SRMJEEE Biology Sample Paper – 10

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. Members of the kingdom Plantae are characterised by a particular mode of nutrition in which they manufacture their own organic food using sunlight, carbon dioxide and water. This mode of nutrition is described as:

(A) autotrophic (photosynthetic)

(B) saprotrophic

(C) parasitic

(D) holozoic

Q2. Which group of plants is regarded as the largest and most advanced group of the plant kingdom, distinguished by the production of true flowers and seeds enclosed within a fruit?

(A) Bryophytes

(B) Angiosperms

(C) Gymnosperms

(D) Pteridophytes

Q3. Which of the following features distinguishes a reptile from an amphibian?

(A) a moist skin used in respiration

(B) external fertilisation in water

(C) a dry, scaly skin and a shelled (amniotic) egg laid on land

(D) a larval (tadpole) stage with gills

Q4. Which of the following gives the seven obligate taxonomic categories arranged in the correct ascending order (from the lowest to the highest rank)?

(A) Kingdom $\rightarrow$ Phylum $\rightarrow$ Class $\rightarrow$ Order $\rightarrow$ Family $\rightarrow$ Genus $\rightarrow$ Species

(B) Species $\rightarrow$ Family $\rightarrow$ Genus $\rightarrow$ Order $\rightarrow$ Class $\rightarrow$ Phylum $\rightarrow$ Kingdom

(C) Genus $\rightarrow$ Species $\rightarrow$ Family $\rightarrow$ Order $\rightarrow$ Class $\rightarrow$ Phylum $\rightarrow$ Kingdom

(D) Species $\rightarrow$ Genus $\rightarrow$ Family $\rightarrow$ Order $\rightarrow$ Class $\rightarrow$ Phylum $\rightarrow$ Kingdom

Q5. In *Bougainvillea* the axillary bud develops into a woody, pointed thorn, while in *Cucurbita* (gourd) it develops into a coiled tendril for climbing. Both the thorn and the tendril are therefore modifications of the:

(A) stem

(B) root

(C) leaf

(D) flower

Q6. The legume (pod) of the family Fabaceae develops from a superior, monocarpellary ovary in which the ovules are attached in two rows along the fused margin of the single carpel. This type of placentation is called:

(A) axile placentation

(B) marginal placentation

(C) parietal placentation

(D) free-central placentation

Q7. In the cockroach, the central nervous system consists of a series of fused, segmentally arranged ganglia joined by connectives to form a:

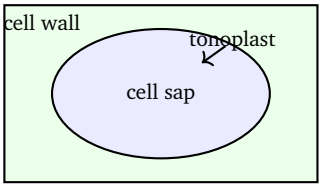
(A) dorsal hollow nerve cord

(B) single brain with no ganglia

(C) double, solid, ventral nerve cord bearing segmental ganglia

(D) radial nerve net

Q8. The large organelle shown below occupies most of the volume of a mature plant cell, is bounded by a single membrane called the *tonoplast*, and keeps the cell firm (turgid) by storing cell sap. This organelle is the:



plant cell — large central vacuole

(A) nucleus

(B) chloroplast

(C) mitochondrion

(D) central vacuole

Q9. Which set of structures is present in a typical plant cell but absent from a typical animal cell?

(A) cell wall, plastids and a large central vacuole

(B) ribosomes, mitochondria and a plasma membrane

(C) nucleus, cytoplasm and endoplasmic reticulum

(D) centrioles and lysosomes

Q10. A phospholipid molecule of the cell membrane has a phosphate "head" that mixes with water and two fatty-acid "tails" that repel water. A molecule that thus possesses both a water-loving and a water-hating end is described as:

(A) completely hydrophobic

(B) amphipathic (amphiphilic)

(C) completely hydrophilic

(D) non-polar throughout

Q11. During which phase of interphase is the DNA of the cell replicated, so that each chromosome comes to consist of two identical sister chromatids?

(A) the G_1 phase

(B) the G_2 phase

(C) the S phase

(D) the M phase

Q12. Meiosis I is described as the *reductional* division because during this division the:

(A) sister chromatids separate from each other

(B) chromosome number is kept the same as in the parent cell

(C) DNA content of the cell is doubled

(D) chromosome number is halved (diploid $\rightarrow$ haploid) as homologous chromosomes separate

Q13. Which of the following changes would *increase* the rate of transpiration in a plant?

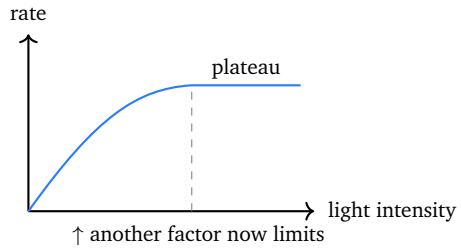
(A) an increase in temperature and a dry, moving (windy) atmosphere

(B) an increase in the humidity of the surrounding air

(C) complete darkness so that the stomata close

(D) a still, water-saturated atmosphere

Q14. The graph shows how the rate of photosynthesis changes as light intensity is raised while CO_2 is kept low. The rate rises and then levels off into a plateau. According to Blackman's law of limiting factors, the plateau is reached because:



(A) light has become toxic to the leaf

(B) some other factor (here CO_2) has now become the limiting factor

(C) the chlorophyll has been destroyed

(D) temperature has fallen to zero

Q15. The respiratory pathway is best described as *amphibolic* because it:

(A) only builds up (synthesises) complex molecules

(B) only breaks down (degrades) complex molecules

(C) involves both breakdown (catabolism) and the supply of intermediates for synthesis (anabolism)

(D) does not involve enzymes at all

Q16. When the apical (terminal) bud of a shoot is removed by "decapitation" (pinching off the tip), the lateral (axillary) buds that were previously dormant begin to grow. This happens because decapitation removes the source of:

(A) cytokinin that promotes lateral growth

(B) water needed by the lateral buds

(C) gibberellin that elongates the stem

(D) apical auxin that was suppressing the lateral buds

Q17. Which of the following correctly lists the final, absorbable end-products of the complete digestion of carbohydrates, proteins and fats respectively?

(A) glucose; amino acids; fatty acids and glycerol

(B) maltose; peptides; triglycerides

(C) starch; proteins; lipids

(D) glycogen; nucleotides; cholesterol

Q18. The respiratory pigment haemoglobin transports most of the oxygen in the blood. In the oxygen-rich environment of the lungs, haemoglobin readily:

(A) releases (dissociates) its oxygen

(B) binds (associates with) oxygen to form oxyhaemoglobin

(C) loses its iron atoms

(D) converts oxygen into carbon dioxide

Q19. In a normal resting adult, one complete cardiac cycle (systole and diastole) takes about 0.8 second. The resulting heart rate is therefore approximately:

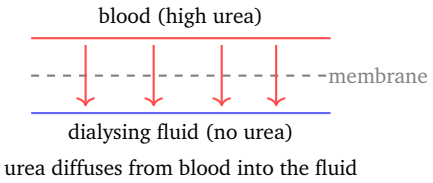
(A) 40 beats per minute

(B) 120 beats per minute

(C) 75 beats per minute

(D) 200 beats per minute

Q20. The diagram shows an artificial kidney (haemodialyser). The patient's blood and the dialysing fluid flow on opposite sides of a selectively permeable membrane, and wastes such as urea pass out of the blood. The principle that drives this removal of urea is:



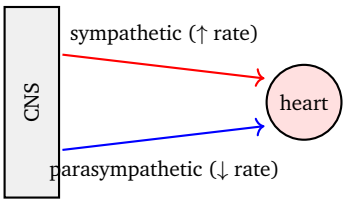
(A) active transport using ATP

(B) osmosis of urea against its gradient

(C) phagocytosis of waste particles

(D) diffusion of wastes down their concentration gradient (dialysis)

Q21. During a sudden fright the heartbeat quickens, the pupils dilate and the airways widen — the "fight-or-flight" response. The autonomic nervous system shown acts on the heart through two antagonistic divisions. Which division produces these fight-or-flight effects?



(A) the sympathetic division

(B) the parasympathetic division

(C) the somatic (voluntary) system

(D) the sensory (afferent) system

Q22. Cortisol and aldosterone, hormones that regulate glucose metabolism and salt–water balance respectively, are steroid hormones secreted by the:

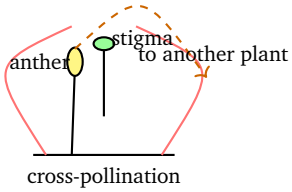
(A) adrenal medulla

(B) adrenal cortex

(C) anterior pituitary

(D) thyroid gland

Q23. In the flower shown, pollen from the anther of one flower is carried to the stigma of a flower on a *different* plant of the same species. This type of pollination is called:



(A) autogamy (self-pollination within the same flower)

(B) geitonogamy (between two flowers of the same plant)

(C) cross-pollination (xenogamy, to a different plant)

(D) cleistogamy

Q24. In the development of a dicot embryo, the zygote first forms a proembryo, which then passes through a characteristic series of stages. The correct sequence of these stages is:

(A) heart-shaped $\rightarrow$ globular $\rightarrow$ proembryo

(B) mature embryo $\rightarrow$ globular $\rightarrow$ proembryo

(C) globular $\rightarrow$ proembryo $\rightarrow$ heart-shaped

(D) proembryo $\rightarrow$ globular $\rightarrow$ heart-shaped $\rightarrow$ mature embryo

Q25. In the human female, the attachment and embedding of the blastocyst into the thickened wall (endometrium) of the uterus is known as:

(A) implantation

(B) ovulation

(C) fertilisation

(D) parturition

Q26. Amniocentesis is a prenatal test meant to detect chromosomal and metabolic disorders in the foetus. Its misuse, which is now legally banned in India, refers to its use for:

(A) diagnosing genetic disorders before birth

(B) determining the sex of the foetus so as to abort female foetuses

(C) delivering medicines to the foetus

(D) monitoring the heartbeat of the foetus

Q27. The Punnett square shows a cross between a homozygous tall pea plant (TT) and a homozygous dwarf pea plant (tt), followed by selfing of the F_1. The law illustrated by the uniform tall F_1 and the 3 tall : 1 dwarf F_2 is the:

	T	t
T	TT	Tt
t	Tt	tt

F_2 : 3 tall : 1 dwarf

(A) law of independent assortment

(B) law of incomplete dominance

(C) law of dominance

(D) law of multiple alleles

Q28. Which of the following correctly names Mendel's three principles of inheritance?

(A) dominance, mutation and linkage

(B) segregation, crossing over and translocation

(C) dominance, polygeny and pleiotropy

(D) dominance, segregation and independent assortment

Q29. Individuals who are *heterozygous* for the sickle-cell allele (HbA HbS) are largely healthy and, in regions where malaria is common, they have an additional advantage in that they are:

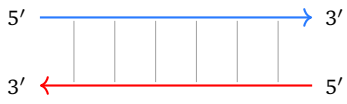
(A) more resistant to malarial infection than normal homozygotes

(B) completely unable to make any haemoglobin

(C) certain to die of severe anaemia in childhood

(D) more susceptible to malaria than other people

Q30. The diagram shows the two strands of a DNA double helix. The two strands run in opposite directions, so that the $5' \rightarrow 3'$ direction of one strand is matched by the $3' \rightarrow 5'$ direction of the other. The two strands are therefore said to be:



antiparallel strands

(A) parallel

(B) antiparallel

(C) identical

(D) single-stranded

Q31. During DNA replication, DNA polymerase adds new nucleotides to build each daughter strand, while another enzyme seals the gaps between the short Okazaki fragments of the lagging strand. The enzyme that joins these fragments is:

(A) helicase

(B) primase

(C) DNA ligase

(D) topoisomerase

Q32. According to the modern synthetic theory of evolution, the raw material for evolution is supplied by genetic variation, which is then sorted and channelled into new species mainly through:

(A) the inheritance of acquired characters

(B) the constant use and disuse of organs

(C) a single sudden saltation event

(D) natural selection acting together with reproductive isolation

Q33. The common cold is a viral infection of the upper respiratory tract. Its causative agent and usual mode of spread are:

(A) rhinoviruses, spread by airborne droplets from coughs and sneezes

(B) *Plasmodium*, spread by mosquito bite

(C) *Salmonella*, spread by contaminated water

(D) a fungus, spread by direct skin contact

Q34. When a person is given a vaccine containing a weakened or inactivated pathogen, the body responds by producing its own antibodies and memory cells. The type of immunity so developed is:

(A) passive immunity

(B) active (acquired) immunity

(C) innate immunity present from birth

(D) no immunity at all

Q35. In Indian households, *Lactobacillus* is used to set curd from milk while another microbe is added to dough so that the carbon dioxide it releases makes idli and bread rise. The microbe used to leaven the dough is:

(A) *Penicillium*

(B) *Rhizobium*

(C) yeast (*Saccharomyces cerevisiae*)

(D) *Clostridium*

Q36. In making a recombinant DNA molecule, a restriction enzyme is first used to cut both the foreign DNA and the vector, and then a second enzyme is used to join the foreign DNA into the vector. The two enzymes used, in that order, are:

(A) DNA polymerase and helicase

(B) ligase and then a restriction enzyme

(C) amylase and lipase

(D) a restriction endonuclease and then DNA ligase

Q37. Bt crops such as Bt cotton and Bt brinjal carry a bacterial gene that makes the plant produce a protein toxic to certain insect larvae. The chief benefit of growing such crops is that they:

(A) are resistant to specific insect pests, reducing the need for chemical insecticides

(B) no longer require any sunlight to grow

(C) grow without any water

(D) produce fruit without flowering

Q38. In molecular diagnosis, a single-stranded labelled piece of DNA or RNA is allowed to base-pair with a complementary sequence in a patient's sample so that the disease gene can be located. This labelled molecule is called a:

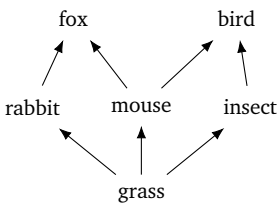
(A) restriction enzyme

(B) DNA probe (used in hybridisation)

(C) plasmid vector

(D) ribosome

Q39. The diagram shows several food chains interconnected so that one organism may be eaten by more than one consumer and one consumer may eat several kinds of prey. Such an interconnected network of food chains in an ecosystem is called a:



interconnected food chains

(A) a single food chain

(B) a pyramid of numbers

(C) a food web

(D) an ecological niche

Q40. Which statement correctly distinguishes ozone-layer depletion from the greenhouse effect?

(A) both are caused only by carbon dioxide

(B) ozone depletion warms the Earth while the greenhouse effect lets in more UV rays

(C) the two terms mean exactly the same thing

(D) ozone depletion (by CFCs) lets in more harmful UV radiation, whereas the greenhouse effect (by CO_2, CH_4, etc.) traps heat and warms the Earth

Detailed Solutions

Q1.

Solution

Concept — Modes of nutrition: Organisms either make their own food (autotrophs) or obtain ready-made organic food from other sources (heterotrophs). The kingdom Plantae is defined largely by the first mode. **Key fact:** Green plants are *autotrophic* and specifically *photosynthetic*: using chlorophyll, they trap solar energy and combine CO_2 and water into glucose, releasing O_2. This self-feeding ability places them at the base of nearly every food chain as producers. **Why other options are wrong:**

- (B) Saprotrophs (most fungi) absorb nutrients from dead organic matter.
- (C) Parasites draw food from a living host; (D) holozoic nutrition (ingesting solid food) is the animal mode.

Final Answer: Plants are autotrophic (photosynthetic) $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q1

Q2.

Solution

Concept — Major plant groups: The plant kingdom ranges from simple bryophytes through pteridophytes and gymnosperms to the angiosperms, with increasing complexity and adaptation to land. **Key fact:** *Angiosperms* (flowering plants) are the largest and most advanced group, with about 300,000 species. Their hallmarks are true flowers, double fertilisation, and seeds enclosed within a *fruit* (the ripened ovary), which aids protection and dispersal. **Why other options are wrong:**

- (A) Bryophytes are the simplest, non-vascular "amphibians of the plant kingdom".
- (C) Gymnosperms bear naked seeds (no fruit); (D) pteridophytes are seedless vascular plants.

Final Answer: Largest, most advanced, fruit-bearing group = angiosperms $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q2

Q3.

Solution

Concept — Amphibians vs reptiles: Reptiles were the first fully terrestrial vertebrates, freeing reproduction and respiration from dependence on water, unlike amphibians. **Key fact:** A reptile has a *dry, scaly (keratinised) skin* that checks water loss and is not used for respiration, and it lays a leathery *amniotic egg* on land. The amnion protects the embryo, so no aquatic larval stage is needed. **Why other options are wrong:**

- (A) A moist respiratory skin and (D) a gilled tadpole stage are amphibian features.
- (B) External fertilisation in water is typical of amphibians; reptiles use internal fertilisation.

Final Answer: Dry scaly skin + amniotic egg = reptile $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q3

Q4.

Solution

Concept — Taxonomic hierarchy: Linnaeus arranged organisms in a hierarchy of obligate (compulsory) categories. Each higher category is broader and contains the ones below it. **Key fact:** Ascending from lowest to highest the seven obligate ranks are: *Species* $\rightarrow$ *Genus* $\rightarrow$ *Family* $\rightarrow$ *Order* $\rightarrow$ *Class* $\rightarrow$ *Phylum (Division)* $\rightarrow$ *Kingdom*. Species is the smallest, most specific unit; Kingdom is the largest. **Why other options are wrong:**

- (A) reverses the order (descending, kingdom first).
- (B),(C) place Family or Genus in the wrong position relative to Species/Genus.

Final Answer: Species $\rightarrow$ Genus $\rightarrow$ Family $\rightarrow$ Order $\rightarrow$ Class $\rightarrow$ Phylum $\rightarrow$ Kingdom $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Stem modifications: Aerial stems may be modified for special functions. Because they arise from *axillary* (or terminal) buds, such structures are recognised as modified stems rather than leaves. **Key fact:** In *Bougainvillea* the axillary bud hardens into a protective *thorn*, and in *Cucurbita* the bud forms a coiled *tendril* for climbing. Their origin from a bud in the axil of a leaf proves both are *stem* modifications. **Why other options are wrong:**

- (B) Roots never bear buds; tendrils/thorns of these plants are not roots.
- (C) Leaf tendrils (e.g. pea) and leaf spines (e.g. *Opuntia*) exist too, but those of *Cucurbita* and *Bougainvillea* are stem-borne; (D) flowers are unrelated.

Final Answer: Thorn of *Bougainvillea* and tendril of *Cucurbita* are stem modifications $\Rightarrow$ A

Answer: (A) Go Back to Q5

Q6.

Solution

Concept — Placentation: Placentation is the arrangement of ovules (placentae) within the ovary, and it is a key feature of a plant family. **Key fact:** In the family Fabaceae the ovary is superior and *monocarpellary* (one carpel). The ovules are borne in two rows along the fused ventral margin of this single carpel — this is *marginal placentation*, seen in the pea/bean pod. **Why other options are wrong:**

- (A) Axile placentation (tomato, china rose) needs a multilocular, syncarpous ovary.
- (C) Parietal placentation (mustard) has ovules on the wall of a unilocular ovary made of fused carpels; (D) free-central (*Dianthus*) has ovules on a central column with no septa.

Final Answer: Legume of Fabaceae shows marginal placentation $\Rightarrow$ B

Answer: (B) Go Back to Q6

Q7.

Solution

Concept — Insect nervous system: In invertebrates such as the cockroach the central nervous system lies *ventrally* (below the gut), unlike the dorsal cord of vertebrates. **Key fact:** The cockroach has a *double, solid, ventral nerve cord* running along the floor of the body. It bears a series of segmental *ganglia* (three in the thorax and six in the abdomen) joined by connectives, with a supra-oesophageal ganglion ("brain") in the head. **Why other options are wrong:**

- (A) A single dorsal hollow nerve cord is a chordate feature.
- (B) The cockroach does have a brain plus many ganglia; (D) a radial nerve net occurs in cnidarians (*Hydra*).

Final Answer: Ventral nerve cord with segmental ganglia $\Rightarrow$ C

Answer: (C) Go Back to Q7

Q8.

Solution

Concept — The plant vacuole: A mature plant cell typically contains one very large fluid-filled sac that can occupy up to 90% of the cell's volume. **Key fact:** This *central vacuole* is bounded by a single membrane, the *tonoplast*, and is filled with cell sap (water, ions, sugars, pigments, wastes). By taking up water it keeps the cell *turgid*, supporting non-woody plant parts, and it also stores materials. The tonoplast in the figure confirms the identity. **Why other options are wrong:**

- (A) The nucleus is a dense, double-membraned body containing chromatin, not a sap-filled sac.
- (B) The chloroplast is green and double-membraned with grana; (C) the mitochondrion has cristae and makes ATP.

Final Answer: Large sap sac with a tonoplast = central vacuole $\Rightarrow$ D

Answer: (D) Go Back to Q8

Q9.

Solution

Concept — Plant cell vs animal cell: Both are eukaryotic and share most organelles, but a few structures are unique to plant cells, reflecting their autotrophic, sedentary life. **Key fact:** A plant cell additionally possesses a rigid *cell wall* (of cellulose), *plastids* (including chloroplasts for photosynthesis) and a *large central vacuole*. Animal cells lack all three but typically have centrioles, which plant cells generally lack. **Why other options are wrong:**

- (B),(C) Ribosomes, mitochondria, plasma membrane, nucleus, cytoplasm and ER are common to *both* cell types.
- (D) Centrioles and prominent lysosomes are typical of *animal* cells, not plant cells.

Final Answer: Cell wall, plastids and a large vacuole are plant-specific $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Lipids: Lipids include *triglycerides* (glycerol + three fatty acids, used for energy storage) and *phospholipids* (glycerol + two fatty acids + a phosphate group, the building blocks of membranes). **Key fact:** A phospholipid has a polar, water-loving phosphate *head* (hydrophilic) and two non-polar, water-hating fatty-acid *tails* (hydrophobic). A molecule bearing both kinds of region is *amphipathic*. This dual nature is why phospholipids spontaneously form the bilayer of cell membranes. **Why other options are wrong:**

- (A),(D) A purely hydrophobic / non-polar molecule would not have the water-loving head.
- (C) A purely hydrophilic molecule would lack the water-hating tails.

Final Answer: A phospholipid is amphipathic $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q10

Q11.

Solution

Concept — Interphase: Before a cell divides it grows and copies its DNA during interphase, which is divided into the G_1, S and G_2 phases. **Key fact:** DNA replication occurs in the *S (synthesis) phase*. Here each DNA molecule is duplicated, so every chromosome comes to consist of two identical *sister chromatids* joined at a centromere, while the chromosome *number* stays unchanged. **Why other options are wrong:**

- (A) G_1 is a growth phase before replication (cell makes proteins, organelles).
- (B) G_2 follows replication and prepares for mitosis; (D) M phase is the actual division, not interphase.

Final Answer: DNA is replicated in the S phase $\Rightarrow$ C

Answer: (C) Go Back to Q11

Q12.

Solution

Concept — Two meiotic divisions: Meiosis consists of meiosis I (reductional) and meiosis II (equational), together producing four haploid cells from one diploid cell. **Key fact:** Meiosis I is *reductional* because homologous chromosomes pair and then *separate*, halving the chromosome number ($2n \rightarrow n$). Meiosis II is *equational* because sister chromatids separate, like mitosis, keeping the (already haploid) number the same. **Why other options are wrong:**

- (A) Sister-chromatid separation happens in meiosis *II*, not I.
- (B) Keeping the number the same describes the equational division; (C) DNA is doubled earlier, in the S phase, not during meiosis I.

Final Answer: Meiosis I halves the chromosome number (reductional) $\Rightarrow$ D

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Transpiration: The rate at which water vapour escapes through the stomata depends on environmental factors that affect either stomatal opening or the steepness of the vapour gradient. **Key fact:** Transpiration *increases* with high *temperature* (more evaporation), *low humidity* (steeper vapour gradient) and *wind* (which sweeps away saturated air), and in *light* (stomata open). Option (A) combines high temperature with a dry, windy atmosphere, so it raises the rate. **Why other options are wrong:**

- (B) High humidity narrows the vapour gradient and *lowers* the rate.
- (C) Darkness closes the stomata, reducing transpiration; (D) still, saturated air also reduces it.

Final Answer: High temperature + dry, windy air raises transpiration $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q13

Q14.

Solution

Concept — Blackman's law of limiting factors: When a process is governed by several factors, its rate at any moment is set by the factor that is in shortest supply — the *limiting factor*. **Key fact:** On the graph, raising light intensity first speeds photosynthesis, but the curve then *plateaus*. At the plateau light is no longer limiting; *another factor (here the low CO_2 supply)* has become the limiting factor, so adding more light cannot raise the rate further until CO_2 is increased. **Why other options are wrong:**

- (A) Ordinary light intensities are not toxic to the leaf.
- (C) Chlorophyll is not destroyed at the plateau; (D) temperature has not dropped to zero — the curve simply reflects a different limiting factor.

Final Answer: The plateau means another factor (CO_2) now limits the rate $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — Catabolism and anabolism: Catabolic pathways break large molecules down (releasing energy); anabolic pathways build molecules up (consuming energy). A pathway that does both is called amphibolic. **Key fact:** The respiratory pathway is *amphibolic*: it mainly *breaks down* glucose (and fats, proteins) to release ATP (catabolism), but its intermediates (e.g. acetyl-CoA, α-ketoglutarate, oxaloacetate) are also *withdrawn to synthesise* fatty acids, amino acids and other compounds (anabolism). **Why other options are wrong:**

- (A),(B) Calling it purely anabolic or purely catabolic ignores half of its role.
- (D) Respiration is an enzyme-driven, multi-step process, so this is false.

Final Answer: Respiration is both catabolic and anabolic, i.e. amphibolic $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Apical dominance: The growing shoot tip suppresses the growth of the lateral buds below it, so the plant tends to grow tall rather than bushy. **Key fact:** This suppression is caused by *auxin* produced at the apical bud, which moves down and inhibits the axillary buds. *Decapitation* (removing the shoot tip) cuts off this auxin supply, so the lateral buds are released from inhibition and sprout — the basis of pruning and hedging. **Why other options are wrong:**

- (A) Cytokinin actually *promotes* lateral-bud growth, so removing it would not release the buds.
- (B) Lateral buds are not starved of water by the tip; (C) gibberellin elongates stems but is not the cause of apical dominance.

Final Answer: Decapitation removes apical auxin and ends suppression $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q16

Q17.

Solution

Concept — End-products of digestion: Digestion hydrolyses large food polymers into small, absorbable monomers that can cross the intestinal lining into the blood or lymph. **Key fact:** Carbohydrates are finally broken to *glucose* (and other monosaccharides), proteins to *amino acids*, and fats to *fatty acids and glycerol* (plus monoglycerides). These are the absorbable end-products taken up in the small intestine. **Why other options are wrong:**

- (B) Maltose, peptides and triglycerides are *intermediate*, not final, products.
- (C) Starch, proteins and lipids are the *starting* materials; (D) glycogen and nucleotides are not the standard digestion end-products of these foods.

Final Answer: Glucose; amino acids; fatty acids and glycerol $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Oxygen transport: Most oxygen in blood is carried bound to *haemoglobin*, the iron-containing pigment of red blood cells. Its binding depends on the partial pressure of oxygen (pO_2). **Key fact:** In the lungs the high pO_2 favours *association*: haemoglobin readily binds O_2 to form *oxyhaemoglobin*. In the tissues, where pO_2 is low, the same pigment *dissociates* and releases oxygen — the basis of the sigmoid oxygen-dissociation curve. **Why other options are wrong:**

- (A) Release of oxygen happens in the *tissues*, not the oxygen-rich lungs.
- (C) Haemoglobin does not lose its iron; (D) it does not chemically convert O_2 into CO_2.

Final Answer: In the lungs haemoglobin binds O_2 as oxyhaemoglobin $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q18

Q19.

Solution

Concept — The cardiac cycle: One cardiac cycle is the sequence of events (atrial and ventricular systole and diastole) in a single heartbeat. The heart rate is the number of such cycles per minute. **Key fact:** If one cycle takes about *0.8 s*, then in 60 s the number of beats $= 60/0.8 = 75$. Hence the normal resting heart rate is about *75 beats per minute*. The beat is initiated by the SA node (pacemaker) and regulated by the autonomic nerves. **Why other options are wrong:**

- (A) 40 bpm would require a 1.5 s cycle (bradycardia).
- (B) 120 bpm needs a 0.5 s cycle; (D) 200 bpm is far above the normal resting rate.

Final Answer: $60/0.8 \approx 75$ beats per minute $\Rightarrow$ C

Answer: (C) Go Back to Q19

Q20.

Solution

Concept — Haemodialysis: An artificial kidney cleans the blood of a patient whose kidneys have failed, by passing the blood next to a dialysing fluid across a selectively permeable membrane. **Key fact:** The dialysing fluid has the same composition as plasma *except* that it contains *no nitrogenous wastes*. So urea and other wastes, being at higher concentration in the blood, *diffuse down their concentration gradient* across the membrane into the fluid (*dialysis*), while useful blood components are retained. No energy is spent on this passive movement. **Why other options are wrong:**

- (A) Active transport needs ATP and a carrier, neither present in a dialyser.
- (B) Osmosis refers to water movement, not urea moving against its gradient; (C) phagocytosis is cell-engulfing, irrelevant here.

Final Answer: Wastes leave by diffusion (dialysis) down their gradient $\Rightarrow$ D

Answer: (D) Go Back to Q20

Q21.

Solution

Concept — The autonomic nervous system: The ANS controls involuntary functions through two antagonistic divisions — the sympathetic and the parasympathetic. **Key fact:** The *sympathetic* division produces the "fight-or-flight" response: it raises the heart rate, dilates the pupils and the bronchioles, and diverts blood to the muscles, preparing the body for emergency action (largely via noradrenaline/adrenaline). **Why other options are wrong:**

- (B) The parasympathetic division causes "rest-and-digest" effects — it *slows* the heart and constricts the pupils.
- (C) The somatic system controls voluntary skeletal muscle; (D) the sensory (afferent) system only carries input to the CNS.

Final Answer: Fight-or-flight = sympathetic division $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q21

Q22.

Solution

Concept — The adrenal gland: Each adrenal gland has an outer *cortex* (secreting steroid hormones) and an inner *medulla* (secreting adrenaline and noradrenaline). **Key fact:** The *adrenal cortex* secretes *cortisol* (a glucocorticoid that raises blood glucose and dampens inflammation) and *aldosterone* (a mineralocorticoid that conserves Na^+ and water and excretes K^+, controlling salt–water balance and blood pressure). **Why other options are wrong:**

- (A) The adrenal medulla secretes the catecholamines adrenaline and noradrenaline, not cortisol/aldosterone.
- (C) The anterior pituitary secretes trophic hormones such as ACTH; (D) the thyroid secretes thyroxine.

Final Answer: Cortisol and aldosterone come from the adrenal cortex $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q22

Q23.

Solution

Concept — Types of pollination: Pollination is the transfer of pollen from the anther to the stigma. It is classed by *where* the pollen comes from relative to the receiving flower. **Key fact:** When pollen is carried to the stigma of a flower on a *different plant* of the same species, it is *cross-pollination* (xenogamy). It brings together genetically different gametes and promotes variation; common agents are insects, wind and water. The dashed arrow in the figure shows pollen travelling to another plant. **Why other options are wrong:**

- (A) Autogamy is self-pollination *within the same flower*.
- (B) Geitonogamy is between two flowers of the *same* plant (genetically self); (D) cleistogamy is pollination inside a flower that never opens.

Final Answer: Pollen to a different plant = cross-pollination $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q23

Q24.

Solution

Concept — Dicot embryogeny: After fertilisation the zygote divides repeatedly to form an embryo through a regular sequence of recognisable stages. **Key fact:** In a dicot the zygote first forms a *proembryo*, which becomes a *globular* (spherical) embryo, then a *heart-shaped* embryo (as the two cotyledons begin to bulge out), and finally the *mature* embryo with two cotyledons, plumule and radicle. So the order is proembryo $\rightarrow$ globular $\rightarrow$ heart-shaped $\rightarrow$ mature. **Why other options are wrong:**

- (A),(B) place the mature or heart-shaped stage *before* the proembryo, reversing development.
- (C) puts the proembryo after the globular stage, which is incorrect.

Final Answer: Proembryo $\rightarrow$ globular $\rightarrow$ heart-shaped $\rightarrow$ mature $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q24

Q25.

Solution

Concept — Early human development: After fertilisation the embryo travels down the fallopian tube as a dividing ball of cells and reaches the uterus as a blastocyst. **Key fact:** *Implantation* is the process in which the blastocyst attaches to and becomes embedded in the thickened, vascular wall (endometrium) of the uterus, about 6–7 days after fertilisation. It marks the start of pregnancy and leads to placenta formation. **Why other options are wrong:**

- (B) Ovulation is the release of the egg from the ovary, before fertilisation.
- (C) Fertilisation is the fusion of sperm and egg; (D) parturition is the act of childbirth.

Final Answer: Embedding of the blastocyst in the uterus = implantation $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q25

Q26.

Solution

Concept — Amniocentesis and MTP: Amniocentesis is a procedure in which a sample of amniotic fluid is withdrawn to study the foetal cells and chromosomes; medical termination of pregnancy (MTP) is the legal removal of a pregnancy. **Key fact:** Although amniocentesis legitimately detects chromosomal disorders (e.g. Down's syndrome) and metabolic defects, it has been *misused for sex determination*, leading to the selective abortion of *female* foetuses. To curb this, prenatal sex determination is banned in India under the PCPNDT Act. **Why other options are wrong:**

- (A) Diagnosing genetic disorders is the proper, legal use — not a misuse.
- (C) The test does not deliver medicines; (D) the foetal heartbeat is monitored by other means (ultrasound).

Final Answer: Misuse = sex determination leading to female foeticide $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q26

Q27.

Solution

Concept — Mendel's law of dominance: In a cross between two pure-breeding parents differing in one trait, only one form of the character appears in the F_1, and both reappear in the F_2 in a fixed ratio. **Key fact:** When tall (TT) is crossed with dwarf (tt), all F_1 are *tall* (Tt) — the dominant "T" masks the recessive "t". Selfing the F_1 gives the Punnett square shown, with genotypes 1 TT : 2 Tt : 1 tt and a phenotypic ratio of *3 tall : 1 dwarf*. This masking of one allele by another is the *law of dominance*. **Why other options are wrong:**

- (A) Independent assortment concerns *two or more* gene pairs (dihybrid 9:3:3:1), not a monohybrid cross.
- (B) Incomplete dominance gives a blended F_1 and a 1:2:1 phenotype, not 3:1; (D) multiple alleles (e.g. ABO) is unrelated here.

Final Answer: Tall masks dwarf giving 3:1 = law of dominance $\Rightarrow$ C

Answer: (C) Go Back to Q27

Q28.

Solution

Concept — Mendel's principles: From his pea-plant crosses Mendel deduced three laws of inheritance that form the foundation of classical genetics. **Key fact:** The three are: (1) the *law of dominance* — one allele masks the other in the heterozygote; (2) the *law of segregation* — the two alleles of a gene separate during gamete formation so each gamete carries only one; and (3) the *law of independent assortment* — alleles of different genes assort independently of one another. **Why other options are wrong:**

- (A) Mutation and linkage are not Mendel's laws (linkage is actually an exception to independent assortment).
- (B),(C) Crossing over, translocation, polygeny and pleiotropy are later genetic concepts, not Mendel's three laws.

Final Answer: Dominance, segregation and independent assortment $\Rightarrow$ D

Answer: (D) Go Back to Q28

Q29.

Solution

Concept — Sickle-cell anaemia: This is an autosomal recessive disorder in which a single base change replaces glutamic acid with valine in the β-globin chain, producing abnormal HbS. Homozygotes (HbS HbS) suffer severe anaemia. **Key fact:**

The *heterozygous* carrier (HbA HbS) makes both normal and sickle haemoglobin, is largely healthy, and importantly is *more resistant to malaria*, because the parasite cannot complete its cycle well in such red cells. This survival advantage keeps the sickle allele common in malaria-endemic regions — a classic example of heterozygote advantage (balanced polymorphism). **Why other options are wrong:**

- (B) Carriers do make haemoglobin (both HbA and HbS).
- (C) Heterozygotes are usually healthy, not destined to die young; (D) they are *more* resistant, not more susceptible, to malaria.

Final Answer: Heterozygotes are more malaria-resistant $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q29

Q30.

Solution

Concept — Structure of DNA: The Watson–Crick model describes DNA as a double helix of two polynucleotide strands held together by base pairing, with a sugar–phosphate backbone on the outside. **Key fact:** The two strands are *antiparallel*:

one runs in the $5' \rightarrow 3'$ direction while its partner runs $3' \rightarrow 5'$. This opposite orientation is essential for complementary base pairing (A–T, G–C) and dictates how the strands are read and replicated (with leading and lagging strands). **Why other options are wrong:**

- (A) "Parallel" (same direction) would not allow proper base pairing.
- (C) The strands are complementary, not identical; (D) DNA here is clearly double-stranded.

Final Answer: The two strands are antiparallel $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q30

Q31.

Solution

Concept — Enzymes of replication: DNA replication is carried out by a team of enzymes. The new DNA is built only in the $5' \rightarrow 3'$ direction, so the lagging strand is made as short pieces (Okazaki fragments) that must be joined. **Key fact:** *DNA polymerase* adds nucleotides to synthesise the new strands, while *DNA ligase* seals the nicks between adjacent Okazaki fragments by forming a phosphodiester bond, producing a continuous strand. **Why other options are wrong:**

- (A) Helicase unwinds and separates the two parental strands.
- (B) Primase lays down the short RNA primer; (D) topoisomerase relieves the supercoiling ahead of the fork.

Final Answer: Okazaki fragments are joined by DNA ligase $\Rightarrow$ C

Answer: (C) Go Back to Q31

Q32.

Solution

Concept — The modern synthetic theory: This theory combines Darwinian natural selection with Mendelian genetics and population biology to explain how species evolve. **Key fact:** It holds that *genetic variation* (from mutation and recombination) provides the raw material, which *natural selection* then sorts by favouring the fitter variants, while *reproductive isolation* prevents gene flow between diverging populations and finally fixes them as separate species. Variation + natural selection + isolation together drive speciation. **Why other options are wrong:**

- (A),(B) Inheritance of acquired characters and use-and-disuse are Lamarckian ideas, now rejected.
- (C) A single saltation does not account for gradual adaptive evolution as the synthetic theory does.

Final Answer: Variation + natural selection + isolation $\Rightarrow$ D

Answer: (D) Go Back to Q32

Q33.

Solution

Concept — The common cold: The common cold is the most frequent viral infection of the nose and upper respiratory tract, marked by nasal congestion, sneezing, sore throat and a running nose. **Key fact:** It is caused chiefly by *rhinoviruses* and spreads through inhaled *droplets* released when an infected person coughs or sneezes, as well as by contaminated hands and surfaces (fomites). It affects the nose and respiratory passages but not the lungs. **Why other options are wrong:**

- (B) *Plasmodium* (a protozoan, mosquito-borne) causes malaria, not a cold.
- (C) *Salmonella* causes typhoid through contaminated food/water; (D) the cold is viral, not fungal.

Final Answer: Rhinoviruses spread by droplets $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q33

Q34.

Solution

Concept — Immunisation: Immunity may be *passive* (ready-made antibodies given from outside) or *active* (the body makes its own antibodies after exposure to an antigen). **Key fact:** A *vaccine* introduces a harmless form of the pathogen (weakened, killed or its antigens), prompting the immune system to mount a primary response, produce *antibodies*, and form *memory cells*. This is *active (acquired) immunity*, which is long-lasting and gives a rapid response on later exposure to the real pathogen. **Why other options are wrong:**

- (A) Passive immunity (e.g. antiserum, mother's antibodies) is borrowed and short-lived, with no memory.
- (C) Innate immunity is non-specific and present from birth; (D) a vaccine clearly does generate immunity.

Final Answer: Vaccination produces active (acquired) immunity $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q34

Q35.

Solution

Concept — Microbes in everyday products: Several common household foods depend on the controlled activity of useful microbes. **Key fact:** *Lactobacillus* (lactic-acid bacteria) curdles milk into curd by producing lactic acid, while *yeast* (*Saccharomyces cerevisiae*) is added to dough, where it ferments sugars and releases *carbon dioxide*; the trapped gas makes idli batter and bread dough *rise* (leavening), giving a soft, porous texture. **Why other options are wrong:**

- (A) *Penicillium* is used to make antibiotics and ripen cheese, not to leaven dough.
- (B) *Rhizobium* fixes nitrogen in root nodules; (D) *Clostridium* is mostly a harmful/anaerobic genus, not a leavening agent.

Final Answer: Dough is leavened by yeast (*Saccharomyces*) $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q35

Q36.

Solution

Concept — Making recombinant DNA: To insert a foreign gene into a vector, the DNA must first be cut at defined points and then the pieces stitched together. **Key fact:** A *restriction endonuclease* cuts both the foreign DNA and the vector at specific palindromic sequences, often leaving complementary "sticky ends". *DNA ligase* then joins the foreign fragment to the vector by sealing the sugar–phosphate backbone, producing the recombinant DNA molecule. The correct order is therefore restriction enzyme first, ligase second. **Why other options are wrong:**

- (A) DNA polymerase and helicase act in replication, not in cutting-and-joining.
- (B) reverses the order (you cannot ligase before cutting); (C) amylase and lipase are digestive enzymes, not used on DNA.

Final Answer: Restriction endonuclease then DNA ligase $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q36

Q37.

Solution

Concept — Biotechnology in agriculture: Genetic engineering can transfer useful genes into crop plants to give traits such as pest resistance, herbicide tolerance or improved nutrition. **Key fact:** *Bt crops* carry a *cry* gene from *Bacillus thuringiensis* that codes for a protein toxic to specific insect larvae (e.g. bollworm). The plant thus protects itself, so growers need far *fewer chemical insecticides*, cutting cost and pollution. Examples are Bt cotton and Bt brinjal. **Why other options are wrong:**

- (B),(C) The Bt gene confers pest resistance only; it does not free the plant from its need for sunlight or water.
- (D) Bt crops still flower and fruit normally.

Final Answer: Bt crops are pest-resistant, reducing insecticide use $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q37

Q38.

Solution

Concept — Molecular diagnosis: Many diseases can be detected at the level of DNA/RNA before symptoms appear, by checking whether a particular gene sequence is present. **Key fact:** A *DNA probe* is a short, single-stranded, labelled (radioactive or fluorescent) piece of DNA/RNA whose sequence is complementary to the target gene. When mixed with the patient's denatured DNA it *hybridises* (base-pairs) with any complementary sequence present; the label then reveals the disease gene. This is the basis of techniques such as Southern blotting and FISH. **Why other options are wrong:**

- (A) A restriction enzyme cuts DNA; it does not detect a sequence by hybridisation.
- (C) A plasmid is a vector for cloning; (D) a ribosome is the site of protein synthesis.

Final Answer: Labelled complementary molecule = DNA probe $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q38

Q39.

Solution

Concept — Food chains and food webs: A food chain is a single linear sequence of who-eats-whom. In nature, however, most organisms have several food sources and several predators. **Key fact:** When many food chains are *interconnected* so that an organism is linked to more than one chain (one prey eaten by several consumers, one consumer eating several preys), the network is called a *food web*. Food webs make an ecosystem more stable, because the loss of one species leaves alternative feeding pathways. **Why other options are wrong:**

- (A) A single food chain is just one straight pathway, not the branched network shown.
- (B) A pyramid of numbers compares population sizes at each trophic level; (D) an ecological niche is an organism's role and habitat, not a feeding network.

Final Answer: Interconnected food chains form a food web $\Rightarrow$ C

Answer: (C) Go Back to Q39

Q40.

Solution

Concept — Two distinct atmospheric problems: Ozone-layer depletion and the greenhouse effect are often confused, but they involve different gases, regions and consequences. **Key fact:** *Ozone depletion* occurs in the *stratosphere*, where *CFCs* release chlorine that destroys O_3, thinning the shield and letting more harmful *UV-B* radiation reach the ground (causing skin cancer, cataracts). The *greenhouse effect* occurs in the *troposphere*, where gases such as CO_2 *and* CH_4 trap outgoing heat (infra-red) and *warm* the Earth, driving global warming. **Why other options are wrong:**

- (A) CO_2 is a greenhouse gas, but ozone depletion is caused by CFCs, so "only CO_2" is wrong.
- (B) swaps the two effects; (C) the two issues are distinct, not identical.

Final Answer: CFCs deplete ozone (more UV); CO_2/CH_4 trap heat (warming) $\Rightarrow$ D

Answer: (D) Go Back to Q40

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	B	3	C	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