

SRMJEEE Biology Sample Paper – 8

Duration: 47 Minutes

Maximum Marks: 40

Instructions

- This paper contains **40** Multiple Choice Questions (Single Correct Answer), modelled on the Biology section of **SRMJEEE** (SRM Joint Engineering Entrance Examination).
- Each correct answer carries **+1 mark**. There is **no negative marking**; an unattempted or wrong answer scores 0.
- Only **one** option is correct. Choose carefully.
- The actual SRMJEEE is a **computer-based test** conducted in remote-proctored online mode, with all sections sharing a common time window and no per-section limit.
- Personal calculators, mobile phones, log tables and other electronic gadgets are strictly prohibited.

Q1. A lichen is a close symbiotic association of two organisms. The photosynthetic partner (phycobiont) and the partner that absorbs water and minerals (mycobiont) are, respectively:

- (A) a fungus and a moss
- (B) a bacterium and a fungus
- (C) an alga and a fungus
- (D) a fungus and an alga

Q2. Algae are classified into three main groups on the basis of their major photosynthetic pigments. The green algae, which store food as starch and contain chlorophyll *a* and *b*, belong to the class:

- (A) Chlorophyceae
- (B) Phaeophyceae
- (C) Rhodophyceae



(D) Bacillariophyceae

Q3. The phylum Porifera (sponges) is characterised by a cellular grade of body organisation and a system of pores and canals through which water circulates. This water-transport system is called the:

(A) water vascular system

(B) canal system

(C) tracheal system

(D) haversian system

Q4. In the hierarchy of taxonomic categories, a group of closely related species that share a common set of features is placed in a single:

(A) family

(B) order

(C) class

(D) genus

Q5. When the ovules are borne on the central axis of a multilocular ovary that has its loculi separated by septa, the type of placentation is:

(A) axile

(B) parietal

(C) marginal

(D) free central

Q6. In the family Solanaceae the five stamens are attached to the inner wall of the corolla tube rather than to the thalamus. Stamens fused to the petals in this way are described as:

(A) epiphyllous

(B) epipetalous

(C) polyandrous



(D) diadelphous

Q7. The mouthparts of the cockroach, which tear and grind solid food before it is swallowed, are of the:

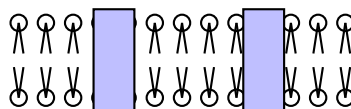
(A) piercing-and-sucking type

(B) sponging type

(C) biting-and-chewing type

(D) siphoning type

Q8. The structure shown below is the boundary of the cell. It consists of a bilayer of phospholipids with proteins embedded in and floating across it, an arrangement described by the fluid-mosaic model. This structure is the:



plasma membrane (lipid bilayer with proteins)

(A) cell wall

(B) nuclear membrane

(C) tonoplast

(D) plasma membrane

Q9. The smallest known living cells, which completely lack a cell wall and can therefore take up many shapes (pleomorphic), are the:

(A) mycoplasmas

(B) cyanobacteria

(C) diatoms

(D) yeasts

Q10. The level of protein structure that describes the precise linear sequence of amino acids joined by peptide bonds in a polypeptide chain is the:



- (A) secondary structure
- (B) primary structure
- (C) tertiary structure
- (D) quaternary structure

Q11. The spindle fibres that move the chromosomes during cell division are made up of a cytoskeletal protein assembled into hollow tubules. This protein is:

- (A) actin
- (B) myosin
- (C) tubulin
- (D) keratin

Q12. In sexually reproducing animals, the reduction division (meiosis) that halves the chromosome number takes place in the:

- (A) liver cells
- (B) skin epidermis
- (C) red blood cells
- (D) germ cells of the gonads

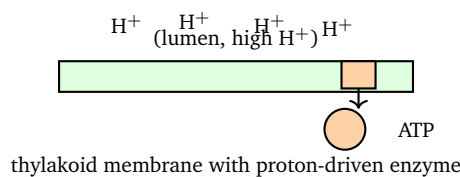
Q13. The phenomenon by which a dry pea seed swells up and bursts its seed coat after being kept in water, due to absorption of water by hydrophilic colloids, is:

- (A) imbibition
- (B) osmosis
- (C) plasmolysis
- (D) transpiration

Q14. In the thylakoid membrane shown, protons accumulate inside the thylakoid lumen and then flow out through a membrane enzyme, driving



the synthesis of ATP. According to the chemiosmotic hypothesis, this enzyme is:



- (A) RuBisCO
- (B) ATP synthase
- (C) NADP reductase
- (D) cytochrome oxidase

Q15. During oxidative phosphorylation, the oxidation of one molecule of NADH along the electron transport chain yields, by the classical textbook estimate, about how many molecules of ATP?

- (A) 1
- (B) 2
- (C) 3
- (D) 5

Q16. The classical bioassay used to estimate the amount of the plant hormone auxin, based on the bending of a decapitated grass seedling tip, is the:

- (A) starch-iodine test
- (B) Benedict's test
- (C) paper chromatography test
- (D) *Avena* coleoptile curvature test

Q17. Pancreatic juice contains a battery of digestive enzymes. The protein-digesting enzyme it secretes in an inactive form (trypsinogen) is:

- (A) trypsin



- (B) pepsin
- (C) ptyalin
- (D) rennin

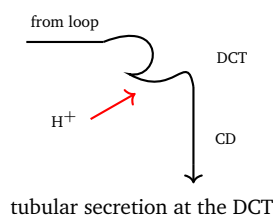
Q18. In the human lungs, the actual exchange of oxygen and carbon dioxide between air and blood takes place across the thin walls of the:

- (A) bronchi
- (B) alveoli
- (C) trachea
- (D) pleura

Q19. The colourless fluid that is formed from the tissue (interstitial) fluid, flows through lymph vessels, and is rich in lymphocytes but lacks red blood cells and most plasma proteins, is:

- (A) plasma
- (B) serum
- (C) lymph
- (D) bile

Q20. In the nephron segment shown, ions such as H^+ , K^+ and NH_3 are actively passed from the surrounding blood capillaries into the tubular filtrate to maintain the pH of body fluids. This process is tubular secretion, and the segment marked is the:

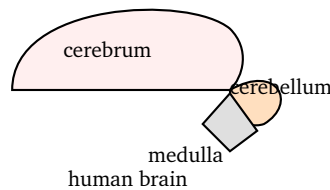


- (A) glomerulus
- (B) Bowman's capsule

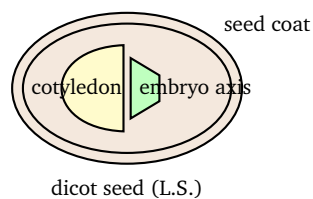


- (C) loop of Henle
- (D) distal convoluted tubule (DCT)

Q21. In the diagram of the human brain shown, the large, folded region marked at the front that controls thought, memory and voluntary actions is the:



- (A) cerebrum
 - (B) cerebellum
 - (C) medulla oblongata
 - (D) pons
- Q22.** The part of the brain that links the nervous and endocrine systems by secreting releasing and inhibiting hormones that control the anterior pituitary is the:
- (A) cerebellum
 - (B) hypothalamus
 - (C) medulla oblongata
 - (D) corpus callosum
- Q23.** In the dicot seed shown in section, the two fleshy structures that store food and are attached to the embryo axis are the:



- (A) endosperm grains



- (B) seed coats
- (C) cotyledons
- (D) radicles

Q24. The wall of a pollen grain has two layers. The hard, outer layer made of the highly resistant substance sporopollenin is called the:

- (A) intine
- (B) nucellus
- (C) integument
- (D) exine

Q25. During human pregnancy, the structure that develops from the embryonic and maternal tissues to provide nutrients and oxygen to the foetus and remove its wastes is the:

- (A) placenta
- (B) amnion
- (C) corpus luteum
- (D) endometrium

Q26. Condoms and diaphragms work by physically preventing the sperm from meeting the ovum. They are therefore classed as:

- (A) hormonal methods
- (B) barrier methods
- (C) surgical methods
- (D) intra-uterine devices

Q27. The Punnett square shows a cross between a father of genotype $I^A i$ and a mother of genotype $I^B i$. What is the probability that a child of this couple has blood group O?



	I^B	i
I^A	$I^A I^B$	$I^A i$
i	$I^B i$	ii

- (A) 0
- (B) 1/2
- (C) 1/4
- (D) 3/4

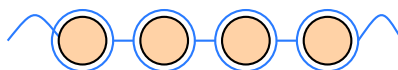
Q28. In humans, sex is determined by the XX–XY mechanism. The sex of a child is decided by the type of sex chromosome carried by the:

- (A) ovum, which may be X or Y
- (B) ovum, which is always Y
- (C) number of autosomes
- (D) sperm, which may carry X or Y

Q29. Which of the following is a *chromosomal* disorder (caused by an abnormality in chromosome number) rather than a single-gene (Mendelian) disorder?

- (A) Down's syndrome
- (B) sickle-cell anaemia
- (C) haemophilia
- (D) phenylketonuria

Q30. In the packaging of DNA shown, the negatively charged DNA is wrapped around a core of positively charged proteins to form the repeating unit of chromatin. This repeating “beads-on-a-string” unit is the nucleosome, and the proteins forming its core are the:



nucleosomes (DNA coiled on protein cores)



- (A) ribosomes
- (B) histones
- (C) enzymes
- (D) lipids

Q31. Retroviruses such as HIV use the enzyme reverse transcriptase to carry out a flow of genetic information opposite to the usual direction. This process synthesises:

- (A) protein from RNA
- (B) RNA from DNA
- (C) DNA from an RNA template
- (D) RNA from RNA

Q32. The wing of a bird and the wing of an insect perform the same function (flight) but have entirely different structures and origins. Such analogous organs are evidence of:

- (A) divergent evolution
- (B) homologous structures
- (C) adaptive radiation
- (D) convergent evolution

Q33. Ringworm, a contagious skin disease producing dry, scaly ring-like lesions, is caused by members of the fungal genera *Microsporum* and *Trichophyton*. It is therefore a:

- (A) fungal disease
- (B) bacterial disease
- (C) viral disease
- (D) protozoan disease



- Q34.** The much faster and stronger immune response seen on a second exposure to the same antigen, compared with the first exposure, is due to the presence of:
- (A) more neutrophils
 - (B) memory B and T cells
 - (C) raised body temperature
 - (D) additional red blood cells
- Q35.** Citric acid is produced industrially on a large scale by the microbial fermentation of sugar using the fungus:
- (A) *Saccharomyces cerevisiae*
 - (B) *Penicillium notatum*
 - (C) *Aspergillus niger*
 - (D) *Lactobacillus acidophilus*
- Q36.** In recombinant DNA work, a foreign gene is often inserted within a marker gene (for example one giving antibiotic resistance) on the vector. Bacteria that took up the recombinant plasmid lose that marker activity. This method of screening recombinants is called:
- (A) gel electrophoresis
 - (B) PCR amplification
 - (C) DNA fingerprinting
 - (D) insertional inactivation
- Q37.** The use of bio-resources and traditional knowledge of a country by multinational companies without proper authorisation or compensation is known as:
- (A) biopiracy
 - (B) bioremediation
 - (C) biofortification

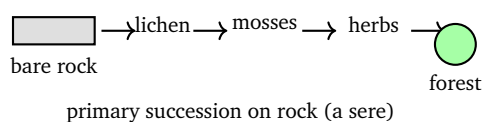


(D) biomagnification

Q38. In a biotechnology production line, the vessel in which raw materials are biologically converted into the desired product, using microbes or enzymes under controlled conditions, is the:

- (A) autoclave
- (B) bioreactor (fermenter)
- (C) centrifuge
- (D) incubator

Q39. The sequence of communities shown develops on a bare rock surface where no community existed before, beginning with lichens and ending in a forest. This orderly process is:



- (A) secondary succession
- (B) eutrophication
- (C) primary succession
- (D) biomagnification

Q40. The large-scale clearing of forests for agriculture, timber and settlement leads to several environmental problems. Which of the following is a direct consequence of deforestation?

- (A) an increase in soil fertility
- (B) a rise in the water table
- (C) a decline in atmospheric CO₂
- (D) increased soil erosion and loss of biodiversity



Detailed Solutions

Q1.

Solution

Concept — Lichens: A lichen is a permanent, mutually beneficial association of two completely different organisms living together as a single body. One partner is photosynthetic and the other absorbs and retains water and minerals.

Key fact: The photosynthetic partner is an *alga* (the phycobiont), usually a green alga or a cyanobacterium, which makes food; the other partner is a *fungus* (the mycobiont), which gives the body its shape and absorbs water and minerals. So the correct phycobiont–mycobiont pair is alga–fungus.

Why other options are wrong:

- (A) A moss is not the photosynthetic partner of a lichen.
- (B) Bacteria (other than cyanobacteria) and (D) the reversed order “fungus and alga” name the partners in the wrong roles — the question asks for phycobiont (alga) first.

Final Answer: Phycobiont = alga, mycobiont = fungus ⇒

[Go Back to Q1](#)

Q2.

Solution

Concept — Classification of algae: Algae are grouped chiefly by their dominant photosynthetic pigments, their stored food and the chemistry of their cell wall. The three major classes are Chlorophyceae, Phaeophyceae and Rhodophyceae.

Key fact: The *green algae* are placed in the class *Chlorophyceae*. They contain chlorophyll *a* and *b*, which give them their grass-green colour, and store food as starch — exactly as in higher plants. Examples include *Chlamydomonas*, *Spirogyra* and *Ulva*.

Why other options are wrong:

- (B) Phaeophyceae (brown algae) have fucoxanthin and store laminarin.
- (C) Rhodophyceae (red algae) have r-phycoerythrin; (D) Bacillariophyceae are the diatoms.

Final Answer: Green algae = Chlorophyceae ⇒



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

Q3.

Solution

Concept — Phylum Porifera: Sponges are the simplest multicellular animals. They show a *cellular* grade of organisation (cells are loosely arranged and do not form true tissues) and have a porous body through which water flows continuously.

Key fact: Water enters through tiny pores (ostia), passes through a network of chambers and canals, and leaves through a large opening (osculum). This unique water-transport network is the *canal system*, and it helps in food gathering, respiration and waste removal.

Why other options are wrong:

- (A) The water vascular system is the special feature of echinoderms (starfish), not sponges.
- (C) The tracheal system is the breathing system of insects; (D) the Haversian system is a feature of mammalian bone.

Final Answer: Sponges have a canal system \Rightarrow **B**

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

Q4.

Solution

Concept — Taxonomic hierarchy: Living organisms are arranged in a series of ranked categories — species, genus, family, order, class, phylum and kingdom — each higher category being more inclusive than the one below it.

Key fact: A *genus* is the category immediately above species; it is a group of closely related species sharing a set of common, distinguishing features. For example, the genus *Panthera* includes the species lion, tiger and leopard.

Why other options are wrong:

- (A),(B),(C) family, order and class are higher categories that group together several genera; they are not the immediate group of related species.

Final Answer: A group of related species = genus \Rightarrow **D**



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

Q5.

Solution

Concept — Placentation: The arrangement of ovules on the placenta inside the ovary is called placentation, and its type is an important feature in identifying plant families.

Key fact: In *axile* placentation the ovary is divided by septa into many chambers (loculi), and the ovules are attached to the *central axis* where the septa meet. It is seen in china rose, tomato and lemon.

Why other options are wrong:

- (B) In parietal placentation the ovules lie on the inner wall of a one-chambered ovary (mustard).
- (C) Marginal placentation has ovules in a row along the ventral suture of a single carpel (pea); (D) free central placentation has ovules on a central column with no septa (*Dianthus*).

Final Answer: Ovules on the central axis with septa = axile \Rightarrow

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

Q6.

Solution

Concept — Attachment of stamens: The stamens of a flower may be free or fused, and they may be attached to the thalamus or to another floral whorl. When stamens are fused by their filaments to the petals, a special term is used.

Key fact: Stamens that are attached to the petals (corolla) are said to be *epipetalous*. This is a characteristic feature of the family Solanaceae (for example brinjal, potato and *Datura*), where the five stamens arise from the corolla tube.

Why other options are wrong:

- (A) Epiphyllous stamens are attached to the perianth/tepals (as in many Liliaceae), not the petals.
- (C) Polyandrous means many free stamens; (D) diadelphous (as in Fabaceae) means stamens united into two bundles.

Final Answer: Stamens fused to petals = epipetalous \Rightarrow



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

Q7.

Solution

Concept — Insect mouthparts: The mouthparts of insects are modified to suit their diet. The cockroach is an omnivore that feeds on solid organic matter and so has unmodified, sturdy mouthparts.

Key fact: The cockroach has *biting-and-chewing* type mouthparts, consisting of a labrum, a pair of mandibles, a pair of maxillae and a labium. The hard mandibles cut and grind the solid food before it is swallowed.

Why other options are wrong:

- (A) Piercing-and-sucking mouthparts occur in mosquitoes and bugs that take liquid food.
- (B) Sponging mouthparts are seen in the housefly; (D) the siphoning (coiled proboscis) type is seen in butterflies and moths.

Final Answer: Cockroach has biting-and-chewing mouthparts ⇒

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

Q8.

Solution

Concept — The plasma membrane: Every cell is bounded by a plasma membrane that separates the living contents from the surroundings and controls what enters and leaves the cell.

Key fact: According to the *fluid-mosaic model* of Singer and Nicolson, the membrane is a bilayer of phospholipids (with water-loving heads outside and water-hating tails inside) in which proteins are embedded and can move sideways like a mosaic floating in a fluid lipid sea — exactly the arrangement drawn in the figure.

Why other options are wrong:

- (A) The cell wall is a rigid non-living layer of cellulose outside the plasma membrane in plants.
- (B) The nuclear membrane surrounds the nucleus; (C) the tonoplast is the membrane of the vacuole. Neither is the cell's outer boundary described here.



Final Answer: Fluid-mosaic lipid bilayer = plasma membrane \Rightarrow

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

Q9.

Solution

Concept — Mycoplasma: Among all known cells, mycoplasmas are exceptional in being the smallest and the simplest free-living organisms.

Key fact: *Mycoplasmas* completely lack a cell wall. Because they have no rigid wall they can change shape (they are pleomorphic), they are the smallest living cells (about 0.1 to 0.3 micrometre), and they are naturally resistant to wall-acting antibiotics like penicillin. Many cause diseases in animals and plants.

Why other options are wrong:

- (B) Cyanobacteria have a definite cell wall and are much larger.
- (C) Diatoms have a hard silica shell; (D) yeasts are eukaryotic fungi with a cell wall.

Final Answer: Smallest cells without a cell wall = mycoplasmas \Rightarrow

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

Q10.

Solution

Concept — Levels of protein structure: A protein can be described at four structural levels — primary, secondary, tertiary and quaternary — each built on the one before it.

Key fact: The *primary structure* is the exact linear sequence of amino acids in the polypeptide, joined one to the next by *peptide bonds*. This sequence is coded by the gene and ultimately decides how the protein folds and functions.

Why other options are wrong:

- (A) Secondary structure is the local coiling/folding into α -helices and β -pleated sheets, held by hydrogen bonds.
- (C) Tertiary structure is the overall three-dimensional shape of one chain; (D) quaternary structure is the assembly of two or more chains (as in haemoglobin).



Final Answer: Sequence of amino acids = primary structure \Rightarrow **B**

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

Q11.

Solution

Concept — The mitotic spindle: During cell division a spindle apparatus forms to capture and move the chromosomes. The spindle fibres are part of the cell's cytoskeleton.

Key fact: Spindle fibres are made of *microtubules*, which are hollow tubes built by the polymerisation of the protein *tubulin*. By assembling and disassembling, these microtubules attach to the centromeres and pull the chromosomes to the poles.

Why other options are wrong:

- (A) Actin and (B) myosin form the microfilaments responsible for muscle contraction and cytokinesis, not the spindle backbone.
- (D) Keratin is a structural protein of hair, nails and skin.

Final Answer: Spindle fibres are made of tubulin microtubules \Rightarrow **C**

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

Q12.

Solution

Concept — Site of meiosis: Meiosis is the special reduction division that halves the chromosome number and forms haploid gametes. It does not occur in ordinary body (somatic) cells.

Key fact: In animals, meiosis takes place in the *germ cells of the gonads* — in the testes (forming sperm) and in the ovaries (forming eggs). This keeps the chromosome number constant from one generation to the next, because fertilisation later restores the diploid number.

Why other options are wrong:

- (A) Liver cells and (B) skin epidermis divide by mitosis for growth and repair.
- (C) Mature mammalian red blood cells lack a nucleus and cannot divide at all.

Final Answer: Meiosis occurs in the germ cells of the gonads \Rightarrow **D**



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

Q13.

Solution

Concept — Water relations of seeds: Dry seeds and other hydrophilic solids can take up large amounts of water and swell, generating great pressure. This is a special kind of diffusion.

Key fact: *Imbibition* is the absorption of water by the solid hydrophilic colloids of a substance (such as the cellulose and proteins of a seed), causing it to swell. The huge imbibition pressure developed allows a germinating seed to push through and crack hard soil.

Why other options are wrong:

- (B) Osmosis is movement of water across a semipermeable membrane down a concentration gradient, not absorption by a solid colloid.
- (C) Plasmolysis is shrinkage of a cell in a hypertonic solution; (D) transpiration is loss of water vapour from a plant.

Final Answer: Swelling of a seed in water = imbibition ⇒ A

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

Q14.

Solution

Concept — The chemiosmotic hypothesis: In photosynthesis, the energy of light is used to pump protons (H^+) across the thylakoid membrane, building up a high concentration of protons inside the thylakoid lumen. The stored energy of this gradient is then used to make ATP.

Key fact: As protons flow back down their gradient, from the lumen into the stroma, they pass through the membrane enzyme *ATP synthase*. This flow drives the enzyme to combine ADP and inorganic phosphate into ATP — the process of chemiosmosis proposed by Peter Mitchell.

Why other options are wrong:

- (A) RuBisCO fixes CO_2 in the Calvin cycle; it does not make ATP.
- (C) NADP reductase forms NADPH; (D) cytochrome oxidase is a respiratory enzyme of the mitochondrion.



Final Answer: Proton-driven ATP-making enzyme = ATP synthase \Rightarrow

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

Q15.

Solution

Concept — Energy from electron carriers: In aerobic respiration the reduced coenzymes NADH and FADH₂ are oxidised along the electron transport chain, and the energy released is used to make ATP.

Key fact: By the classical textbook accounting, each molecule of NADH that is oxidised yields about 3 ATP, while each FADH₂ yields about 2 ATP, because NADH feeds its electrons in at a higher-energy point of the chain and so pumps more protons.

Why other options are wrong:

- (A) 1 ATP greatly under-counts the yield from NADH.
- (B) 2 ATP is the yield from FADH₂, not NADH; (D) 5 ATP exceeds the energy obtainable from one NADH.

Final Answer: One NADH gives about 3 ATP \Rightarrow

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

Q16.

Solution

Concept — Bioassay of a hormone: A bioassay measures the amount or activity of a substance from the response of a living tissue. For the plant hormone auxin a classic and very sensitive bioassay exists.

Key fact: In the *Avena coleoptile curvature test*, an auxin-containing agar block is placed on one side of a decapitated oat (*Avena*) coleoptile. The auxin diffuses down that side, makes those cells elongate more, and the coleoptile bends away. The angle of bending is proportional to the amount of auxin, giving a quantitative estimate.

Why other options are wrong:

- (A) The starch-iodine test detects starch, not auxin.
- (B) Benedict's test detects reducing sugars; (C) paper chromatography separates pigments/molecules but does not measure auxin activity by a biological



response.

Final Answer: Auxin bioassay = *Avena* coleoptile curvature test \Rightarrow

Answer: [Go Back to Q16](#)

Q17.

Solution

Concept — Pancreatic juice: The pancreas pours its juice into the duodenum. This juice contains enzymes that act on all three classes of food — proteins, fats and carbohydrates.

Key fact: The protein-digesting enzyme *trypsin* is secreted as an inactive precursor, *trypsinogen*, which is activated in the intestine by enterokinase. Active trypsin then digests proteins (and activates chymotrypsinogen). The pancreas also supplies chymotrypsin, lipase and amylase.

Why other options are wrong:

- (B) Pepsin is secreted by the stomach (as pepsinogen), not the pancreas.
- (C) Ptyalin (salivary amylase) comes from the salivary glands; (D) rennin is a gastric enzyme of infants.

Final Answer: Pancreatic protease secreted as trypsinogen = trypsin \Rightarrow

Answer: [Go Back to Q17](#)

Q18.

Solution

Concept — Gas exchange in the lungs: The respiratory tract is divided into a conducting part (which only carries air) and a respiratory part (where gases are actually exchanged with the blood).

Key fact: The *alveoli* are millions of tiny, thin-walled air sacs richly supplied with capillaries. Their extremely thin walls and huge total surface area make them the actual site where O_2 diffuses into the blood and CO_2 diffuses out.

Why other options are wrong:

- (A) The bronchi and (C) the trachea are only conducting tubes; their thick walls do not allow gas exchange.
- (D) The pleura is the double membrane covering the lungs; it has no role in



gas exchange.

Final Answer: Gas exchange occurs at the alveoli \Rightarrow **B**

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

Q19.

Solution

Concept — Body fluids: Besides blood, the body has another circulating fluid that bathes the tissues and drains into a separate set of vessels — the lymphatic system.

Key fact: *Lymph* is the colourless fluid formed when plasma and white cells leak out of capillaries into the tissue spaces (interstitial fluid) and then enter the lymph vessels. It lacks red blood cells and most large plasma proteins, is rich in lymphocytes, returns tissue fluid to the blood, and absorbs digested fats from the intestine.

Why other options are wrong:

- (A) Plasma is the fluid part of blood and does contain plasma proteins.
- (B) Serum is plasma minus clotting factors; (D) bile is a digestive secretion of the liver.

Final Answer: Tissue fluid flowing in lymph vessels = lymph \Rightarrow **C**

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

Q20.

Solution

Concept — Tubular secretion: Besides filtering and reabsorbing, the nephron actively adds certain substances from the blood back into the filtrate. This third step, tubular secretion, is important for keeping the acid–base balance of the body.

Key fact: The *distal convoluted tubule (DCT)* is a major site of tubular secretion. Here H^+ , K^+ and NH_3 are pumped from the peritubular blood into the filtrate, while Na^+ and HCO_3^- can be reabsorbed, helping the kidney maintain the pH of the body fluids.

Why other options are wrong:

- (A) The glomerulus and (B) Bowman's capsule carry out filtration, not secretion.



- (C) The loop of Henle mainly concentrates the filtrate by setting up an osmotic gradient.

Final Answer: Site of tubular secretion shown = DCT \Rightarrow

[Go Back to Q20](#)

Q21.

Solution

Concept — The human brain: The brain has three main regions — the forebrain, midbrain and hindbrain. The figure shows the three most familiar parts: the cerebrum, the cerebellum and the medulla.

Key fact: The *cerebrum* is the largest part of the brain. Its deeply folded surface (with gyri and sulci) houses the centres for thinking, memory, intelligence, speech and voluntary movement, making it the seat of higher mental activity.

Why other options are wrong:

- (B) The cerebellum (hindbrain) controls balance and coordinates muscular activity, not thought.
- (C) The medulla oblongata controls involuntary actions like heartbeat and breathing; (D) the pons relays signals between brain regions.

Final Answer: Large folded region of thought = cerebrum \Rightarrow

[Go Back to Q21](#)

Q22.

Solution

Concept — Neuro-endocrine control: The nervous system and the endocrine system are linked at one key region of the brain, which translates nerve signals into hormonal signals.

Key fact: The *hypothalamus* secretes a number of *releasing* and *inhibiting* hormones that travel through a portal blood system to the anterior pituitary, switching the pituitary's own hormones on or off. It thus sits at the top of the endocrine control hierarchy.

Why other options are wrong:

- (A) The cerebellum coordinates movement and balance; it secretes no hor-



mones.

- (C) The medulla oblongata controls vital reflexes; (D) the corpus callosum is only a band of nerve fibres joining the two cerebral hemispheres.

Final Answer: Source of releasing/inhibiting hormones = hypothalamus ⇒

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

Q23.

Solution

Concept — Structure of a dicot seed: A seed is made of a protective seed coat enclosing the embryo. In dicots the embryo has two seed leaves that store the food the seedling will use.

Key fact: The two large, fleshy food-storing structures attached to the embryo axis are the *cotyledons* (seed leaves). The embryo axis between them bears the radicle (future root) and the plumule (future shoot); the whole seed is wrapped in the seed coat (testa and tegmen).

Why other options are wrong:

- (A) In many dicots (like pea and bean) food is stored in the cotyledons, not in a separate endosperm.
- (B) The seed coat is the outer covering, not the food store; (D) the radicle is the embryonic root, a single small structure.

Final Answer: The two food-storing seed leaves = cotyledons ⇒

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

Q24.

Solution

Concept — Pollen grain wall: The wall of a mature pollen grain has two distinct layers that protect the male gametophyte and help in its germination.

Key fact: The outer layer is the *exine*, made of *sporopollenin* — one of the most resistant organic materials known, able to withstand high temperature and the action of strong acids, alkalis and enzymes. It bears the germ pores. The inner layer (intine) is thin and made of cellulose and pectin.

Why other options are wrong:



- (A) The intine is the soft inner layer, not the hard outer one.
- (B) The nucellus and (C) the integument are tissues of the ovule, not of the pollen grain wall.

Final Answer: Hard outer pollen wall of sporopollenin = exine \Rightarrow

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

Q25.

Solution

Concept — Pregnancy and the placenta: After implantation, a special connecting organ develops between the growing embryo and the wall of the mother's uterus.

Key fact: The *placenta* is formed jointly from the chorionic villi of the embryo and the uterine tissue of the mother. It allows the exchange of nutrients, oxygen and wastes between the foetal and maternal blood (which stay separate), and also acts as an endocrine gland secreting hormones such as hCG, progesterone and oestrogen.

Why other options are wrong:

- (B) The amnion is the fluid-filled membrane that cushions the foetus, not the exchange organ.
- (C) The corpus luteum is a structure in the ovary; (D) the endometrium is the uterine lining that helps form, but is not itself, the placenta.

Final Answer: Foetal–maternal exchange organ = placenta \Rightarrow

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

Q26.

Solution

Concept — Methods of contraception: Birth-control methods are grouped by how they work — as barrier, hormonal, intra-uterine, surgical or natural methods.

Key fact: *Barrier methods* work by physically preventing the sperm and ovum from meeting. Condoms (worn over the penis or inside the vagina) and the diaphragm and cervical cap (which cover the cervix) are the common barrier devices; they also reduce the spread of sexually transmitted infections.

Why other options are wrong:



- (A) Hormonal methods (pills) stop ovulation chemically, not by a physical barrier.
- (C) Surgical methods are vasectomy and tubectomy; (D) IUDs are devices placed in the uterus, a different category.

Final Answer: Condoms and diaphragms = barrier methods \Rightarrow B

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

Q27.

Solution

Concept — ABO blood-group inheritance: Blood group is controlled by three alleles, I^A , I^B and i . I^A and I^B are dominant over i but codominant to each other; the genotype ii gives blood group O.

Key fact: The cross $I^A i \times I^B i$ gives four equally likely genotypes: $I^A I^B$ (group AB), $I^A i$ (group A), $I^B i$ (group B) and ii (group O). Only the single ii box gives group O, so the probability of a group-O child is $\frac{1}{4}$.

Why other options are wrong:

- (A) 0 is wrong because both parents carry the recessive i allele, so an ii child is possible.
- (B) $\frac{1}{2}$ and (D) $\frac{3}{4}$ over-count: only one of the four boxes is ii .

Final Answer: Probability of group O = $\frac{1}{4} \Rightarrow$ C

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

Q28.

Solution

Concept — Sex determination in humans: Humans have 22 pairs of autosomes and one pair of sex chromosomes. Females are XX and males are XY.

Key fact: Since the mother is XX, every *ovum* carries an X chromosome. The father is XY, so his *sperm* may carry either an X or a Y. If an X-bearing sperm fertilises the egg the child is XX (girl); if a Y-bearing sperm does so the child is XY (boy). Thus the sex of the child is decided by the sperm.

Why other options are wrong:

- (A),(B) The ovum is always X, never Y, so it cannot decide the sex.



- (C) The number of autosomes is the same in both sexes and has no role in sex determination.

Final Answer: Sex is decided by the X- or Y-bearing sperm \Rightarrow

Answer: [Go Back to Q28](#)

Q29.

Solution

Concept — Genetic disorders: Human genetic disorders are of two broad kinds: *Mendelian* (single-gene) disorders, caused by a mutation in one gene, and *chromosomal* disorders, caused by an excess, deficiency or abnormal arrangement of whole chromosomes.

Key fact: *Down's syndrome* is a chromosomal disorder caused by an extra copy of chromosome 21 (trisomy-21), so the affected person has 47 chromosomes instead of 46. It results from non-disjunction during gamete formation, not from a single faulty gene.

Why other options are wrong:

- (B) Sickle-cell anaemia is a single-gene (point-mutation) disorder of the β -globin gene.
- (C) Haemophilia and (D) phenylketonuria are also single-gene (Mendelian) disorders.

Final Answer: Chromosomal disorder = Down's syndrome \Rightarrow

Answer: [Go Back to Q29](#)

Q30.

Solution

Concept — Packaging of DNA: A eukaryotic cell holds about two metres of DNA in a tiny nucleus, so the DNA must be tightly and neatly packed. This is done with the help of basic (positively charged) proteins.

Key fact: The negatively charged DNA wraps about 1.75 turns around a core of eight positively charged *histone* proteins to form a *nucleosome*. A chain of nucleosomes gives the “beads-on-a-string” appearance of chromatin, which then coils further into the chromosome.

Why other options are wrong:



- (A) Ribosomes are the sites of protein synthesis, not DNA-packaging cores.
- (C) Enzymes catalyse reactions; (D) lipids form membranes. Neither forms the nucleosome core.

Final Answer: DNA winds around histones \Rightarrow

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

Q31.

Solution

Concept — The flow of genetic information: The central dogma states that information normally flows DNA \rightarrow RNA \rightarrow protein. Some viruses, however, reverse the first step.

Key fact: *Retroviruses* (such as HIV) have an RNA genome and the enzyme reverse transcriptase. By *reverse transcription* they make a complementary DNA copy from their RNA template; this viral DNA then integrates into the host chromosome.

Why other options are wrong:

- (A) Making protein from RNA is translation, the normal final step.
- (B) Making RNA from DNA is ordinary transcription; (D) RNA-from-RNA (RNA replication) is done by RNA-dependent RNA polymerase, not reverse transcriptase.

Final Answer: Reverse transcription makes DNA from RNA \Rightarrow

Answer: (C) [Go Back to Q31](#)

Q32.

Solution

Concept — Patterns of evolution: When different lineages adapt to similar environments, unrelated organisms may come to resemble one another. This is contrasted with related organisms diverging into different forms.

Key fact: The wing of a bird and the wing of an insect are *analogous organs* — they look and work alike but have different internal structures and separate evolutionary origins. Such similarity arising independently in unrelated groups facing similar selection pressures is *convergent evolution*.

Why other options are wrong:



- (A),(B) Divergent evolution produces homologous structures (same basic plan, different functions), as in the forelimbs of mammals — the opposite of this case.
- (C) Adaptive radiation is the diversification of one ancestor into many forms (e.g. Darwin's finches), which is itself a form of divergence.

Final Answer: Analogous wings = convergent evolution \Rightarrow

Answer: (D) [Go Back to Q32](#)

Q33.

Solution

Concept — Causes of disease: Human diseases are caused by different kinds of pathogens — bacteria, viruses, fungi and protozoa. Ringworm, despite its name, has nothing to do with worms.

Key fact: Ringworm is a fungal skin disease caused by genera such as *Microsporum*, *Trichophyton* and *Epidermophyton*. It produces dry, scaly, ring-shaped lesions on the skin, nails and scalp, and spreads through contact with infected persons, soil or articles like towels.

Why other options are wrong:

- (B) Bacterial skin diseases include those caused by *Staphylococcus*, but *Microsporum* and *Trichophyton* are fungi.
- (C) Viral and (D) protozoan diseases are caused by quite different agents (e.g. measles virus; *Plasmodium*).

Final Answer: Ringworm is a fungal disease \Rightarrow

Answer: (A) [Go Back to Q33](#)

Q34.

Solution

Concept — Primary and secondary immune responses: The first time the body meets an antigen it mounts a slow, weak *primary* response. On a later encounter with the same antigen it mounts a faster, stronger *secondary* response.

Key fact: The heightened secondary response is due to *memory B and T cells*, which were produced during the first exposure and survive in the body. On re-exposure they recognise the antigen at once and multiply rapidly, giving a quick,



large antibody response — the basis of long-lasting immunity and of vaccination.

Why other options are wrong:

- (A) Neutrophils give non-specific (innate) defence and carry no immunological memory.
- (C) A raised temperature (fever) is a general defence, not the reason for the stronger second response; (D) red blood cells have no role in immunity.

Final Answer: Stronger second response is due to memory cells ⇒ **B**

Answer: (B) [Go Back to Q34](#)

Q35.

Solution

Concept — Microbes in industrial products: Many organic acids, alcohols and enzymes are produced commercially by growing selected microbes on cheap sugary substrates in fermenters.

Key fact: *Citric acid*, used widely in foods and beverages, is manufactured industrially by the fungus *Aspergillus niger* grown on a sugar (molasses) medium. The mould converts the sugar into citric acid, which is then recovered and purified.

Why other options are wrong:

- (A) *Saccharomyces cerevisiae* (yeast) is used to make ethanol and bread.
- (B) *Penicillium notatum* yields the antibiotic penicillin; (D) *Lactobacillus* produces lactic acid and curd.

Final Answer: Citric acid is produced by *Aspergillus niger* ⇒ **C**

Answer: (C) [Go Back to Q35](#)

Q36.

Solution

Concept — Selecting recombinant cells: After a foreign gene is joined to a vector and put into host bacteria, only some cells actually take up the recombinant DNA. These must be told apart from the rest using a marker.

Key fact: In *insertional inactivation*, the foreign gene is inserted into the middle of a marker gene (for instance one giving resistance to an antibiotic). Insertion destroys that marker's function, so recombinant cells lose the marker activity (e.g.



become sensitive to the antibiotic) while non-recombinants keep it — allowing the recombinants to be identified.

Why other options are wrong:

- (A) Gel electrophoresis separates DNA fragments by size; it does not select transformed colonies.
- (B) PCR amplifies DNA; (C) DNA fingerprinting identifies individuals from DNA patterns.

Final Answer: Screening by a destroyed marker gene = insertional inactivation ⇒

Answer: (D) [Go Back to Q36](#)

Q37.

Solution

Concept — Bioethics and bio-resources: Genetic resources and the traditional knowledge associated with them have great commercial value, raising questions about who owns and benefits from them.

Key fact: *Biopiracy* is the exploitation or patenting of the bio-resources and traditional knowledge of a nation or community by another nation or organisation *without proper authorisation and without fair sharing of benefits*. The cases of basmati rice, neem and turmeric patents are classic examples.

Why other options are wrong:

- (B) Bioremediation is the use of organisms to clean up pollutants.
- (C) Biofortification is breeding crops richer in nutrients; (D) biomagnification is the increasing concentration of a toxin up the food chain.

Final Answer: Unauthorised use/patenting of bio-resources = biopiracy ⇒

Answer: (A) [Go Back to Q37](#)



Q38.

Solution

Concept — Production by fermentation: The heart of any biotechnology production process is the vessel where the actual biological conversion takes place, followed by recovery of the product.

Key fact: The *bioreactor* (fermenter) is a large vessel in which microbes or enzymes convert raw materials into the desired product under carefully controlled temperature, pH, oxygen and stirring. After fermentation, the product is recovered and purified in the steps known as *downstream processing*.

Why other options are wrong:

- (A) An autoclave sterilises equipment and media; it does not carry out the conversion.
- (C) A centrifuge separates particles by spinning; (D) an incubator only maintains a set temperature for small cultures.

Final Answer: Vessel for biological conversion = bioreactor ⇒ **B**

Answer: (B) [Go Back to Q38](#)

Q39.

Solution

Concept — Ecological succession: The orderly and predictable change of communities at a site over time, until a stable climax community is reached, is called succession. The whole sequence of communities is called a sere.

Key fact: *Primary succession* begins on a bare area where no community existed before — such as a newly cooled lava flow, a bare rock or a new pond. The first colonisers (pioneers), usually lichens on rock, slowly build soil so that mosses, herbs, shrubs and finally a forest can establish.

Why other options are wrong:

- (A) Secondary succession starts on a site that already had soil and a community but was disturbed (e.g. an abandoned field after fire); it is faster.
- (B) Eutrophication is nutrient enrichment of water bodies; (D) biomagnification is build-up of toxins along a food chain.

Final Answer: Succession on bare rock = primary succession ⇒ **C**

Answer: (C) [Go Back to Q39](#)



Q40.

Solution

Concept — Deforestation: The conversion of forested land to non-forested uses removes the protective plant cover and the services forests provide, with several harmful effects on the environment.

Key fact: A direct consequence of deforestation is *increased soil erosion and loss of biodiversity*: without roots to bind the soil and a canopy to break the rain, fertile topsoil is washed away, and the destruction of habitat causes many plant and animal species to disappear. Deforestation also raises atmospheric CO₂ and disturbs the water cycle.

Why other options are wrong:

- (A) Soil fertility *falls*, not rises, as topsoil and humus are lost.
- (B) The water table generally *drops*; (C) atmospheric CO₂ *increases* because fewer trees absorb it.

Final Answer: Deforestation causes soil erosion and biodiversity loss ⇒

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Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	C	2	A	3	B	4	D	5	A
6	B	7	C	8	D	9	A	10	B
11	C	12	D	13	A	14	B	15	C
16	D	17	A	18	B	19	C	20	D
21	A	22	B	23	C	24	D	25	A
26	B	27	C	28	D	29	A	30	B
31	C	32	D	33	A	34	B	35	C
36	D	37	A	38	B	39	C	40	D

