

AIIMS Paramedical Biology

Sample Paper – 8

Duration: 30 Minutes

Maximum Marks: 30

Instructions

- This paper contains **30** Multiple Choice Questions (Single Correct Answer), modelled on the Biology portion of **AIIMS Paramedical** entrance.
- Each correct answer carries **+1 mark**. Each incorrect answer attracts a **penalty of $-\frac{1}{3}$ mark**. Unattempted questions carry **0 marks**.
- Only **one** option is correct. Choose carefully.
- Syllabus level: **Class 11 & 12 NCERT Biology**
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited.

- Q1.** Which of the following statements about the terms *species* and *taxon* is correct?
- (A) A species is the basic taxonomic unit, while a taxon is any unit at any rank of the classification hierarchy.
- (B) A taxon is always lower in rank than a species.
- (C) Species and taxon are exactly synonymous and interchangeable terms.
- (D) A taxon refers only to the kingdom level of classification.
- Q2.** A document that contains the comprehensive information on any one taxon, such as a complete account of all known oak species, is called a:
- (A) Flora
- (B) Monograph
- (C) Manual



(D) Catalogue

Q3. Slime moulds are placed in the kingdom Protista. Under unfavourable conditions, the plasmodium of an acellular slime mould:

- (A) Produces motile zoospores that swim away
- (B) Forms a chitinous mycelium like true fungi
- (C) Differentiates and forms fruiting bodies bearing spores with true walls
- (D) Converts entirely into a single large diploid gamete

Q4. Which of the following is correctly matched with respect to the economic importance of algae?

- (A) Agar — obtained from *Chlorella*
- (B) Carrageenan — obtained from green algae
- (C) Single-cell protein — obtained from *Gelidium*
- (D) Algin — obtained from brown algae

Q5. Which feature is the distinctive hallmark of the phylum Echinodermata?

- (A) Presence of a closed circulatory system with haemoglobin
- (B) Soft body covered by a calcareous shell secreted by a mantle
- (C) Metamerically segmented body with a true coelom
- (D) A water vascular system with tube feet and an endoskeleton of calcareous ossicles

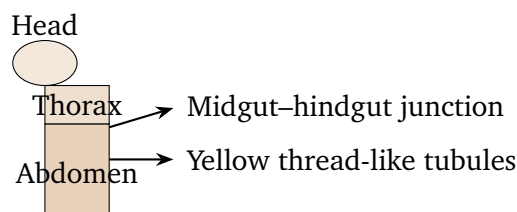
Q6. In the tissue-system organisation of a plant, the cortex, pericycle, pith and medullary rays together constitute the:

- (A) Ground tissue system
- (B) Epidermal tissue system
- (C) Vascular tissue system



(D) Dermal tissue system

Q7. The diagram shows a simplified dorsal view of the cockroach body regions. The structures labelled in the cockroach that carry out excretion by removing nitrogenous waste from the haemolymph are the:



- (A) Hepatic caecae
- (B) Malpighian tubules
- (C) Salivary glands
- (D) Phallic glands

Q8. Which statement about the plant cell wall is correct?

- (A) The middle lamella is the innermost layer made up of pure cellulose.
- (B) The primary wall is rigid, thick and incapable of growth.
- (C) The middle lamella is mainly made of calcium pectate and cements adjacent cells together.
- (D) The secondary wall is always absent in all mature plant cells.

Q9. Which of the following correctly describes a feature of nucleic acids?

- (A) In DNA, adenine pairs with cytosine through three hydrogen bonds.
- (B) RNA contains the sugar deoxyribose and the base thymine.
- (C) The two strands of a DNA double helix run in the same (parallel) direction.
- (D) A nucleotide consists of a nitrogenous base, a pentose sugar and a phosphate group.



- Q10.** The loss of water in the form of liquid droplets from the margins or tips of leaves of small herbaceous plants, usually in the early morning, is called:
- (A) Guttation
 - (B) Transpiration
 - (C) Imbibition
 - (D) Plasmolysis
- Q11.** Which of the following statements correctly distinguishes C_4 plants from C_3 plants?
- (A) In C_4 plants the first stable product is the 3-carbon 3-phosphoglyceric acid (PGA).
 - (B) C_4 plants possess Kranz anatomy and the primary CO_2 acceptor is phosphoenolpyruvate (PEP).
 - (C) C_4 plants show high rates of photorespiration compared with C_3 plants.
 - (D) C_4 plants lack the enzyme RuBisCO entirely.
- Q12.** During alcoholic fermentation carried out by yeast, pyruvic acid is converted to ethanol. The two enzymes that catalyse this conversion are:
- (A) Hexokinase and aldolase
 - (B) Lactate dehydrogenase and enolase
 - (C) Pyruvate decarboxylase and alcohol dehydrogenase
 - (D) Citrate synthase and fumarase
- Q13.** A patient shows chronic inflammation of the bronchi and bronchioles with difficulty in breathing due to spasm of smooth muscles surrounding them. This condition is characteristic of:
- (A) Emphysema caused by long-term cigarette smoking
 - (B) Occupational respiratory disease (silicosis)



- (C) Pneumonia of the alveoli
- (D) Asthma

Q14. A fall in blood volume and blood pressure is sensed by the juxtaglomerular cells of the kidney. This directly triggers the release of:

- (A) Renin, activating the renin–angiotensin–aldosterone mechanism
- (B) Atrial natriuretic factor from the heart
- (C) Anti-diuretic hormone from the kidney itself
- (D) Insulin from the pancreatic islets

Q15. Which hormone–source pairing is correct?

- (A) Glucagon — secreted by the beta cells of the islets of Langerhans
- (B) Adrenaline — secreted by the adrenal medulla
- (C) Insulin — secreted by the adrenal cortex
- (D) Cortisol — secreted by the alpha cells of the pancreas

Q16. After fertilisation in a flowering plant, which transformation is correctly stated?

- (A) The ovule develops into the fruit and the ovary into the seed.
- (B) The zygote develops directly into the endosperm.
- (C) The ovary develops into the fruit and the ovule into the seed.
- (D) The integuments degenerate completely and no seed coat is formed.

Q17. In the human male, the hormone that acts on the Leydig (interstitial) cells of the testis to stimulate the synthesis and secretion of testosterone is:

- (A) Follicle stimulating hormone (FSH)
- (B) Prolactin
- (C) Oxytocin



(D) Luteinising hormone (LH)

Q18. Which of the following is the most effective preventive measure against the transmission of sexually transmitted diseases (STDs)?

- (A) Taking oral contraceptive pills regularly
- (B) Using intrauterine devices (IUDs)
- (C) Undergoing tubectomy or vasectomy
- (D) Avoiding multiple partners and using condoms / barrier methods

Q19. Which statement correctly distinguishes a test cross from a back cross?

- (A) A test cross is a cross of an individual with the homozygous recessive parent; every test cross is a back cross but every back cross is not a test cross.
- (B) A test cross always involves crossing two heterozygous individuals.
- (C) A back cross can only be made with the homozygous dominant parent.
- (D) Test cross and back cross are identical in every case without exception.

Q20. Sickle-cell anaemia is caused by the substitution of:

- (A) Valine by glutamic acid at the sixth position of the alpha-globin chain
- (B) Glutamic acid by valine at the sixth position of the beta-globin chain
- (C) Glutamic acid by valine at the sixth position of the alpha-globin chain
- (D) Lysine by valine at the second position of the beta-globin chain

Q21. In a transcription unit of DNA, the strand that has the polarity $3' \rightarrow 5'$ and acts as the template for RNA synthesis is referred to as the:

- (A) Coding strand
- (B) Sense strand



- (C) Antisense (coding) strand of the messenger RNA
- (D) Template strand

Q22. The process of charging of tRNA, in which an amino acid is activated in the presence of ATP and linked to its specific tRNA, is called:

- (A) Aminoacylation of tRNA
- (B) Capping of the transcript
- (C) Splicing of introns
- (D) Polyadenylation

Q23. Which of the following best describes the evidence for evolution provided by fossils?

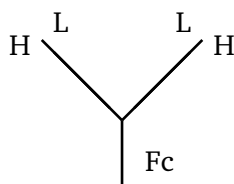
- (A) Fossils prove that all present-day species appeared simultaneously.
- (B) The study of fossils in different sedimentary rock strata indicates the geological time at which organisms existed and shows a sequence of evolutionary forms.
- (C) Fossils are remains found only in the topmost (youngest) layer of rock.
- (D) Fossils provide no information about the age of organisms.

Q24. Typhoid fever caused by *Salmonella typhi* can be confirmed by a particular diagnostic test. That test is the:

- (A) ELISA test
- (B) Mantoux test
- (C) Widal test
- (D) Benedict's test

Q25. The diagram represents the basic structure of an antibody molecule. An immunoglobulin is correctly represented as having:





- (A) Four light chains only, with no heavy chains
- (B) One heavy chain and three light chains
- (C) Two identical heavy chains and two identical light chains, forming an H_2L_2 structure
- (D) Two heavy chains and four light chains arranged linearly

Q26. Which microorganism–product pairing used in industry is correctly matched?

- (A) *Aspergillus niger* — citric acid
- (B) *Acetobacter aceti* — lactic acid
- (C) *Clostridium butylicum* — acetic acid
- (D) *Lactobacillus* — citric acid

Q27. In the production of a biotechnological product, the processes of separation and purification of the product, followed by formulation and quality control, after completion of the reaction in the bioreactor, are together called:

- (A) Upstream processing
- (B) Downstream processing
- (C) Gene cloning
- (D) Bioremediation

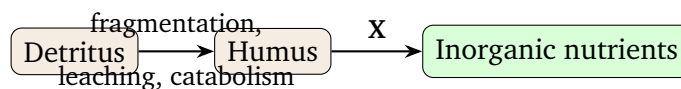
Q28. The method of introducing foreign DNA into plant cells by bombarding them with high-velocity micro-particles of gold or tungsten coated with DNA is known as:

- (A) Microinjection



- (B) Electroporation
- (C) Biolistics (gene gun method)
- (D) *Agrobacterium*-mediated transfer

Q29. The decomposition process breaks down detritus into inorganic nutrients. The correct sequence of steps in decomposition is shown below; identify the process represented by the arrow marked **X**, in which humus is degraded to release inorganic nutrients.



- (A) Mineralisation
- (B) Fragmentation
- (C) Leaching
- (D) Catabolism

Q30. Which statement about biodiversity conservation is correct?

- (A) Biodiversity hotspots are regions of high endemism and high levels of threatened habitat, prioritised for in-situ conservation.
- (B) The Red Data Book is a record of common and abundant species only.
- (C) Hotspots are areas that have no endemic species at all.
- (D) Ex-situ conservation means protecting a species inside its natural habitat.



Detailed Solutions

Q1.

Solution

Concept — Species and taxon: Taxonomy arranges organisms in a hierarchy of ranks. A *taxon* is a taxonomic group of any rank, whereas a *species* is one particular rank (the basic unit).

Step 1 — Define species: A species is the lowest, basic taxonomic unit, made of individuals that are fundamentally similar and can interbreed.

Step 2 — Define taxon: A taxon represents a real group of organisms recognised at *any* level of the hierarchy — kingdom, phylum, class, order, family, genus or species. Thus Mammalia (a class) and Insecta (a class) are taxa, just as a single species is a taxon.

Why other options are wrong:

- Option B: A taxon is not always lower than a species; it can be of any rank.
- Option C: They are not synonymous; species is one specific rank.
- Option D: A taxon is not restricted to the kingdom level.

Final Answer: A species is the basic unit while a taxon is a group at any rank ⇒

A

Answer: (A) [Go Back to Q1](#)

Q2.

Solution

Concept — Taxonomic aids: Flora, manuals, monographs and catalogues are written records that help in identification and documentation.

Step 1 — Monograph: A monograph contains complete and comprehensive information on any *one* taxon, for example all the species of one genus.

Step 2 — Match: A complete account of all known oak species (genus *Quercus*) is exactly a monograph.

Why other options are wrong:

- Option A: A flora describes the plants of a particular area or period.
- Option C: A manual provides information for identification of names of species in an area.



- Option D: A catalogue is merely a systematic list.

Final Answer: Comprehensive account of one taxon = monograph $\Rightarrow$ **B**

Answer: (B) [Go Back to Q2](#)

Q3.

Solution

Concept — Slime moulds: These are saprophytic protists. The body moves as an aggregation of protoplasm called the plasmodium.

Step 1 — Favourable conditions: Under suitable conditions the plasmodium grows and spreads over decaying material.

Step 2 — Unfavourable conditions: The plasmodium differentiates and forms fruiting bodies that bear spores at their tips. The spores possess true walls and are extremely resistant, surviving for many years.

Why other options are wrong:

- Option A: Spores, not swimming zoospores, are formed in unfavourable conditions.
- Option B: Slime moulds do not form a chitinous fungal mycelium.
- Option D: They do not convert into a single large gamete.

Final Answer: The plasmodium forms fruiting bodies bearing walled spores $\Rightarrow$ **C**

Answer: (C) [Go Back to Q3](#)

Q4.

Solution

Concept — Economic importance of algae: Many commercial products are obtained from specific algal groups.

Step 1 — Algin: Algin is a hydrocolloid obtained from the cell walls of brown algae (Phaeophyceae), such as *Laminaria*.

Step 2 — Verify: Agar comes from red algae (*Gelidium*, *Gracilaria*); carrageenan also comes from red algae; *Chlorella* is the source of single-cell protein.

Why other options are wrong:

- Option A: Agar is from red algae, not *Chlorella*.



- Option B: Carrageenan is from red algae, not green algae.
- Option C: Single-cell protein is from *Chlorella*, not *Gelidium*.

Final Answer: Algin is obtained from brown algae $\Rightarrow$ D

Answer: (D) [Go Back to Q4](#)

Q5.

Solution

Concept — Echinodermata: These are exclusively marine animals such as starfish and sea urchins.

Step 1 — Key feature: The defining feature is the water (ambulacral) vascular system bearing tube feet, which is used for locomotion, capture and transport of food, and respiration.

Step 2 — Skeleton: They also have an endoskeleton of calcareous ossicles, which gives the phylum its name (echinos = spiny).

Why other options are wrong:

- Option A: They lack a true closed circulatory system with haemoglobin.
- Option B: A mantle-secreted shell is a feature of Mollusca.
- Option C: Metameric segmentation is characteristic of Annelida and Arthropoda.

Final Answer: Water vascular system with tube feet and ossicles $\Rightarrow$ D

Answer: (D) [Go Back to Q5](#)

Q6.

Solution

Concept — Tissue systems: A plant is organised into three tissue systems — epidermal, ground (fundamental) and vascular.

Step 1 — Ground tissue: All tissues except the epidermis and vascular bundles form the ground tissue system. This includes the cortex, pericycle, pith and medullary rays.

Step 2 — Eliminate: The epidermal system is the outer covering, and the vascular system is xylem plus phloem.

Why other options are wrong:



- Option B: Epidermal system is only the outer protective layer.
- Option C: Vascular system is xylem and phloem only.
- Option D: “Dermal” refers to the epidermis, not these internal tissues.

Final Answer: Cortex, pericycle, pith and rays = ground tissue $\Rightarrow$ A

Answer: (A) [Go Back to Q6](#)

Q7.

Solution

Concept — Cockroach excretion: The cockroach is an insect that excretes nitrogenous waste in the form of uric acid (uricotelic).

Step 1 — Locate the organ: Excretion is performed by Malpighian tubules, which are fine yellow thread-like structures attached at the junction of the midgut and hindgut.

Step 2 — Function: They absorb nitrogenous waste from the haemolymph (blood) and convert it into uric acid for removal through the hindgut.

Why other options are wrong:

- Option A: Hepatic caecae secrete digestive juice.
- Option C: Salivary glands aid digestion, not excretion.
- Option D: Phallic glands are accessory reproductive glands.

Final Answer: Malpighian tubules carry out excretion $\Rightarrow$ B

Answer: (B) [Go Back to Q7](#)

Q8.

Solution

Concept — Cell wall: The plant cell wall has a middle lamella, a primary wall and sometimes a secondary wall.

Step 1 — Middle lamella: The middle lamella is the outermost layer common to adjacent cells. It is composed mainly of calcium pectate and acts as cement holding neighbouring cells together.

Step 2 — Other layers: The primary wall is thin and capable of growth, while the secondary wall is formed later on the inner side in some cells.

Why other options are wrong:



- Option A: The middle lamella is the outermost, not innermost, layer and is pectate, not cellulose.
- Option B: The primary wall is thin and capable of growth.
- Option D: A secondary wall is present in many mature cells (e.g. sclerenchyma, xylem).

Final Answer: Middle lamella is calcium pectate cementing cells $\Rightarrow$ C

Answer: (C) [Go Back to Q8](#)

Q9.

Solution

Concept — Nucleic acids: DNA and RNA are polymers of nucleotides.

Step 1 — Nucleotide: Each nucleotide is made of a nitrogenous base, a pentose sugar (deoxyribose in DNA, ribose in RNA) and a phosphate group. This is true for both DNA and RNA.

Step 2 — Verify other facts: In DNA, adenine pairs with thymine (two H bonds) and guanine with cytosine (three H bonds); the two strands are antiparallel.

Why other options are wrong:

- Option A: Adenine pairs with thymine (two bonds), not cytosine.
- Option B: RNA contains ribose and uracil, not deoxyribose and thymine.
- Option C: The two strands are antiparallel, running in opposite directions.

Final Answer: A nucleotide = base + pentose sugar + phosphate $\Rightarrow$ D

Answer: (D) [Go Back to Q9](#)

Q10.

Solution

Concept — Water loss as droplets: Plants can lose water as vapour (transpiration) or as liquid droplets (guttation).

Step 1 — Guttation: Guttation is the loss of water in liquid form from the margins or tips of leaves through special pores called hydathodes. It occurs mainly in the early morning when root pressure is high and transpiration is low.

Step 2 — Distinguish: Imbibition is the absorption of water by solids (e.g. seeds), and plasmolysis is shrinkage of protoplasm in a hypertonic solution.



Why other options are wrong:

- Option B: Transpiration is loss of water vapour, not liquid droplets.
- Option C: Imbibition is absorption of water by colloids.
- Option D: Plasmolysis is cell shrinkage, not water loss as droplets.

Final Answer: Loss of liquid water from leaf tips = guttation $\Rightarrow$ **A**

Answer: (A) [Go Back to Q10](#)

Q11.

Solution

Concept — C_3 vs C_4 pathways: Plants fix CO_2 either by the Calvin cycle alone (C_3) or with an additional C_4 cycle.

Step 1 — C_4 features: C_4 plants possess Kranz anatomy (bundle sheath cells with many chloroplasts). The primary CO_2 acceptor is the 3-carbon molecule phosphoenolpyruvate (PEP), and the first stable product is the 4-carbon oxaloacetic acid.

Step 2 — Advantage: Because CO_2 is concentrated in bundle sheath cells, C_4 plants show negligible photorespiration.

Why other options are wrong:

- Option A: PGA as first product is a feature of C_3 plants.
- Option C: C_4 plants show very low photorespiration.
- Option D: C_4 plants do have RuBisCO (in bundle sheath cells).

Final Answer: C_4 plants have Kranz anatomy and PEP acceptor $\Rightarrow$ **B**

Answer: (B) [Go Back to Q11](#)

Q12.

Solution

Concept — Fermentation: In the absence of oxygen, pyruvate formed in glycolysis is converted to ethanol (in yeast) or lactic acid (in some bacteria and muscle).

Step 1 — Step one of alcoholic fermentation: Pyruvic acid is decarboxylated to acetaldehyde by the enzyme pyruvate decarboxylase, releasing CO_2 .

Step 2 — Step two: Acetaldehyde is then reduced to ethanol by alcohol dehydro-



genase, using NADH.

Why other options are wrong:

- Option A: Hexokinase and aldolase act in glycolysis, not in this conversion.
- Option B: Lactate dehydrogenase produces lactic acid, not ethanol.
- Option D: Citrate synthase and fumarase belong to the Krebs cycle.

Final Answer: Pyruvate decarboxylase and alcohol dehydrogenase $\Rightarrow$ C

Answer: (C) [Go Back to Q12](#)

Q13.

Solution

Concept — Respiratory disorders: Different disorders affect different parts of the respiratory tract.

Step 1 — Asthma: Asthma is characterised by difficulty in breathing due to inflammation of the bronchi and bronchioles and spasm (constriction) of the smooth muscles surrounding them.

Step 2 — Contrast: In emphysema the alveolar walls are damaged, reducing the respiratory surface; this is a different mechanism.

Why other options are wrong:

- Option A: Emphysema damages alveolar walls, not bronchiolar smooth muscle spasm.
- Option B: Silicosis is fibrosis of the lung from inhaled silica dust.
- Option C: Pneumonia is infection and fluid accumulation in alveoli.

Final Answer: Bronchial inflammation with muscle spasm = asthma $\Rightarrow$ D

Answer: (D) [Go Back to Q13](#)



Q14.

Solution

Concept — Regulation of kidney function: Kidney function is regulated by hormonal feedback involving ADH, the renin–angiotensin system and ANF.

Step 1 — Trigger: A fall in blood volume and blood pressure is detected by the juxtaglomerular apparatus (JGA), which releases the enzyme renin.

Step 2 — Cascade: Renin converts angiotensinogen to angiotensin I, then to angiotensin II, which raises blood pressure and stimulates the adrenal cortex to release aldosterone. This is the renin–angiotensin–aldosterone mechanism.

Why other options are wrong:

- Option B: ANF is released when blood pressure is high, causing vasodilation.
- Option C: ADH is released from the posterior pituitary, not the kidney.
- Option D: Insulin regulates blood glucose, not blood pressure here.

Final Answer: JG cells release renin, activating RAAS $\Rightarrow$ **A**

Answer: (A) [Go Back to Q14](#)

Q15.

Solution

Concept — Endocrine sources: Each hormone is secreted by a specific gland or cell type.

Step 1 — Adrenaline: Adrenaline (epinephrine) is secreted by the chromaffin cells of the adrenal medulla. It is the emergency “fight or flight” hormone.

Step 2 — Verify pancreatic hormones: Insulin is from beta cells and glucagon from alpha cells of the islets of Langerhans; cortisol is from the adrenal cortex.

Why other options are wrong:

- Option A: Glucagon is from alpha cells, not beta cells.
- Option C: Insulin is from pancreatic beta cells, not the adrenal cortex.
- Option D: Cortisol is from the adrenal cortex, not pancreatic alpha cells.

Final Answer: Adrenaline is secreted by the adrenal medulla $\Rightarrow$ **B**

Answer: (B) [Go Back to Q15](#)



Q16.

Solution

Concept — Post-fertilisation events: After double fertilisation, the parts of the flower undergo specific transformations.

Step 1 — Ovule to seed: The fertilised ovule develops into the seed; the integuments harden to form the seed coat and the zygote becomes the embryo.

Step 2 — Ovary to fruit: The ovary wall develops into the fruit (pericarp), which encloses and protects the seeds.

Why other options are wrong:

- Option A: The relationship is reversed; ovary → fruit and ovule → seed.
- Option B: The zygote becomes the embryo; the primary endosperm nucleus forms the endosperm.
- Option D: The integuments form the seed coat; they do not fully degenerate.

Final Answer: Ovary → fruit and ovule → seed ⇒ C

Answer: (C) [Go Back to Q16](#)

Q17.

Solution

Concept — Hormonal control of spermatogenesis: Gonadotropins from the anterior pituitary control testicular function.

Step 1 — LH action: Luteinising hormone (LH) acts on the Leydig (interstitial) cells of the testis and stimulates them to synthesise and secrete testosterone (androgens).

Step 2 — FSH action: FSH acts on the Sertoli cells, which support spermatogenesis. Thus the testosterone-stimulating hormone is LH.

Why other options are wrong:

- Option A: FSH acts on Sertoli cells, not on Leydig cells.
- Option B: Prolactin acts on the mammary glands.
- Option C: Oxytocin causes smooth muscle contraction, not androgen secretion.

Final Answer: LH stimulates Leydig cells to secrete testosterone ⇒ D

Answer: (D) [Go Back to Q17](#)



Q18.

Solution

Concept — Prevention of STDs: Sexually transmitted diseases spread mainly through unprotected sexual contact.

Step 1 — Effective prevention: Avoiding sex with unknown or multiple partners and using condoms (barrier methods) physically prevent the exchange of body fluids and so prevent transmission.

Step 2 — Contraceptives vs protection: Oral pills, IUDs and surgical methods prevent pregnancy but do not protect against STD transmission.

Why other options are wrong:

- Option A: Oral pills prevent conception but not infection.
- Option B: IUDs do not block pathogen transmission.
- Option C: Sterilisation prevents pregnancy, not STDs.

Final Answer: Avoiding multiple partners and using condoms $\Rightarrow$ D

Answer: (D) [Go Back to Q18](#)

Q19.

Solution

Concept — Back cross and test cross: Both involve crossing an organism with one of its parental genotypes.

Step 1 — Test cross: A test cross is a cross of an individual (of unknown or dominant phenotype) with the homozygous recessive parent, to determine the unknown genotype.

Step 2 — Relationship: A back cross is a cross with either parent. Therefore every test cross is a back cross (with the recessive parent), but not every back cross is a test cross (it may be with the dominant parent).

Why other options are wrong:

- Option B: A test cross is with the homozygous recessive, not two heterozygotes.
- Option C: A back cross can also be made with the dominant parent.
- Option D: The two are not identical in every case.

Final Answer: Test cross is with recessive parent; every test cross is a back cross $\Rightarrow$ A



Answer: (A) [Go Back to Q19](#)

Q20.

Solution

Concept — Sickle-cell anaemia: It is an autosomal recessive disorder caused by a point mutation in the gene for the beta-globin chain of haemoglobin.

Step 1 — The substitution: The mutation replaces the amino acid glutamic acid by valine at the sixth position of the beta-globin chain.

Step 2 — Effect: The mutant haemoglobin (HbS) polymerises under low oxygen, changing the biconcave red cells into a sickle shape.

Why other options are wrong:

- Option A: The change is glutamic acid $\rightarrow$ valine, not the reverse.
- Option C: The substitution is in the beta chain, not the alpha chain.
- Option D: It is the sixth position of the beta chain, not the second.

Final Answer: Glutamic acid $\rightarrow$ valine at position 6 of beta-globin $\Rightarrow$ **B**

Answer: (B) [Go Back to Q20](#)

Q21.

Solution

Concept — Transcription unit: A transcription unit has a promoter, a structural gene and a terminator, and uses one of the two DNA strands as a template.

Step 1 — Template strand: The strand with polarity $3' \rightarrow 5'$ serves as the template strand on which RNA is synthesised in the $5' \rightarrow 3'$ direction.

Step 2 — Coding strand: The other strand ($5' \rightarrow 3'$) has the same sequence as the RNA (except T for U) and is called the coding strand.

Why other options are wrong:

- Option A and B: Coding (sense) strand is the non-template $5' \rightarrow 3'$ strand.
- Option C: The antisense/coding terminology here is mismatched; the question asks for the template strand by name.

Final Answer: The $3' \rightarrow 5'$ strand acting as template = template strand $\Rightarrow$ **D**

Answer: (D) [Go Back to Q21](#)



Q22.

Solution

Concept — Charging of tRNA: Before translation, each tRNA must be linked to its correct amino acid.

Step 1 — Aminoacylation: In the presence of ATP, the amino acid is activated and then attached (linked) to its specific tRNA. This activation and attachment is called aminoacylation (charging) of tRNA.

Step 2 — Significance: Two charged tRNAs brought close on the ribosome allow the formation of a peptide bond.

Why other options are wrong:

- Option B: Capping is addition of methyl guanosine to the 5' end of mRNA.
- Option C: Splicing removes introns from hnRNA.
- Option D: Polyadenylation adds a poly-A tail to the 3' end of mRNA.

Final Answer: Activation and linking of amino acid to tRNA = aminoacylation ⇒

A

Answer: (A) [Go Back to Q22](#)

Q23.

Solution

Concept — Palaeontological evidence: Fossils are the preserved remains or impressions of past organisms found in sedimentary rocks.

Step 1 — Strata and age: Different rock strata correspond to different geological ages. Studying fossils in successive strata reveals the time at which organisms existed.

Step 2 — Sequence of forms: The fossil record shows a gradual sequence of forms, providing direct evidence of evolutionary change over time.

Why other options are wrong:

- Option A: Fossils show that species appeared at different times, not simultaneously.
- Option C: Fossils occur in many layers; deeper layers are older.
- Option D: Fossils do indicate the age of organisms.

Final Answer: Fossils in strata give geological age and a sequence of forms ⇒

B



Answer: (B) [Go Back to Q23](#)

Q24.

Solution

Concept — Diagnosis of typhoid: Typhoid fever is caused by *Salmonella typhi*, which infects the intestine.

Step 1 — Widal test: The classic confirmatory test for typhoid is the Widal test, which detects antibodies (agglutinins) against *Salmonella* antigens in the patient's serum.

Step 2 — Other tests: ELISA, Mantoux and Benedict's tests are used for other purposes.

Why other options are wrong:

- Option A: ELISA is used for diseases such as HIV/AIDS.
- Option B: The Mantoux test diagnoses tuberculosis.
- Option D: Benedict's test detects reducing sugars, not infection.

Final Answer: Typhoid is confirmed by the Widal test $\Rightarrow$

Answer: (C) [Go Back to Q24](#)

Q25.

Solution

Concept — Antibody structure: An antibody (immunoglobulin) is a Y-shaped protein produced by B-lymphocytes.

Step 1 — Chains: Each antibody molecule is made of four polypeptide chains: two identical longer heavy (H) chains and two identical shorter light (L) chains. This is represented as H_2L_2 .

Step 2 — Shape: The chains are held by disulphide bonds in a Y shape; the two arms bind antigen and the stem (Fc) interacts with immune cells.

Why other options are wrong:

- Option A: There are heavy chains as well; not light chains only.
- Option B: There are two heavy and two light chains, not one and three.
- Option D: The structure is H_2L_2 , not two heavy and four light chains.

Final Answer: Two heavy and two light chains (H_2L_2) $\Rightarrow$



Answer: (C) [Go Back to Q25](#)

Q26.

Solution

Concept — Microbial products: Many microbes are used industrially to produce organic acids and enzymes.

Step 1 — Citric acid: The fungus *Aspergillus niger* is the chief industrial producer of citric acid.

Step 2 — Verify others: *Acetobacter aceti* produces acetic acid (vinegar), *Clostridium butylicum* produces butyric acid, and *Lactobacillus* produces lactic acid.

Why other options are wrong:

- Option B: *Acetobacter aceti* gives acetic acid, not lactic acid.
- Option C: *Clostridium butylicum* gives butyric acid, not acetic acid.
- Option D: *Lactobacillus* gives lactic acid, not citric acid.

Final Answer: *Aspergillus niger* → citric acid ⇒ A

Answer: (A) [Go Back to Q26](#)

Q27.

Solution

Concept — Downstream processing: Industrial biotechnology has upstream steps (media, inoculation), the bioreactor stage, and downstream steps.

Step 1 — Definition: After the biosynthesis in the bioreactor is complete, the product must be separated and purified. This stage of separation, purification, formulation and quality control is called downstream processing.

Step 2 — Importance: It often determines the final cost and purity of the product.

Why other options are wrong:

- Option A: Upstream processing is everything before the product is made.
- Option C: Gene cloning is making copies of a gene, a separate step.
- Option D: Bioremediation uses microbes to clean pollutants.

Final Answer: Separation, purification and formulation = downstream processing ⇒ B



Answer: (B) [Go Back to Q27](#)

Q28.

Solution

Concept — Methods of gene transfer: Foreign DNA can be introduced into cells by several physical, chemical or biological methods.

Step 1 — Biolistics: In the gene gun (biolistic) method, cells are bombarded with high-velocity micro-particles of gold or tungsten coated with DNA, which carry the DNA into the cells.

Step 2 — Distinguish: Microinjection injects DNA directly with a needle; *Agrobacterium* acts as a natural vector in plants; electroporation uses electric pulses.

Why other options are wrong:

- Option A: Microinjection uses a fine needle, not metal particles.
- Option B: Electroporation uses electric pulses to make pores.
- Option D: *Agrobacterium* is a biological vector, not particle bombardment.

Final Answer: Bombarding cells with DNA-coated metal particles = biolistics ⇒
☐ C

Answer: (C) [Go Back to Q28](#)

Q29.

Solution

Concept — Decomposition: Decomposition breaks down detritus into inorganic nutrients through fragmentation, leaching, catabolism, humification and mineralisation.

Step 1 — Steps before X: Detritus is fragmented, then water-soluble inorganic nutrients leach out, and microbial enzymes (catabolism) degrade detritus, finally forming dark amorphous humus.

Step 2 — Step X (mineralisation): Humus is further degraded by microbes to release inorganic nutrients. This final release of inorganic nutrients from humus is called mineralisation.

Why other options are wrong:

- Option B: Fragmentation is the initial breaking of detritus into smaller



pieces.

- Option C: Leaching is the washing down of soluble nutrients into soil.
- Option D: Catabolism is enzymatic degradation that precedes humus formation.

Final Answer: Release of inorganic nutrients from humus = mineralisation $\Rightarrow$ **A**

Answer: (A) [Go Back to Q29](#)

Q30.

Solution

Concept — Biodiversity conservation: Conservation is done in-situ (in natural habitat) and ex-situ (outside natural habitat).

Step 1 — Hotspots: Biodiversity hotspots are regions with very high species richness, high endemism and a high degree of habitat threat. They are prioritised for in-situ conservation.

Step 2 — Red Data Book: The Red Data Book is a record of threatened and endangered species, not common species.

Why other options are wrong:

- Option B: The Red Data Book records threatened species, not abundant ones.
- Option C: Hotspots have a high level of endemism, not zero.
- Option D: Ex-situ conservation is outside the natural habitat; protection within it is in-situ.

Final Answer: Hotspots are high-endemism, high-threat regions for in-situ conservation $\Rightarrow$ **A**

Answer: (A) [Go Back to Q30](#)



Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	B	3	C	4	D	5	D
6	A	7	B	8	C	9	D	10	A
11	B	12	C	13	D	14	A	15	B
16	C	17	D	18	D	19	A	20	B
21	D	22	A	23	B	24	C	25	C
26	A	27	B	28	C	29	A	30	A

