

KCET 2025 Biology Question Paper with Solutions

Time Allowed :1 Hour 20 Minutes

Maximum Marks :180

Total Questions :60

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 1 hours 20 minutes duration.
2. The question paper consists of 60 questions. The maximum marks are 180.
3. The questions are from Biology, of equal weightage.

Q1. Which of the following are the techniques for detection of cancer of internal organs?

- a) Radiography, MRI
- b) MRI, computed tomography
- c) Widal test, radiography
- d) MRI, Widal test

- (1) b and c
- (2) b and d
- (3) a and b
- (4) a and c

Correct Answer: (3) a and b

Solution:

- Detection of internal organ cancers requires imaging techniques that can visualize tissues inside the body.
- Radiography uses X-rays to produce images of internal structures, helpful for tumors in dense tissues.
- MRI (Magnetic Resonance Imaging) produces detailed images of soft tissues, making it effective for detecting internal organ cancers.
- Computed Tomography (CT) scan combines X-ray images from multiple angles to create cross-sectional images of internal organs.
- Widal test is a serological test for typhoid fever, not for cancer detection.

💡 Quick Tip

Remember: Imaging techniques like Radiography, MRI, and CT are used for detecting internal organ cancers. Blood tests like Widal test are disease-specific and not useful for cancer detection.

Q2. Malignant malaria is caused by:

- (1) *Plasmodium falciparum*
- (2) *Plasmodium rubrum*
- (3) *Plasmodium malariae*
- (4) *Plasmodium vivax*

Correct Answer: (1) *Plasmodium falciparum*

Solution:

- Malaria is caused by protozoan parasites of the genus *Plasmodium*.
- *Plasmodium falciparum* causes the most severe form called malignant malaria, leading to complications like cerebral malaria and organ failure.
- Other species (*P. vivax*, *P. malariae*) cause milder forms.
- Correct identification is crucial for appropriate treatment.

 Quick Tip

Associate *P. falciparum* with severe/malignant malaria, while *P. vivax* and *P. malariae* cause milder disease.

Q3. The drug prescribed to the patients who have undergone organ transplant is ----- and is produced by -----.

- (1) Cyclosporin-A, *Trichoderma polysporum*
- (2) Stain, *Trichoderma polysporum*
- (3) Cyclosporin-A, *Monascus purpureus*
- (4) Stain, *Monascus purpureus*

Correct Answer: (1) Cyclosporin-A, *Trichoderma polysporum*

Solution:

- Cyclosporin-A is an immunosuppressive drug used to prevent organ transplant rejection.
- It inhibits T-lymphocyte activity to prevent immune-mediated damage to transplanted organs.
- Cyclosporin-A is a cyclic peptide produced by the fungus *Trichoderma polysporum*.
- Other options like statins are produced by different fungi (*Monascus purpureus*) and are used for cholesterol control, not transplant medicine.

💡 Quick Tip

Connect Cyclosporin-A with organ transplant and *Trichoderma polysporum*. Remember: immunosuppressive drugs prevent graft rejection.

Q4. Statement-I: Biocontrol refers to the use of biological methods for controlling plant diseases and pests.

Statement-II: Trichoderma species are effective biocontrol agents for several plant pathogens.

- (1) Statement-I is incorrect but Statement-II is correct
- (2) Both statement-I and statement-II are correct
- (3) Statement-I and statement-II are incorrect
- (4) Both statement-I and statement-II are incorrect

Correct Answer: (2) Both statement-I and statement-II are correct

Solution:

- Biocontrol uses living organisms to control pests and pathogens in crops instead of chemical pesticides.
- Examples include *Trichoderma*, *Bacillus thuringiensis*, and predatory insects.
- *Trichoderma* species act against fungal pathogens through competition, antibiosis, and mycoparasitism, making them effective biocontrol agents.

💡 Quick Tip

Remember: Biocontrol = use of living organisms. *Trichoderma* is a fungal biocontrol agent effective against plant pathogens.

Q5. Match the column-I with column-II. Choose the correct option given below.

Column-I	Column-II
a) Streptococcus	i) Free living nitrogen fixing bacteria
b) <i>Penicillium</i>	ii) Colt buster
c) Methanogens	iii) Source of antibiotic
d) Anabaena	iv) Biogas production

- (1) a-iv, b-iii, c-i, d-ii
- (2) a-iv, b-i, c-iii, d-ii

(3) a-ii, b-iii, c-iv, d-i

(4) a-i, b-iv, c-iii, d-i

Correct Answer: (3) a-ii, b-iii, c-iv, d-i

Solution:

- a) Streptococcus is matched with ii) Colt buster, as it is known to cause diseases like strep throat and is associated with colt-related infections. - b) Penicillium is matched with iii) Source of antibiotic, as it produces penicillin, a well-known antibiotic. - c) Methanogens are matched with iv) Biogas production, as they produce methane gas used in biogas. - d) Anabaena is matched with i) Free living nitrogen fixing bacteria, as it is a cyanobacterium that fixes nitrogen in the soil.

Thus, the correct matching is a-ii, b-iii, c-iv, d-i.

💡 Quick Tip

Match based on biological roles: Antibiotics from fungi, nitrogen fixation by cyanobacteria, biogas from methanogens.

Q6. Match the contents of List-I with List-II

List-I	List-II
a) Bioreactors	i) Insulin produced by rDNA technology
b) Downstream processing	ii) Vessels which convert raw material into specific product
c) Recombinant protein	iii) Detect mutated genes in suspected cancer patient
d) PCR	iv) Involves separation and purification

(1) a-i, b-ii, c-iv, d-iii

(2) a-i, b-i, c-iii, d-iv

(3) a-ii, b-iv, c-i, d-iii

(4) a-iv, b-ii, c-iii, d-i

Correct Answer: (3) a-ii, b-iv, c-i, d-iii

Solution:

- a) Bioreactors are matched with ii) Vessels which convert raw material into specific product,

as they are used to facilitate biological reactions. - b) Downstream processing is matched with iv) Involves separation and purification, as it includes the steps to purify products after biosynthesis. - c) Recombinant protein is matched with i) Insulin produced by rDNA technology, as recombinant DNA technology is used to produce insulin. - d) PCR is matched with iii) Detect mutated genes in suspected cancer patient, as it is a technique used to amplify DNA for genetic analysis.

Thus, the correct matching is a-ii, b-iv, c-i, d-iii.

 Quick Tip

Understand biotechnology processes: Bioreactors for conversion, downstream for purification, rDNA for proteins, PCR for gene detection.

Q7. The part of plasmid that codes for proteins involved in the replication of the pBR322 plasmid is:

- (1) "rop"
- (2) Cloning site
- (3) Ori site
- (4) Selectable marker

Correct Answer: (3) Ori site

Solution:

- Plasmids like pBR322 have an origin of replication (Ori) that allows autonomous replication in host cells.
- "rop" gene regulates plasmid copy number, not replication directly.
- Cloning site is used for insertion of foreign DNA.
- Selectable markers (e.g., antibiotic resistance) allow identification of transformed cells.

 Quick Tip

Ori site = origin of replication, essential for plasmid duplication. Remember distinction between regulatory genes, cloning site, and selectable marker.

Q8. To isolate DNA from fungal cells, bacterial cells, and plant cells, the enzymes required are respectively:

- (1) Chitinase, Lysozyme and Cellulase
- (2) Cellulase, Protease and Lysozyme
- (3) Lysozyme, Cellulase and Chitinase
- (4) Lysozyme, Proteases and Ribonuclease

Correct Answer: (1) Chitinase, Lysozyme and Cellulase

Solution:

- Fungal cell walls contain chitin → use Chitinase to break them.
- Bacterial cell walls contain peptidoglycan → Lysozyme hydrolyzes the -1,4-glycosidic linkages in peptidoglycan.
- Plant cell walls contain cellulose → Cellulase is required to degrade cellulose for DNA extraction.

 Quick Tip

Match the enzyme to the major structural polymer of the cell wall: Chitin (fungi), Peptidoglycan (bacteria), Cellulose (plants).

Q9. In mature insulin, which of the peptide is not present?

- (1) C-peptide
- (2) A and B peptides
- (3) A-peptide
- (4) B-peptide

Correct Answer: (1) C-peptide

Solution:

- Insulin is initially synthesized as preproinsulin → proinsulin → mature insulin.
- Proinsulin has A, B, and C peptides.
- During maturation, C-peptide is cleaved off, leaving A and B chains linked by disulfide bonds.
- Therefore, mature insulin contains only A and B peptides; C-peptide is not present.

 Quick Tip

Remember: C-peptide is removed to activate insulin. Its measurement in blood is used to assess endogenous insulin production.

Q10. A scientist wants to produce virus-free plants in tissue culture. Which part of the plant will he use as an explant?

- a) Mature stem
- b) Axillary meristem
- c) Apical meristem
- d) Mesophyll cell

- (1) b only
- (2) c and d
- (3) a only
- (4) b and c

Correct Answer: (4) b and c

Solution:

- Apical and axillary meristems are regions of actively dividing cells at the tips and nodes of plants.
- These meristems are often free from systemic viruses because they grow faster than virus spread.
- Mature stem and mesophyll cells may contain viruses; thus, they are not ideal for virus-free cultures.

💡 Quick Tip

For virus-free plant tissue culture, always use apical or axillary meristem. Fast-dividing meristematic cells exclude viruses.

Q11. Some strains of *Bacillus thuringiensis* produce proteins that kill insects. Which one is NOT killed?

- (1) Cotton bollworm
- (2) Tapeworm
- (3) Tobacco budworm
- (4) Armyworm

Correct Answer: (2) Tapeworm

Solution:

- *Bacillus thuringiensis* (Bt) produces Cry proteins toxic to specific insects.
- Targets include Lepidopteran larvae like cotton bollworm, tobacco budworm, armyworm.
- Tapeworm is a helminth (parasitic worm) not susceptible to Bt toxins.

💡 Quick Tip

Bt toxins are insect-specific; they do not affect mammals or helminths. Know the Lepidopteran pests targeted.

Q12. Which population attributes contribute to an increase in population density?

- (1) Natality and Emigration
- (2) Mortality and Immigration
- (3) Natality and Immigration
- (4) Mortality and Emigration

Correct Answer: (3) Natality and Immigration

Solution:

- Population density increases if the number of individuals entering or born exceeds those leaving or dying.
- Natality (birth rate) adds individuals; Immigration brings individuals from other populations.
- Mortality (death rate) and Emigration reduce population density.

💡 Quick Tip

For population growth: **Increase factors = Natality + Immigration, Decrease factors = Mortality + Emigration.**

Q13. If 8 individuals in a laboratory population of 80 fruit flies died during a specified time interval, the death rate in the population during that period is:

- (1) 0.1 individual/time interval
- (2) 1 individual/time interval
- (3) 0.01 individual/time interval
- (4) 0.001 individual/time interval

Correct Answer: (1) 0.1 individual/time interval

Solution:

- Death rate = Number of deaths / Total population
- Here, Number of deaths = 8, Population = 80

$$\text{Death rate} = \frac{8}{80} = 0.1 \text{ individual/time interval}$$

- This indicates that 10% of the population died during that interval.

 Quick Tip

Death rate is calculated as deaths divided by total population. Always convert numbers to the same unit (individuals/time interval) for clarity.

Q14. Choose the correct sequence of steps involved in decomposition:

- (1) Fragmentation → Mineralisation → Humification → Leaching → Catabolism
- (2) Fragmentation → Leaching → Catabolism → Humification → Mineralisation
- (3) Fragmentation → Catabolism → Leaching → Humification → Mineralisation
- (4) Fragmentation → Leaching → Catabolism → Mineralisation → Humification

Correct Answer: (2) Fragmentation → Leaching → Catabolism → Humification → Mineralisation

Solution:

- Decomposition is the breakdown of organic matter by detritivores and microbes.
- **Step 1: Fragmentation** – larger debris is broken into smaller pieces by detritivores.
- **Step 2: Leaching** – soluble substances are removed by water.
- **Step 3: Catabolism** – microbial enzymatic breakdown of organic molecules.
- **Step 4: Humification** – formation of humus from partially decomposed matter.
- **Step 5: Mineralisation** – conversion of organic nutrients into inorganic forms usable by plants.

 Quick Tip

Remember the decomposition sequence: Fragmentation → Leaching → Catabolism → Humification → Mineralisation. Focus on the order from physical breakdown to chemical conversion.

Q15. With respect to limitation of Ecological pyramids, which statements are correct?

- a) It does not take into account the same species belonging to two or more trophic levels.
- b) It assumes a simple food chain, something that almost never existed in nature.
- c) It accommodates saprophytes.
- d) It does not accommodate a food web.

- (1) c and d
- (2) a, b and d
- (3) a and b
- (4) b and c

Correct Answer: (2) a, b and d

Solution:

- Ecological pyramids represent energy, biomass, or numbers in trophic levels.
- Limitations:
 - **a)** Cannot show species in multiple trophic levels (e.g., omnivores).
 - **b)** Assumes linear food chain; real ecosystems are complex food webs.
 - **d)** Cannot accommodate complex food webs.
- Saprophytes are decomposers and not represented in trophic pyramids.

 Quick Tip

Remember: Pyramids simplify ecosystems; they cannot depict omnivores, saprophytes, or food webs.

Q16. The 'Sixth Extinction' of species, presently in progress, is how many times faster than the previous five episodes of mass extinctions?

- (1) 1000 to 10000
- (2) 1 to 10
- (3) 10 to 100
- (4) 100 to 1000

Correct Answer: (1) 1000 to 10000

Solution:

- The Sixth Extinction refers to the rapid ongoing loss of species caused by human activities.
- Current extinction rates are estimated 1000–10000 times higher than background rates observed in previous mass extinctions.
- Causes include habitat destruction, overexploitation, pollution, invasive species, and climate change.

 Quick Tip

Associate 'Sixth Extinction' with human-driven species loss, much faster than natural historical extinctions.

Q17. Species diversity as we move away from the ___ towards ___:

- (1) Decreases, Poles, Equator
- (2) Stable, Equator, Poles
- (3) Increases, Equator, Poles
- (4) Decreases, Equator, Poles

Correct Answer: (1) Decreases, Poles, Equator

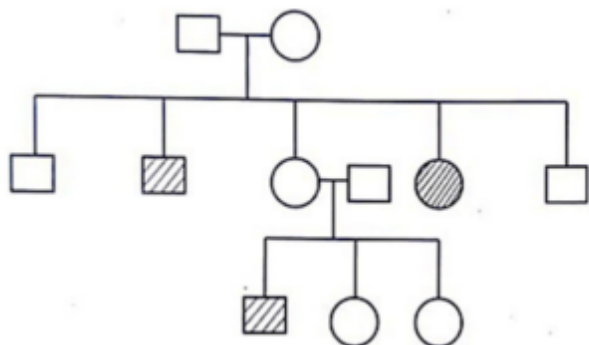
Solution:

- Latitudinal gradient of biodiversity: species diversity is highest at the equator and decreases toward the poles.
- Factors: stable climate, higher primary productivity, and more complex habitats in tropics.
- Polar regions have extreme climates and fewer resources, limiting species diversity.

💡 Quick Tip

Remember: Tropical regions (Equator) = high diversity; Polar regions = low diversity.
This is a fundamental pattern in ecology.

Q18. In a practical examination, the following pedigree chart was given as a spotter for identification. The students identify the given pedigree chart as



- (1) Sex-linked dominant
- (2) Sex-linked recessive
- (3) Autosomal dominant
- (4) Autosomal recessive

Correct Answer: (2) Sex-linked recessive

Solution: A pedigree chart helps determine the inheritance pattern based on distribution of affected individuals across generations and sexes.

- Sex-linked recessive traits appear more in males because they have only one X chromosome.
- Affected males pass the trait to all daughters (carriers), not sons. - The trait can skip generations.

Assuming I-1 is affected male, II-2 carrier daughter, III-1 affected male, this matches sex-linked recessive inheritance seen in hemophilia or color blindness.

- Autosomal dominant: affects both sexes equally, does not skip generations. - Autosomal recessive: requires both parents to be carriers, affects both sexes. - Sex-linked dominant: more females affected, does not skip generations.

Thus, correct identification is sex-linked recessive.

 Quick Tip

Look for male predominance and carrier females in pedigrees to identify sex-linked recessive traits.

Q19. A student observed the T.S. of a plant organ slide under microscope. The vascular bundles in the stelar region were conjoint collateral and open. Identify the organ.

- (1) Monocot Root
- (2) Monocot Stem
- (3) Dicot Root
- (4) Dicot Stem

Correct Answer: (2) Monocot Stem

Solution:

- Conjoint collateral vascular bundles = xylem and phloem together.
- Open vascular bundles have a cambium between xylem and phloem → capable of secondary growth.
- Monocot stems show open, conjoint collateral bundles arranged scattered in ground tissue.
- Roots usually have radial or closed bundles; dicot stems have closed bundles arranged in a ring.

 Quick Tip

Key identifiers: Conjoint + open → Monocot stem; Conjoint + closed → Dicot stem; Radial → Root.

Q20. A student observed the slide of mitosis under the microscope and observed chromosomes at opposite poles. Identify the stage.

- (1) Metaphase
- (2) Telophase
- (3) Prophase
- (4) Anaphase

Correct Answer: (2) Telophase

Solution:

- Telophase is the stage where separated chromatids reach opposite poles.
- Nuclear membrane re-forms around each set; chromosomes decondense into chromatin.
- Metaphase → chromosomes aligned at equatorial plate; Anaphase → chromatids separate; Prophase → chromosomes condense.

💡 Quick Tip

Identify mitotic stages: Chromosome location and spindle attachment are key. Chromosomes at poles = Telophase.

Q21. Identify the incorrect statement with respect to the rules of Binomial Nomenclature.

- (1) Biological names are underlined separately when handwritten
- (2) Biological names are printed in Italics to indicate their non-Latin origin
- (3) The first word represents the genus while second component denotes the specific epithet
- (4) Biological names are generally in Latin or Latinised irrespective of their origin

Correct Answer: (2) Biological names are printed in Italics to indicate their non-Latin origin

Solution:

- Biological names are always Latin or Latinised; italics indicate scientific naming convention, not origin.
- First word = genus (capitalized), second = specific epithet (lowercase).
- When handwritten, underline both words separately.

 Quick Tip

Remember: Italics indicate scientific naming format, not non-Latin origin. Genus capitalized, species lowercase.

Q22. Match Column-I with Column-II and choose the correct option given below:

	Column-I (Bacteria)		Column -II (Shape)
a)	Coccus	i)	Rod-shaped
b)	Bacillus	ii)	Spiral
c)	Vibrium	iii)	Spherical
d)	Spirillum	iv)	Comma-shaped

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

Correct Answer: (4) a-iii, b-i, c-iv, d-ii

Solution: a) Coccus: Refers to spherical-shaped bacteria, so it matches with iii.

b) Bacillus: Refers to rod-shaped bacteria, so it matches with i.

c) Vibrio: Refers to comma-shaped bacteria, so it matches with iv.

d) Spirillum: Refers to spiral-shaped bacteria, so it matches with ii.

Thus, the correct matching is a-iii, b-i, c-iv, d-ii.

 Quick Tip

Match bacterial shapes with their morphological characteristics for accurate pairing.

Q23. Read the given statements:

Statement I: Gemmae are green unicellular sexual buds which develop in receptacles called gemma cups.

Statement II: Protonema develops directly from a spore

- (1) Statement I is false but Statement II is true
- (2) Both Statement I and Statement II are false

- (3) Both Statement I and Statement II are true
(4) Statement I is true but Statement II is false

Correct Answer: (1) Statement I is false but Statement II is true

Solution:

- Gemmae are **asexual** buds, not sexual. They develop in gemma cups for vegetative propagation.
- Protonema is the first filamentous stage of a moss, which develops directly from a haploid spore.

 Quick Tip

Gemmae = asexual, not sexual. Protonema originates from spore in bryophytes.

Q24. During a field trip a student observed a marine organism with worm-like body. The cylindrical body was divisible into proboscis, collar and a long trunk. Identify the organism.

- (1) Pterophyllum
(2) Trygon
(3) Balanoglossus
(4) Ophiura

Correct Answer: (3) Balanoglossus

Solution:

- Balanoglossus is a hemichordate with tripartite body: proboscis, collar, trunk.
- Pterophyllum = freshwater fish; Trygon = stingray; Ophiura = echinoderm (brittle star).

 Quick Tip

Body divisions help in identifying hemichordates. Proboscis + collar + trunk = Balanoglossus.

Q25. Identify the types of aestivation in corolla labelled as 'a', 'b', 'c' and 'd'



- (1) a-Vexillary, b-Imbricate, c-Twisted, d-Valvate
 (2) a-Vexillary, b-Imbricate, c-Valvate, d-Twisted
 (3) a-Vexillary, b-Twisted, c-Imbricate, d-Valvate
 (4) a-Imbricate, b-Valvate, c-Vexillary, d-Twisted

Correct Answer: (1) a-Vexillary, b-Imbricate, c-Twisted, d-Valvate

Solution: Aestivation is the arrangement of petals or sepals in a flower bud.

- Vexillary: one posterior petal overlaps two lateral petals (e.g., pea). - Imbricate: irregular overlapping (e.g., Cassia). - Twisted: one margin overlaps adjacent petal (e.g., China rose). - Valvate: edges meet, no overlapping (e.g., mustard).

Assigning labels logically:

- 'a' → Vexillary - 'b' → Imbricate - 'c' → Twisted - 'd' → Valvate

Thus, option (1) is correct.

💡 Quick Tip

Recall aestivation types with examples: Vexillary (pea), Imbricate (Cassia), Twisted (China rose), Valvate (mustard).

Q26. Match the Column-I with Column-II and choose the correct option:

	Column-I (characteristics of vascular bundle)		Column-II (Transverse section)
a)	Radial, tetrarch, cambial ring between xylem and phloem at later stages	i)	T.S of monocot stem
b)	Conjoint, open and endarch	ii)	T.S of dicot root
c)	Radial, Polyarch, large pith without cambial ring	iii)	T.S of monocot root
d)	Conjoint, closed with sclerenchymatous bundle sheath	iv)	T.S of dicot stem

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

Correct Answer: (1) a - ii, b - iv, c - iii, d - i

Solution: - **a (Radial, tetrarch, cambial ring at later stages)** matches **ii (T.S of dicot root)**: Dicot roots have radial bundles and typically a diarch to tetrarch number of xylem groups. Though typically cambial rings form during secondary growth, the core root characteristics are radial and tetrarch.

- **b (Conjoint, open and endarch)** matches **iv (T.S of dicot stem)**: Dicot stems have conjoint (xylem and phloem together), open (presence of cambium), and endarch (protoxylem towards the pith) vascular bundles.

- **c (Radial, Polyarch, large pith without cambial ring)** matches **iii (T.S of monocot root)**: Monocot roots have radial bundles, polyarch (many xylem groups), a large pith, and lack a cambial ring as they do not undergo secondary growth.

- **d (Conjoint, closed with sclerenchymatous bundle sheath)** matches **i (T.S of monocot stem)**: Monocot stems have conjoint, closed (absence of cambium) bundles, often surrounded by a prominent sclerenchymatous bundle sheath.

- The correct matching combination is **a – ii, b – iv, c – iii, d – i**.

💡 Quick Tip

Remember the key rules: **Roots** are **Radial**, **Stems** are **Conjoint**. **Dicot stems** are **Open** (cambium), **Monocot stems** are **Closed** (no cambium).

Q27. Which of the following statements are correct with respect to Frogs?

- (1) Bidder's canals are present in male Frogs
- (2) Copulatory pads are present in female Frogs
- (3) Sound producing vocal sacs are present in male Frogs
- (4) Cloaca is present in male Frog only

Correct Answer: (1) and (3)

Solution:

- Male frogs have **Bidder's canals** in testes for sperm transport.

- **Copulatory pads** are present in males to hold female during amplexus, not females.

- **Vocal sacs** in male frogs help amplify mating calls.

- Cloaca is present in both male and female frogs for excretion and reproduction.

💡 Quick Tip

Remember: Male frogs → Bidder's canals + vocal sacs + copulatory pads; Cloaca in both sexes.

Q28. The reserve material in prokaryotic cells are stored in the cytoplasm in the form of:

- (1) Exclusion and inclusion bodies
- (2) Fat bodies
- (3) Exclusion bodies
- (4) Inclusion bodies

Correct Answer: (4) Inclusion bodies

Solution:

- Prokaryotic cells store reserve materials as **inclusion bodies** in the cytoplasm.
- Examples: glycogen granules, polyhydroxybutyrate granules, sulfur granules.
- Exclusion bodies refer to pathological aggregates; fat bodies are storage in some eukaryotes.

💡 Quick Tip

In prokaryotes: Inclusion bodies = nutrient storage in cytoplasm.

Q29. The cell wall-less prokaryote among the following is:

- (1) Cyanobacteria
- (2) Mycoplasma
- (3) Bacteria
- (4) Blue-Green Algae

Correct Answer: (2) Mycoplasma

Solution:

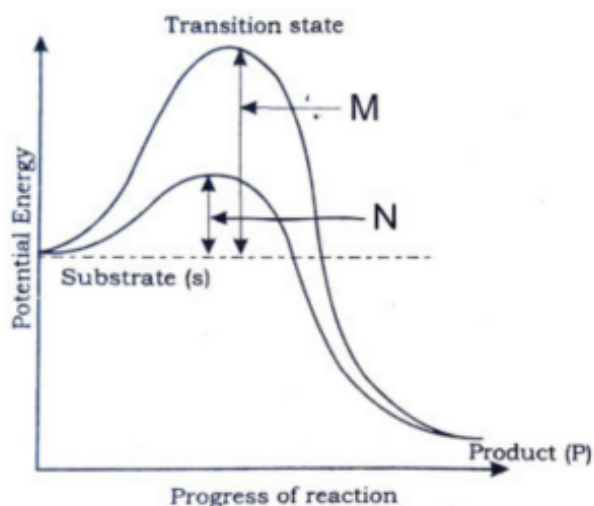
- Mycoplasma are prokaryotes that naturally lack a cell wall.
- Other prokaryotes like Cyanobacteria, Bacteria, and Blue-Green Algae have peptidoglycan-based cell walls.

- Lack of cell wall allows flexibility but makes them sensitive to osmotic stress.

💡 Quick Tip

Cell wall absent = Mycoplasma; Remember it's the only naturally wall-less prokaryote.

Q30. The graph showing the concept of activation energy of enzyme is given below. Observe the graph and choose the correct option for M and N.



- (1) M-High temperature, High activation energy, N-Low temperature, Low activation energy
- (2) M-High substrate, High activation energy, N-Low substrate, Low activation energy
- (3) M-Activation energy without enzyme, N-Activation energy with enzyme
- (4) M-Activation energy with enzyme, N-Activation energy without enzyme

Correct Answer: (3) M-Activation energy without enzyme, N-Activation energy with enzyme

Solution: In enzyme kinetics, activation energy is the energy barrier for a reaction.

- Without enzyme: higher activation energy (M). - With enzyme: lower activation energy (N), as enzyme stabilizes the transition state.

Graph shows:

- Higher peak: uncatalyzed reaction - Lower peak: catalyzed reaction

Options about temperature or substrate are irrelevant to activation energy. Correct identification is M → without enzyme, N → with enzyme.

💡 Quick Tip

Enzymes lower activation energy; identify peaks in energy profiles for catalyzed vs. uncatalyzed reactions.

Q31. Match the stages of prophase I given in Column-I with their features in Column-II and choose the correct options from the choices given below:

Column-I	Column-II
a) Leptotene	i) Exchange of genetic materials between non-sister chromatids of the homologous chromosomes
b) Zygotene	ii) Chromosomes visible under light microscope
c) Pachytene	iii) Dissolution of synaptonemal complex
d) Diplotene	iv) Chromosomes start pairing together
e) Diakinesis	v) Terminalisation of chiasmata

- (1) a-iv, b-i, c-ii, d-iii, e-v
(2) a-ii, b-iv, c-i, d-iii, e-v
(3) a-i, b-ii, c-iii, d-iv, e-v
(4) a-v, b-iv, c-i, d-iii, e-ii

Correct Answer: (1) a-iv, b-i, c-ii, d-iii, e-v

Solution:

a) Leptotene: Chromosomes appear as thin threads, so it matches with iv.

b) Zygotene: Homologous chromosomes pair up and become shorter and thicker, so it matches with i.

c) Pachytene: Crossing over occurs between homologous chromosomes, so it matches with ii.

d) Diplotene: Chromosomes start to separate, and crossing over is visible, so it matches with iii.

e) Diakinesis: Terminalization of chiasmata occurs, so it matches with v.

Thus, the correct matching is a-iv, b-i, c-ii, d-iii, e-v.

 Quick Tip

Understand the sequence and key events of prophase I stages for accurate matching.

Q32. Read the given statements:

Statement-I: In Calvin cycle, Carboxylation is catalysed by PEP Carboxylase

Statement-II: In Hatch-Slack pathway, Carboxylation is catalysed by RuBP Carboxylase

- (1) Statement I is false but Statement II is true
- (2) Both Statement I and Statement II are false
- (3) Both Statement I and Statement II are true
- (4) Statement I is true but Statement II is false

Correct Answer: (1) Statement I is false but Statement II is true

Solution:

- **Calvin cycle** (C3 pathway) uses **RuBP Carboxylase** (Rubisco) for carboxylation of RuBP with CO₂.
- **Hatch-Slack pathway** (C4 pathway) uses **PEP Carboxylase** to fix CO₂ into oxaloacetate.
- Statement I is reversed; Statement II is true.

 Quick Tip

C3: RuBP Carboxylase; C4: PEP Carboxylase. Do not confuse Calvin and Hatch-Slack pathways.

Q33. The TCA cycle starts with the condensation of acetyl group with:

- (1) -Ketoglutaric acid
- (2) Succinic acid
- (3) Oxaloacetic acid
- (4) Citric acid

Correct Answer: (3) Oxaloacetic acid

Solution:

- In the TCA (Krebs) cycle, acetyl-CoA (2C) condenses with oxaloacetic acid (4C) to form **citric acid** (6C).
- This is catalyzed by **citrate synthase**.
- -Ketoglutarate and succinate are intermediate compounds formed later.

💡 Quick Tip

TCA start: Acetyl-CoA + Oxaloacetate → Citrate. Key for remembering Krebs cycle entry step.

Q34. Match the plant growth hormones of Column-I with suitable chemical derivatives present Column-II and choose the correct option given below:

Column-I	Column-II
a) Absciscic acid	i) Adenine derivative
b) Gibberellins	ii) Indole acetic acid
c) Kinetin	iii) Carotenoid derivative
d) Auxin	iv) Terpenes

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

Correct Answer: (1) a-iii, b-iv, c-i, d-ii

Solution:

- **a (Auxin)** is an **Indole compound** (ii), as the primary natural auxin, Indole-3-acetic acid (IAA), is an indole derivative.
- **b (Gibberellin)** is a **Terpene** (iv). Gibberellins (GAs) are synthesized from mevalonic acid pathway intermediates, which classify them as terpenes.
- **c (Cytokinin)** is an **Adenine derivative** (i), with the main natural form (Zeatin) being a modified adenine.
- **d (Absciscic acid - ABA)** is a **Carotenoid derivative** (iii), specifically synthesized from cleavage of carotenoids (xanthophylls) in plants.
- The correct match is: **a – iii, b – iv, c – i, d – ii.**

💡 Quick Tip

Remember the chemical classes: Auxin → Indole; Cytokinin → Adenine; Gibberellin → Terpene; Absciscic Acid → Carotenoid.

Q35. The respiratory mechanism controlled by medulla oblongata can be altered by:

- (1) Both Pneumotaxic and Chemoreceptive areas of pons and medulla oblongata
- (2) Corpus callosum of brain
- (3) Pneumotaxic center in the pons
- (4) Chemoreceptive area in the medulla

Correct Answer: (1) Both Pneumotaxic and Chemoreceptive areas of pons and medulla oblongata

Solution:

- Medulla oblongata controls involuntary respiration via **respiratory centers**.
- **Pneumotaxic center** in pons regulates rate and depth of breathing.
- **Chemoreceptive areas** detect CO₂, O₂ and pH changes to modify respiration.
- Corpus callosum is for brain hemispheric communication; not respiratory control.

 Quick Tip

Respiration centers: Medulla + Pons → control breathing rate and depth. Remember chemoreceptors for feedback.

Q36. Which among the three layers of blood vessel wall—Tunica intima, Tunica media, and Tunica externa—is comparatively thin in the veins?

- (1) Tunica externa
- (2) Both tunica media and tunica externa
- (3) Tunica media
- (4) Tunica intima

Correct Answer: (3) Tunica media

Solution:

- Blood vessels have three layers:
 1. **Tunica intima:** Innermost endothelial layer, providing smooth lining for blood flow.
 2. **Tunica media:** Middle layer made of smooth muscle and elastic fibers, regulates vessel diameter and blood pressure.
 3. **Tunica externa (adventitia):** Outer connective tissue layer, provides mechanical support and prevents overexpansion.
- In **arteries**, tunica media is thick due to high pressure and elastic recoil.
- In **veins**, tunica media is **thin** as veins operate under lower pressure and rely on valves and surrounding skeletal muscles for blood return.
- Tunica externa is relatively thicker in veins to provide structural support.

💡 Quick Tip

Artery: Thick tunica media; Vein: Thin tunica media, thick tunica externa. Always link thickness to pressure handled by the vessel.

Q37. In nephron, transport of substances like sodium chloride and urea is facilitated by the special arrangement called counter-current mechanism that comprises of:

- (1) Vasa Recta and collecting duct
- (2) Ascending limb and collecting duct
- (3) Henle's loop and Vasa Recta
- (4) Henle's loop and glomerulus

Correct Answer: (3) Henle's loop and Vasa Recta

Solution:

- The **counter-current mechanism** is crucial for concentrating urine and maintaining osmotic gradient in kidney medulla.
- Components: **Henle's loop** (descending and ascending limbs) and **Vasa Recta** (peritubular capillaries).
- Mechanism:
 1. Descending limb is permeable to water but not solutes → water moves out, concentrating filtrate.
 2. Ascending limb is impermeable to water but actively pumps out Na^+ and Cl^- → dilutes filtrate.
 3. Vasa recta maintains osmotic gradient by absorbing water and solutes in opposite direction (counter-current exchange).
- Collecting duct also participates but counter-current system is defined by Henle's loop + Vasa Recta.

💡 Quick Tip

Counter-current mechanism = Henle + Vasa Recta. Remember: descending = water out, ascending = salts out, maintains medullary osmotic gradient.

Q38. In the mechanism of muscle contraction or shortening of muscle, the ___ get reduced whereas the ___ retain the length.

- (1) Z line, I bands
- (2) A bands, Z line

- (3) A bands, I bands
- (4) I bands, A bands

Correct Answer: (4) I bands, A bands

Solution:

- Skeletal muscle contraction follows the **sliding filament theory**:
- 1. **Thin filaments (actin)** slide over **thick filaments (myosin)**.
- 2. **A-band** (length of myosin) remains constant as thick filaments do not shorten.
- 3. **I-band** (region with only actin) **reduces** as filaments slide over each other.
- 4. **Z-lines** move closer, shortening the sarcomere and thus the whole muscle.
- So, I-bands shorten, A-bands retain length during contraction.

💡 Quick Tip

Sliding filament theory: A-band constant, I-band shortens. Z-line movement indicates contraction.

Q39. Identify the correct sequence of action potential as it arrives at the axon terminal from the choices given below:

- (1) Axon terminal → Post-synaptic membrane → Synaptic cleft → Synaptic vesicles → Post-synaptic neuron
- (2) Axon terminal → Synaptic vesicles → Post-synaptic membrane → Synaptic cleft → Post-synaptic neuron
- (3) Axon terminal → Synaptic vesicles → Synaptic cleft → Post-synaptic membrane → Post-synaptic neuron
- (4) Axon terminal → Synaptic cleft → Synaptic vesicles → Post-synaptic neuron → Post-synaptic membrane

Correct Answer: (3) Axon terminal → Synaptic vesicles → Synaptic cleft → Post-synaptic membrane → Post-synaptic neuron

Solution:

- Steps of neurotransmission at chemical synapse:
- 1. Arrival of **action potential at axon terminal**.
- 2. Depolarization opens voltage-gated Ca^{2+} channels → **synaptic vesicles** release neurotransmitter.
- 3. Neurotransmitter diffuses across the **synaptic cleft**.
- 4. Binds to receptors on **post-synaptic membrane**, generating postsynaptic potential.
- 5. Signal propagates in **post-synaptic neuron**.

- Sequence reflects the correct flow of information in chemical synapses.

💡 Quick Tip

Synapse steps: AP arrives → vesicles release → cleft diffusion → postsynaptic binding → neuron activation.

Q40. Identify the statement/s given below that does not correspond to the functions of cortisol:

- i) Maintains cardiovascular system and kidney functions
- ii) Produces anti-inflammatory reactions
- iii) Maintains electrolyte balance, osmosis and blood pressure
- iv) Suppresses immune response
- v) Stimulates RBC production

- (1) iii only
- (2) iv only
- (3) i and ii only
- (4) iii and iv only

Correct Answer: (1) iii only

Solution:

- Cortisol is a glucocorticoid hormone from adrenal cortex; its main functions:
- 1. **Maintains cardiovascular function** by sensitizing vessels to catecholamines → i is true.
- 2. **Anti-inflammatory action** by inhibiting cytokines and prostaglandins → ii is true.
- 3. **Does not directly maintain electrolyte balance, osmosis, or BP** → iii is false; aldosterone is responsible for these.
- 4. **Suppresses immune response** (iv) → actually true for preventing excessive immunity.
- 5. **Does not stimulate RBC production** (v) → this is function of erythropoietin.

💡 Quick Tip

Cortisol = stress hormone, anti-inflammatory, regulates metabolism. Electrolytes BP → aldosterone, not cortisol.

Q41. When pollen grains of a flower of plant pollinate the stigma of a flower of another plant, it is called:

- (1) Dichogamy
- (2) Geitonogamy
- (3) Xenogamy
- (4) Autogamy

Correct Answer: (3) Xenogamy

Solution:

- **Xenogamy** = cross-pollination between different plants → genetic variation.
- **Autogamy** = self-pollination within the same flower.
- **Geitonogamy** = transfer of pollen between flowers of the same plant.
- **Dichogamy** = temporal separation of male and female maturation in same flower.

💡 Quick Tip

Xenogamy = cross-plant fertilization; remember: auto = self, geito = same plant, dichogamy = timing difference.

Q42. Fusion of a male gamete with the central cell in the embryo sac of an angiosperm is called:

- (1) Syngamy
- (2) Apomixis
- (3) Double fertilization
- (4) Triple fusion

Correct Answer: (4) Triple fusion

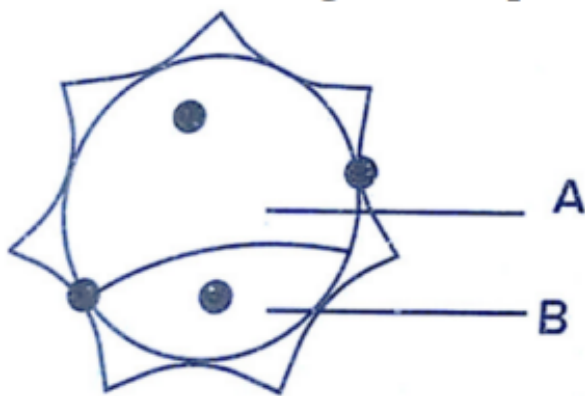
Solution:

- In angiosperms, **double fertilization** occurs:
 1. One sperm fuses with egg → forms **zygote** (syngamy).
 2. Other sperm fuses with **two polar nuclei** in central cell → forms **triploid primary endosperm** (triple fusion).
- **Apomixis** = asexual seed formation without fertilization.
- So, fusion with central cell specifically = **triple fusion**.

💡 Quick Tip

Double fertilization: sperm + egg = zygote; sperm + 2 polar nuclei = triploid endosperm (triple fusion). Key for angiosperms.

Q43. Which of these options is true in the context of the below diagram of pollen grain?



- (1) 'A' is a generative cell which gives rise to pollen tube and 'B' is a vegetative cell which forms male gametes
- (2) 'A' is a vegetative cell with abundant food reserve and 'B' is a generative cell which forms male gametes
- (3) 'A' is a generative cell which forms male gametes and 'B' is a vegetative cell which produces pollen tube
- (4) 'A' is a vegetative cell which gives rise to male gametes and 'B' is a generative cell which produces pollen tube

Correct Answer: (3) 'A' is a generative cell which forms male gametes and 'B' is a vegetative cell which produces pollen tube

Solution: Pollen grain contains:

- Generative cell: divides to form two male gametes during pollen tube growth.
- Vegetative cell: larger cell forming pollen tube with food reserves.

In diagram:

- 'A' → generative cell → male gametes
- 'B' → vegetative cell → pollen tube

Option (3) correctly assigns roles.

💡 Quick Tip

Remember: Generative cell → male gametes, Vegetative cell → pollen tube in pollen grain structure.

Q44. Match the hormone with its site of production:

Hormone	Site of production
a) hCG and hPL	i) Ovary
b) Progesterone	ii) Placenta
c) Androgens	iii) Corpus luteum
d) Relaxin	iv) Leydig cells

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

Correct Answer: (3) a-ii, b-iii, c-iv, d-i

Solution:

- **a (hCG and hPL)** are produced primarily by the **Placenta** (ii).
- **b (Progesterone)** is initially produced by the **Corpus luteum** (iii) and later in pregnancy also by the placenta.
- **c (Androgens)** are produced by the **Leydig cells** (iv) in the testes.
- **d (Relaxin)** is produced by the **Ovary** (i) (specifically the corpus luteum) and the placenta during pregnancy.
- The correct matching combination is **a – ii, b – iii, c – iv, d – i**.

 Quick Tip

Hormones like hCG and hPL are unique to pregnancy and are placental hormones. Progesterone and Relaxin have multiple sources during the reproductive cycle.

Q45. Choose the correct sequence of sperm transport during ejaculation:

- (1) Seminiferous tubules → vasa efferentia → rete testis → epididymis → vas deferens → ejaculatory duct
(2) Seminiferous tubules → rete testis → epididymis → vas deferens → vasa efferentia → ejaculatory duct
(3) Seminiferous tubules → rete testis → vasa efferentia → epididymis → vas deferens → ejaculatory duct
(4) Seminiferous tubules → rete testis → epididymis → vasa efferentia → vas deferens → ejaculatory duct

Correct Answer: (3) Seminiferous tubules → rete testis → vasa efferentia → epididymis → vas deferens → ejaculatory duct

Solution:

- **Seminiferous tubules:** site of spermatogenesis in testes.
- **Rete testis:** network connecting seminiferous tubules to vasa efferentia.
- **Vasa efferentia:** transport sperm from rete testis to epididymis.
- **Epididymis:** sperm maturation and storage.
- **Vas deferens:** muscular tube carrying sperm from epididymis to ejaculatory duct.
- **Ejaculatory duct:** connects vas deferens to urethra for ejaculation.
- Sequence reflects proper anatomical flow from sperm production to release.

 Quick Tip

Sperm transport sequence: Testes → Rete testis → Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct → Urethra.

Q46. Select the mismatched pair:

- a) First month of pregnancy – Formation of heart
- b) Second month of pregnancy – Movement of foetus
- c) Third month of pregnancy – Formation of most of the major organ systems
- d) Sixth month of pregnancy – Eye lids separate and eye lashes are formed

- (1) c
- (2) d
- (3) a
- (4) b

Correct Answer: (4) b Second month – Movement of foetus

Solution:

- **First month:** Formation of heart begins (organogenesis starts).
- **Second month:** Limbs, fingers, eyes develop; foetal movement is minimal and not perceptible externally (movements usually detectable 4th–5th month).
- **Third month:** Major organ systems completed.
- **Sixth month:** Eyelids separate, eyelashes and eyebrows develop.
- Therefore, statement b is mismatched.

 Quick Tip

Foetal development: Heart → month 1; Limbs, face → month 2; Organ systems → month 3; Eye lashes external features → month 6.

Q47. Out of the following options, identify which one is NOT a natural method of contraception:

- (1) Lactational amenorrhea
- (2) Periodic abstinence
- (3) Coitus interruptus
- (4) Implants

Correct Answer: (4) Implants

Solution:

- **Natural methods:** No artificial device or chemical, e.g.,
- Lactational amenorrhea (temporary infertility during breastfeeding).
- Periodic abstinence (avoiding intercourse during fertile period).
- Coitus interruptus (withdrawal method).
- **Implants:** artificial hormonal device → artificial method, not natural.

 Quick Tip

Natural contraception = no devices or chemicals; Implants and IUDs are artificial methods.

Q48. In zygote intrafallopian tube transfer, the embryo up to which stage is transferred into the fallopian tube?

- (1) 8 blastomeres
- (2) 32 blastomeres
- (3) 2 blastomeres
- (4) 16 blastomeres

Correct Answer: (1) 8 blastomeres

Solution:

- **ZIFT (Zygote Intrafallopian Transfer):** fertilized zygote (1-cell) cultured in vitro until 8-cell stage.
- Embryo then transferred into fallopian tube for natural implantation in uterus.
- Advantages: allows natural transport to uterus, mimics in vivo fertilization timing.
- Later stages (16, 32 blastomeres) are transferred in IVF directly into uterus.

💡 Quick Tip

ZIFT = 1-cell → 8-cell zygote into fallopian tube; IVF embryo transfer = later stage into uterus.

Q49. Read the following statements:

Statement I: MTP is to get rid of unwanted pregnancies due to casual unprotected intercourse, contraceptive failure, or rape.

Statement II: MTPs are performed legally by qualified doctors with proper medical justification.

- (1) Statement I correct, Statement II incorrect
- (2) Statement I incorrect, Statement II correct
- (3) Both statements I and II correct
- (4) Both statements I and II incorrect

Correct Answer: (3) Both statements I and II correct

Solution:

- **MTP (Medical Termination of Pregnancy)** is performed to terminate unwanted pregnancy safely.
- Legal requirements: must be done by certified doctors in authorized clinics with proper medical justification.
- Statement I correctly explains purpose; Statement II correctly explains legal framework.

💡 Quick Tip

MTP = safe, legal abortion. Key: both purpose and legal execution must be considered.

Q50. How many types of gametes will be formed by a parent with genotype 'AaBbCc'?

- (1) 8
- (2) 12
- (3) 6
- (4) 4

Correct Answer: (1) 8

Solution:

- Number of gametes = 2^n , where n = number of heterozygous loci.
- Given genotype: AaBbCc → 3 heterozygous loci (A, B, C).
- Total gametes = $2^3 = 8$.
- Possible gametes: ABC, ABc, AbC, Abc, aBC, aBc, abC, abc.

💡 Quick Tip

Gametes = combination of alleles from heterozygous loci only. Formula: 2^n , n = number of heterozygotes.

Q51. When a single gene exhibits multiple phenotypic expressions, the phenomenon is called:

- (1) Pleiotropy
- (2) Co-dominance
- (3) Polygenic inheritance
- (4) Incomplete dominance

Correct Answer: (1) Pleiotropy

Solution:

- **Pleiotropy:** single gene influences multiple, apparently unrelated traits.
- Example: Marfan syndrome → mutation in fibrillin gene affects skeletal system, eyes, cardiovascular system.
- Co-dominance → both alleles expressed equally.
- Polygenic inheritance → multiple genes affect single trait.
- Incomplete dominance → heterozygote shows intermediate phenotype.

💡 Quick Tip

Pleiotropy = one gene, multiple effects. Polygenic = many genes, one effect. Co-dominance = both alleles expressed. Incomplete = intermediate.

Q52. A colourblind man marries a carrier woman. The percentage of their colourblind progeny in the next generation will be:

- (1) 75%
- (2) 100%
- (3) 25%

(4) 50%

Correct Answer: (4) 50%

Solution:

- **Colour blindness:** X-linked recessive (X^c).
- Father: X^cY ; Mother: X^CX^c (carrier).
- Punnett square:

	X^C	X^c
X^c	X^CX^c	X^cX^c
Y	X^CY	X^cY

- Progeny: 2 out of 4 males will be colourblind $\rightarrow$ 50%. Females: 1 carrier, 1 affected $\rightarrow$ only males counted usually.

 Quick Tip

X-linked recessive inheritance: Males XY, Females XX. Carrier female + affected male $\rightarrow$ 50

Q53. Identify the option where the features listed for both Down's Syndrome and Turner's Syndrome are correct:

	Down's syndrome symptoms	Turner's syndrome symptoms
a)	Short -statured individual	Gynaecomastia in man
b)	Round head, partially open mouth	Overall masculine development
c)	Broad palm, physical and mental development retarded	Sterile females with rudimentary ovaries
d)	Additional copy of an X-chromosome	Absence of an X-chromosome

- (1) a
- (2) b
- (3) c
- (4) d

Correct Answer: (3) c

Solution:

- **Pair (c)** is correct: **Down's Syndrome** is characterized by broad palms and intellectual/physical developmental delays. **Turner's Syndrome** is characterized by sterile females with underdeveloped (rudimentary) ovaries.
- **Pair (a)** is incorrect: Gynaecomastia is a feature of Klinefelter's Syndrome (**47, XXY**), not Turner's Syndrome (**45, X**).
- **Pair (b)** is incorrect: Overall masculine development does not describe Turner's Syndrome (which results in sterile females).
- **Pair (d)** is incorrect: The Down's Syndrome feature listed (additional copy of an X-chromosome) describes Klinefelter's Syndrome (**47, XXY**), not Down's (which is Trisomy 21).

 Quick Tip

Associate **Down's Syndrome** with **Trisomy 21** (autosomal), and **47** total chromosomes. Associate **Turner's Syndrome** with **45, X** (monosomy of sex chromosome), resulting in sterile female features.

Q54. RNA polymerase II is responsible for the transcription of:

- (1) hnRNA
- (2) snRNA
- (3) tRNA
- (4) rRNA

Correct Answer: (1) hnRNA

Solution:

- RNA polymerase II transcribes **heterogeneous nuclear RNA (hnRNA)**, which is processed into mRNA in eukaryotes.
- RNA polymerase I → rRNA, RNA polymerase III → tRNA and 5S rRNA.
- hnRNA contains introns and exons → splicing yields mature mRNA.

 Quick Tip

Eukaryotic transcription: Pol I → rRNA, Pol II → mRNA/hnRNA, Pol III → tRNA & 5S rRNA.

Q55. Which of the following enzymes increases the permeability of the bacterial cell to lactose?

- (1) Transacetylase
- (2) Amylase
- (3) -galactosidase
- (4) Permease

Correct Answer: (4) Permease

Solution:

- **Lac permease:** membrane protein facilitating uptake of lactose into bacterial cell.
- -galactosidase: hydrolyses lactose → glucose + galactose.
- Transacetylase: detoxifies non-metabolizable lactose analogues.
- Amylase: hydrolyzes starch, irrelevant for lactose.

💡 Quick Tip

Lactose uptake: Permease brings lactose in, -galactosidase breaks it down. Permease increases membrane permeability to lactose.

Q56. Which of the following statements are correct with reference to prokaryotic genome?

- (1) Monocistronic structural genes
- (2) Introns absent in structural genes
- (3) Transcription and translation are coupled processes
- (4) Primary transcript undergoes splicing
- (5) Only one RNA polymerase is present

Correct Answer: (2), (3), (5)

Solution:

- **Prokaryotic genome characteristics:**
- Usually **polycistronic** operons exist (one mRNA codes for multiple proteins), so option 1 is incorrect.
- **Introns are absent** in prokaryotic structural genes → option 2 correct.
- **Transcription and translation are coupled** in cytoplasm since no nucleus → option 3 correct.
- No splicing occurs in prokaryotes → option 4 incorrect.

- **Single RNA polymerase** synthesizes all RNA types → option 5 correct.

💡 Quick Tip

Prokaryotic genome: Polycistronic operons, no introns, transcription & translation coupled, single RNA polymerase, no splicing.

Q57. When a change in the gene frequency of a population occurs by chance, it is called:

- (1) Genetic recombination
- (2) Genetic drift
- (3) Founder effect
- (4) Gene migration

Correct Answer: (2) Genetic drift

Solution:

- **Genetic drift:** Random fluctuations in allele frequencies due to chance, especially in small populations.
- Example: A few individuals reproduce by chance → some alleles may be lost.
- Distinction:
- Founder effect: a type of genetic drift in new populations.
- Genetic recombination: exchange of alleles during meiosis.
- Gene migration: movement of alleles between populations.

💡 Quick Tip

Genetic drift = random allele frequency change; more pronounced in small populations; includes founder effect.

Q58. Darwin's finches represent one of the best examples of:

- (1) Chemical evolution
- (2) Genetic equilibrium
- (3) Seasonal migration
- (4) Adaptive radiation

Correct Answer: (4) Adaptive radiation

Solution:

- **Adaptive radiation:** diversification of a single ancestral species into multiple species adapted to different ecological niches.
- Darwin's finches on Galapagos Islands: different beak shapes evolved according to food sources.
- Not chemical evolution (origin of life), not genetic equilibrium (population stability), not migration.

💡 Quick Tip

Adaptive radiation = one species → multiple species in different niches; classic example: Darwin's finches.

Q59. Choose the correct statements from the following:

- (1) Charles Darwin travelled around the world in a ship called HMS Beagle
- (2) There has been gradual evolution of life forms
- (3) According to Darwin, fitness refers to physical fitness only
- (4) Fossils are remains of hard parts of life forms found in rocks
- (5) Hugo De Vries, a naturalist worked in Malay Archipelago

Correct Answer: 1, 2, 4

Solution:

- 1) True: Darwin's voyage on HMS Beagle (1831–1836).
- 2) True: gradual evolution through natural selection.
- 3) False: fitness = reproductive success, not physical fitness.
- 4) True: fossils = preserved hard parts (bones, shells) of organisms.
- 5) False: Hugo De Vries worked on mutation theory in the Netherlands, not Malay Archipelago.

💡 Quick Tip

Darwin facts: HMS Beagle voyage, gradual evolution, fitness = reproductive success; fossils preserve hard parts; De Vries = mutation theory, Netherlands.

Q60. In which of the following, HIV replicates and produces its progeny viruses?

- (1) Killer T-lymphocytes
- (2) Suppressor T-lymphocytes
- (3) Helper T-lymphocytes

(4) Memory T-lymphocytes

Correct Answer: (3) Helper T-lymphocytes

Solution:

- **HIV targets CD4+ cells:** mainly helper T-lymphocytes.
- Virus binds to CD4 receptor + co-receptor → enters cell → reverse transcription → viral replication → new virions released.
- Killer T-cells (cytotoxic) destroy infected cells, not main replication site.
- Suppressor and memory T-cells less affected.

 Quick Tip

HIV = retrovirus; primary target = CD4+ helper T-cells; replication occurs inside helper T-lymphocytes, reducing immune defense.
