residue has an additional -OH group present at 2' position in the ribose.
- Thymine is an example of Pyrimidine.

Options:

- (A), (B), and (E) only
- (D) and (E) only
- (B) and (D) only
- (B) and (E) only

Correct Answer: 2. (D) and (E) only

Solution:

- (A) Correct: Purines (adenine, guanine) and pyrimidines (cytosine, thymine, uracil) are nitrogenous bases.

- (B) Correct: Nucleotides are not enzymes.
- (C) Correct: Phosphate attaches to 5' carbon of nucleoside.
- (D) Incorrect: In RNA, the ribose sugar has a 2' –OH group, but not every nucleotide residue has this group.
- (E) Incorrect: Thymine is a pyrimidine found in DNA, but not in RNA.

💡 Quick Tip

Thymine is in DNA, while RNA has uracil. Ribose in RNA has an additional –OH group.

Q42: Arrange the given steps of DNA fingerprinting in the sequence from initiation to end:

- (A) Digestion of DNA by restriction endonuclease
- (B) Isolation of DNA
- (C) Hybridisation using labelled VNTR probe
- (D) Transferring (blotting) of separated DNA fragments to synthetic membrane

Options:

1. (A), (B), (C), (D)
2. (A), (D), (B), (C)
3. (B), (A), (D), (C)
4. (C), (D), (A), (B)

Correct Answer: 3. (B), (A), (D), (C)

Solution: The correct sequence for DNA fingerprinting is:

1. Isolation of DNA (B): DNA is extracted from the sample.
2. Digestion by restriction endonucleases (A): DNA is cut into fragments.
3. Blotting to synthetic membrane (D): DNA fragments are transferred to a nylon or nitrocellulose membrane.
4. Hybridisation with VNTR probe (C): Probes hybridize with complementary DNA sequences.

💡 Quick Tip

DNA fingerprinting steps: Isolation → Digestion → Blotting → Hybridisation.

Q43: Nucleosome is associated with _____ molecules of histones.

1. Four
2. Nine
3. Two
4. Eight

Correct Answer: 4. Eight

Solution: A nucleosome consists of eight histone proteins, forming an octamer (two each of H2A, H2B, H3, and H4), around which DNA is wrapped.

 Quick Tip

Nucleosome = DNA wrapped around a histone octamer (8 molecules).

Q44: Select the observations drawn from the human genome project which are correct:

- (A) The human genome contains 3164.7 million bp.
- (B) The average gene consists of 3000 bases.
- (C) Total number of genes is estimated at 30,000.
- (D) The functions are unknown for over 50% of discovered genes.
- (E) Less than 2% of the genome codes for proteins.

Options:

- 1. (A), (B), (C) and (D) only
- 2. (A), (C), (D) and (E) only
- 3. (A), (C) and (E) only
- 4. (A), (B), (C), (D) and (E)

Correct Answer: 4. (A), (B), (C), (D) and (E)

Solution: All listed statements are true observations from the Human Genome Project, which revealed the detailed composition and structure of the human genome.

 Quick Tip

Key HGP facts: 3164.7 million bp, 30,000 genes, 1.2% coding DNA, unknown functions for 50% of genes.

Q45: Analogous structures are a result of:

- 1. Convergent evolution
- 2. Divergent evolution
- 3. Parallel evolution
- 4. Retrogressive evolution

Correct Answer: 1. Convergent evolution

Solution: Analogous structures arise from convergent evolution, where different organisms independently evolve similar traits to adapt to similar environments.

 Quick Tip

Analogous = Similar function, different origin → Convergent evolution.

Q46: Which of the following does **not** affect the Hardy-Weinberg equilibrium?

- 1. Natural selection
- 2. Genetic drift
- 3. Gene pool
- 4. Gene migration

Correct Answer: 3. Gene pool

Solution: The Hardy-Weinberg equilibrium is disturbed by factors like natural selection, genetic drift, gene flow, and mutation. The gene pool itself does not directly affect the equilibrium unless it undergoes change.

 Quick Tip

Hardy-Weinberg equilibrium factors: Selection, drift, migration, mutation—not the static gene pool.

Q47: Which of the following primates was more like an ape?

1. *Homo erectus*
2. *Dryopithecus*
3. *Australopithecines*
4. *Ramapithecus*

Correct Answer: 2. *Dryopithecus*

Solution: *Dryopithecus* is considered an early ape-like primate. It was quadrupedal and arboreal, more similar to modern apes than humans.

 Quick Tip

Dryopithecus = Ape-like; *Homo erectus* and *Australopithecines* = Human ancestors.

Q48: Match List-I with List-II:

List-I (Placental mammals)	List-II (Counterpart Marsupials)
(A) Anteater	(I) Spotted cuscus
(B) Bobcat	(II) Numbat
(C) Lemur	(III) Flying Phalanger
(D) Flying squirrel	(IV) Tasmanian tiger cat

Options:

1. (A) - (II), (B) - (IV), (C) - (I), (D) - (III)
2. (A) - (III), (B) - (I), (C) - (IV), (D) - (II)
3. (A) - (IV), (B) - (I), (C) - (II), (D) - (III)
4. (A) - (IV), (B) - (I), (C) - (III), (D) - (II)

Correct Answer: 1. (A) - (II), (B) - (IV), (C) - (I), (D) - (III)

Solution:

- Anteater matches with the marsupial Numbat.
- Bobcat corresponds to Tasmanian tiger cat.
- Lemur pairs with Spotted cuscus.
- Flying squirrel is matched with Flying Phalanger.

💡 Quick Tip

Placental mammals and marsupials often exhibit convergent evolution, leading to ecological equivalents.

Q49: Identify the **incorrect** statement/s:

- (A) Intestinal perforation and death may occur in severe cases of typhoid infection.
- (B) Common cold is caused by Rhinoviruses.
- (C) Lips and fingernails may turn grey to bluish colour in severe cases of pneumonia.
- (D) Pneumonia is caused by *Salmonella*.
- (E) Typhoid fever could be confirmed by Widal test.

Options:

- 1. (A), (C) and (D) only
- 2. (B) and (E) only
- 3. (D) only
- 4. (A) and (D) only

Correct Answer: 3. (D) only

Solution:

- (A) Correct: Typhoid can lead to intestinal perforation.
- (B) Correct: Common cold is caused by Rhinoviruses.
- (C) Correct: Bluish lips and fingernails indicate hypoxia in pneumonia.
- (D) Incorrect: Pneumonia is caused by *Streptococcus pneumoniae* or other bacteria, not *Salmonella*.
- (E) Correct: Widal test is used for diagnosing typhoid.

💡 Quick Tip

Pneumonia: *Streptococcus pneumoniae*; Typhoid: *Salmonella typhi*.

Q50: Match List-I with List-II:

List-I (Types of barriers)	List-II (Examples)
(A) Cytokine barriers	(I) Mucus coating
(B) Physical barriers	(II) Tears from eyes
(C) Cellular barriers	(III) Phagocytosis
(D) Physiological barriers	(IV) Interferons

Options:

- 1. (A) - (IV), (B) - (III), (C) - (I), (D) - (II)
- 2. (A) - (IV), (B) - (II), (C) - (III), (D) - (I)
- 3. (D) - (I), (B) - (C), (C) - (IV), (A) - (III)
- 4. (A) - (IV), (B) - (I), (C) - (II), (D) - (III)

Correct Answer: 2. (A) - (IV), (B) - (II), (C) - (III), (D) - (I)

Solution:

- Cytokine barriers: Interferons (antiviral proteins).
- Physical barriers: Tears protect from infections.
- Cellular barriers: Phagocytosis by macrophages.
- Physiological barriers: Mucus traps pathogens.

 Quick Tip

Barriers are categorized as physical (tears), physiological (mucus), cellular (phagocytes), and cytokine (interferons).