SRMJEEE Biology Sample Paper – 5

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. Viruses are not included in Whittaker's five-kingdom system of classification mainly because they are:

(A) acellular (non-cellular) and obligate intracellular parasites

(B) prokaryotic single-celled organisms

(C) eukaryotic and multicellular

(D) capable of independent metabolism outside a host

Q2. Which pair of features is unique to and defining of the angiosperms (flowering plants) among all plant groups?

(A) naked seeds and motile sperm

(B) the presence of flowers and double fertilisation

(C) a dominant gametophyte and archegonia

(D) dichotomous venation and circinate vernation

Q3. Roundworms such as *Ascaris* possess a false body cavity (a pseudocoelom) not lined by mesoderm. They are placed in the phylum:

(A) Platyhelminthes

(B) Annelida

(C) Aschelminthes (Nematoda)

(D) Arthropoda

Q4. According to the rules of biological nomenclature, which of the following is the correct way to write the scientific name of the mango?

(A) mangifera Indica

(B) Mangifera Indica

(C) MANGIFERA indica

(D) *Mangifera indica* (genus capitalised, species in lower case, both italicised)

Q5. In the pea plant, the upper leaflets of the compound leaf are modified into slender coiling structures that help the weak stem climb. These tendrils are modifications of the:

(A) leaf

(B) root

(C) flower

(D) seed

Q6. The family Fabaceae is of great economic importance because its members provide protein-rich pulses and, through root nodules, enrich the soil with:

(A) fixed atmospheric carbon dioxide

(B) fixed atmospheric nitrogen

(C) additional phosphate ions

(D) potassium ions

Q7. The heart of a frog is described as three-chambered because it consists of:

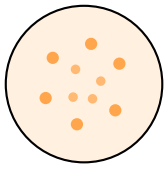
(A) one atrium and two ventricles

(B) three ventricles only

(C) two atria and one ventricle

(D) two atria and two ventricles

Q8. The cell organelle shown below is a single-membrane vesicle packed with hydrolytic (digestive) enzymes and is often called the "suicidal bag" of the cell. It is the:



hydrolytic enzymes inside a single membrane

(A) ribosome

(B) centriole

(C) peroxisome

(D) lysosome

Q9. The fine cytoplasmic threads that pass through the cell walls and connect the protoplasm of adjacent plant cells, allowing exchange of materials, are called:

(A) plasmodesmata

(B) desmosomes

(C) gap junctions

(D) plasmolysis channels

Q10. A non-protein, often loosely bound organic molecule (such as NAD or FAD) that is essential for the catalytic activity of certain enzymes is best described as a:

(A) substrate

(B) coenzyme

(C) competitive inhibitor

(D) zymogen

Q11. Mitosis is biologically significant because it brings about growth, repair of tissues and:

(A) halving of the chromosome number

(B) genetic recombination through crossing over

(C) the equational division that keeps the daughter cells genetically identical to the parent

(D) the formation of haploid gametes

Q12. One diploid cell undergoing meiosis (meiosis I followed by meiosis II) ultimately gives rise to:

(A) two diploid cells

(B) two haploid cells

(C) four diploid cells

(D) four haploid cells

Q13. According to the cohesion–tension theory, the main force that pulls a continuous column of water up the xylem from the roots to the leaves is generated by:

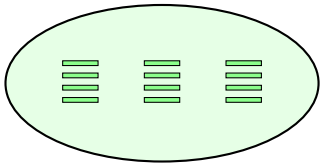
(A) the transpiration pull at the leaf surface

(B) root pressure alone

(C) active pumping by xylem vessels

(D) capillary rise in the soil

Q14. The light reaction of photosynthesis takes place on the thylakoid membranes shown. Besides oxygen, the two energy-rich products formed and later used in the Calvin cycle are:



chloroplast — thylakoid membranes (grana)

(A) glucose and starch

(B) ATP and NADPH

(C) CO_2 and water

(D) pyruvate and lactic acid

Q15. In the absence of oxygen, fermentation in yeast converts pyruvic acid into:

(A) carbon dioxide and water only

(B) lactic acid

(C) ethanol (ethyl alcohol) and carbon dioxide

(D) glucose and oxygen

Q16. Which plant growth regulator, known as the “stress hormone”, closes the stomata during water shortage and promotes bud and seed dormancy?

(A) auxin

(B) gibberellin

(C) cytokinin

(D) abscisic acid (ABA)

Q17. In the human alimentary canal, the absorption of most of the digested food into the blood takes place chiefly in the small intestine through finger-like projections called:

(A) villi

(B) rugae

(C) taste buds

(D) gastric pits

Q18. During normal inspiration in humans, the diaphragm and the external intercostal muscles:

(A) relax, decreasing the volume of the thoracic cavity

(B) contract, increasing the volume of the thoracic cavity and drawing air in

(C) contract, forcing air out of the lungs

(D) have no role; breathing is purely passive

Q19. In mammals, blood passes through the heart twice during one complete circuit of the body. This arrangement, made up of a pulmonary circuit and a systemic circuit, is called:

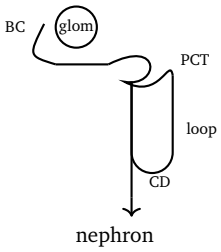
(A) single circulation

(B) open circulation

(C) incomplete circulation

(D) double circulation

Q20. Urine formation in the nephron shown involves three processes. The step in which substances such as H^+, K^+ and ammonia are actively passed from the blood into the tubular filtrate is called:



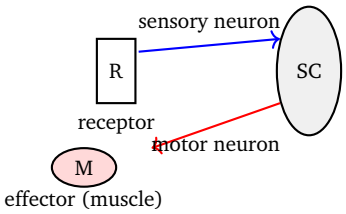
(A) glomerular filtration

(B) selective reabsorption

(C) tubular secretion

(D) micturition

Q21. The reflex arc shown is the pathway of a reflex action. Counting from the stimulus to the response, the five components in correct sequence are:



(A) receptor → sensory neuron → spinal cord (interneuron) → motor neuron → effector

(B) effector → motor neuron → spinal cord → sensory neuron → receptor

(C) receptor → motor neuron → brain → sensory neuron → effector

(D) sensory neuron → receptor → effector → motor neuron → spinal cord

Q22. Which hormone, secreted by the α-cells of the islets of Langerhans, *raises* the blood glucose level by promoting the breakdown of glycogen in the liver?

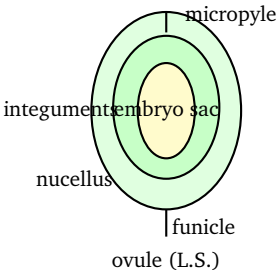
(A) insulin

(B) glucagon

(C) thyroxine

(D) calcitonin

Q23. In the ovule shown, the small pore at the tip through which the pollen tube usually enters the embryo sac is the:



(A) funicle

(B) hilum

(C) micropyle

(D) chalaza

Q24. After fertilisation in a flowering plant, which of the following correctly describes the post-fertilisation changes?

(A) the ovary develops into the seed

(B) the ovule develops into the fruit

(C) the stigma develops into the seed

(D) the ovule develops into the seed and the ovary develops into the fruit

Q25. In the human male reproductive system, the correct path taken by the sperms after they are produced is:

(A) testis $\rightarrow$ epididymis $\rightarrow$ vas deferens $\rightarrow$ urethra

(B) testis $\rightarrow$ vas deferens $\rightarrow$ epididymis $\rightarrow$ urethra

(C) epididymis $\rightarrow$ testis $\rightarrow$ urethra $\rightarrow$ vas deferens

(D) urethra $\rightarrow$ vas deferens $\rightarrow$ epididymis $\rightarrow$ testis

Q26. Gonorrhoea, syphilis and AIDS belong to a group of diseases transmitted mainly through sexual contact. The single most effective way to avoid contracting such sexually transmitted diseases is to:

(A) take antibiotics regularly

(B) avoid sex with unknown or multiple partners and use a condom (safe-sex practices)

(C) get vaccinated against all of them

(D) avoid donating blood

Q27. The Punnett square shows a monohybrid cross between two heterozygous tall pea plants ($Tt \times Tt$). The *genotypic* ratio obtained in the F_2 generation is:

	T	t
T	TT	Tt
t	Tt	tt

(A) $3:1$

(B) $1:1$

(C) $9:3:3:1$

(D) $1:2:1$

Q28. The condition in which a single gene controls or influences several different (apparently unrelated) phenotypic traits, as seen in phenylketonuria, is called:

(A) incomplete dominance

(B) co-dominance

(C) pleiotropy

(D) polygenic inheritance

Q29. Haemophilia, the "bleeder's disease" in which blood fails to clot normally, is inherited as a(n):

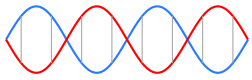
(A) X-linked recessive trait

(B) Y-linked dominant trait

(C) autosomal dominant trait

(D) mitochondrial trait

Q30. A single nucleotide, the repeating unit of a DNA strand shown below, is made up of three chemical components, namely:



DNA — nucleotides along the backbone

(A) three nitrogenous bases

(B) a pentose sugar, a phosphate group and a nitrogenous base

(C) two phosphate groups and one sugar

(D) an amino acid, a sugar and a phosphate

Q31. During translation, the triplet of bases on the mRNA that codes for an amino acid is the codon. The complementary triplet on the tRNA that recognises and base-pairs with this codon is the:

(A) promoter

(B) operator

(C) anticodon

(D) replicon

Q32. The Oparin–Haldane hypothesis on the origin of life, which proposed chemical evolution in a reducing primitive atmosphere, was experimentally supported by:

(A) Mendel's experiments on pea plants

(B) Darwin's voyage on the *Beagle*

(C) Pasteur's swan-necked flask experiment

(D) the Miller–Urey experiment, which produced amino acids from a simulated primitive atmosphere

Q33. Pneumonia, a disease in which the alveoli of the lungs become filled with fluid, is caused mainly by:

(A) bacteria (such as *Streptococcus pneumoniae*) or viruses

(B) a deficiency of vitamin C

(C) a protozoan transmitted by mosquitoes

(D) exposure to ultraviolet radiation

Q34. HIV, the virus that causes AIDS, is a retrovirus that progressively weakens immunity because it specifically infects and destroys the:

(A) red blood cells

(B) helper T-lymphocytes (T_H cells)

(C) blood platelets

(D) liver hepatocytes

Q35. Which of the following is a group of living organisms used as biofertilisers to enrich soil fertility?

(A) *Penicillium* and *Streptomyces*

(B) *Bacillus thuringiensis* and *Trichoderma*

(C) *Rhizobium*, *Azotobacter*, cyanobacteria and mycorrhiza

(D) *Lactobacillus* and *Saccharomyces*

Q36. When a restriction endonuclease cuts both strands of DNA exactly at the centre of the palindrome, leaving no unpaired overhang, the fragments produced have:

(A) single-stranded sticky ends

(B) cohesive (staggered) ends

(C) a 5′ overhang

(D) blunt (flush) ends

Q37. Transgenic animals are those that carry a foreign gene deliberately introduced into their genome. A transgenic cow such as “Rosie” is valued because it can:

(A) produce milk enriched with a useful human protein

(B) digest cellulose more efficiently than normal cows

(C) survive entirely without food

(D) reproduce without fertilisation

Q38. ELISA (enzyme-linked immunosorbent assay) is a sensitive diagnostic technique that detects a pathogen or disease by identifying the presence of:

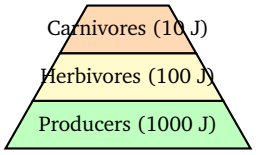
(A) only whole living bacteria

(B) specific antigens or antibodies

(C) red blood cells

(D) heavy-metal ions

Q39. According to Lindeman's ten per cent law, illustrated by the energy-flow diagram, the amount of usable energy that is transferred from one trophic level to the next is about:



energy flow through trophic levels

(A) 1%

(B) 50%

(C) 10%

(D) 90%

Q40. Zoological parks, botanical gardens, seed banks and gene banks are all examples of:

(A) in-situ conservation

(B) biosphere reserves

(C) national parks

(D) ex-situ conservation

Detailed Solutions

Q1.

Solution

Concept — Why viruses are excluded: Whittaker's five-kingdom system (Monera, Protista, Fungi, Plantae, Animalia) classifies organisms made of cells. Viruses sit outside this scheme because they do not satisfy the basic criterion of being cellular.

Key fact: A virus is *acellular* — it is merely a nucleic acid (DNA or RNA) enclosed in a protein coat. It has no cytoplasm, no organelles and no machinery for its own metabolism, and it can multiply *only* inside a living host cell (obligate intracellular parasite). Outside a host it behaves like inert chemical matter.

Why other options are wrong:

- (B) Viruses are not prokaryotic cells; they are non-cellular and far simpler than bacteria.
- (C) They are neither eukaryotic nor multicellular; (D) they cannot metabolise independently outside a host.

Final Answer: Viruses are acellular obligate parasites $\Rightarrow$ A

Answer: (A) Go Back to Q1

Q2.

Solution

Concept — Defining features of angiosperms: Angiosperms are the most advanced and dominant plant group. Two features are found only in them and together define the group.

Key fact: The presence of true *flowers* (the reproductive structures bearing enclosed ovules) and the phenomenon of *double fertilisation* (one male gamete fuses with the egg to form the zygote, the other with the two polar nuclei to form the triploid endosperm) are unique to angiosperms. Seeds are enclosed within a fruit.

Why other options are wrong:

- (A) Naked seeds occur in gymnosperms; motile sperm occur in algae, bryophytes and pteridophytes.
- (C) A dominant gametophyte and archegonia are features of bryophytes; (D) circinate vernation is a fern character.

Final Answer: Flowers + double fertilisation $\Rightarrow$ B

Answer: (B) Go Back to Q2

Q3.

Solution

Concept — Phylum Aschelminthes (Nematoda): These are the roundworms, the first animals to possess a body cavity. However, the cavity is not lined throughout by mesoderm, so it is a *false coelom* or pseudocoelom.

Key fact: *Ascaris* (the human intestinal roundworm) is a typical aschelminth: it has a cylindrical, unsegmented, bilaterally symmetrical body, a complete digestive tract, and a fluid-filled *pseudocoelom* between the gut and the body wall. Sexes are separate (dioecious).

Why other options are wrong:

- (A) Platyhelminthes (flatworms) are acoelomate — they have no body cavity at all.
- (B) Annelida and (D) Arthropoda are true coelomates with a mesoderm-lined coelom.

Final Answer: *Ascaris* = Aschelminthes (pseudocoelomate) $\Rightarrow$ C

Answer: (C) Go Back to Q3

Q4.

Solution

Concept — Conventions of writing a scientific name: The international rules of botanical nomenclature lay down a fixed style for printing a binomial name so that it is recognised uniformly worldwide.

Key fact: The genus name begins with a *capital* letter and the specific epithet is written entirely in *lower case*. When printed, the whole name is *italicised*; when handwritten, each word is *underlined separately*. Thus the mango is correctly written *Mangifera indica*.

Why other options are wrong:

- (A) The genus must be capitalised, so "mangifera" is wrong.
- (B) The species epithet must not be capitalised ("Indica" is wrong); (C) using all capitals for the genus and no italics violates the rules.

Final Answer: Correct form is *Mangifera indica* ⇒ D

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Leaf modifications for climbing: Weak-stemmed plants climb supports using tendrils — thread-like sensitive structures that coil on contact. Tendrils may be modified stems or modified leaves depending on the plant.

Key fact: In the *pea* (*Pisum sativum*), the terminal leaflets of the pinnately compound leaf are modified into *leaf tendrils*. Because they arise from leaf parts, the pea tendril is regarded as a modification of the *leaf*.

Why other options are wrong:

- (B) Roots are underground absorbing organs, not the source of pea tendrils.
- (C) The flower is the reproductive structure; (D) the seed develops from the ovule — neither forms the climbing tendril.

Final Answer: Pea tendrils are modified leaves ⇒ A

Answer: (A) Go Back to Q5

Q6.

Solution

Concept — Economic importance of Fabaceae: The pea or legume family is one of the most useful plant families for humans, providing food, fodder and natural soil enrichment.

Key fact: Fabaceae members (gram, pea, bean, lentil, soybean, groundnut) are rich in protein and form the *pulses* of the diet. Their roots bear nodules containing symbiotic *Rhizobium* bacteria that fix *atmospheric nitrogen* into a usable form, naturally restoring soil fertility — which is why legumes are used in crop rotation.

Why other options are wrong:

- (A) Carbon dioxide is fixed by all green plants in photosynthesis, not a special legume trait.
- (C),(D) Legume nodules add nitrogen, not phosphate or potassium ions.

Final Answer: Legumes fix atmospheric nitrogen ⇒ B

Answer: (B) Go Back to Q6

Q7.

Solution

Concept — The amphibian heart: The frog's heart is a transitional design between the two-chambered fish heart and the four-chambered mammalian heart, with partial separation of blood.

Key fact: The frog heart has *three chambers*: two atria (a right atrium receiving deoxygenated blood from the body and a left atrium receiving oxygenated blood from the lungs) and a single *ventricle*. Because there is only one ventricle, oxygenated and deoxygenated blood mix to some extent.

Why other options are wrong:

- (A) One atrium and two ventricles is not the frog pattern.
- (B) Three ventricles do not occur; (D) two atria and two ventricles is the mammalian/bird four-chambered heart.

Final Answer: Two atria + one ventricle $\Rightarrow$ C

Answer: (C) Go Back to Q7

Q8.

Solution

Concept — The lysosome: Discovered by Christian de Duve, lysosomes are tiny single-membrane vesicles budded off from the Golgi apparatus and filled with powerful digestive (hydrolytic) enzymes that work best at acidic pH.

Key fact: Lysosomes digest worn-out organelles, food particles and foreign matter (intracellular digestion). They are called the *"suicidal bags"* because, if the organelle ruptures, its enzymes are released into the cytoplasm and digest (autolyse) the cell itself. The figure's single membrane packed with enzymes points to the lysosome.

Why other options are wrong:

- (A) Ribosomes are tiny non-membranous particles that synthesise proteins.
- (B) Centrioles form the spindle during division; (C) peroxisomes mainly handle H_2O_2 and fatty-acid oxidation, not general autolysis.

Final Answer: The "suicidal bag" = lysosome $\Rightarrow$ D

Answer: (D) Go Back to Q8

Q9.

Solution

Concept — Cytoplasmic continuity in plants: Although plant cells have rigid walls, their living protoplasts are not isolated; they remain connected to neighbouring cells through tiny channels in the wall.

Key fact: *Plasmodesmata* are fine cytoplasmic bridges that pass through pores in adjacent plant cell walls, linking the protoplasm of one cell with the next. They form the symplastic pathway, allowing direct movement of water, ions and small molecules from cell to cell without crossing the wall.

Why other options are wrong:

- (B) Desmosomes and (C) gap junctions are cell junctions found in *animal* tissues, not plants.
- (D) "Plasmolysis channels" is not a real structure; plasmolysis is the shrinkage of protoplasm in a hypertonic solution.

Final Answer: Plant cytoplasmic connections = plasmodesmata $\Rightarrow$ A

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Enzyme cofactors: Many enzymes are not fully active as the protein (apoenzyme) alone; they require a non-protein helper. Such helpers are collectively called cofactors and include inorganic ions, prosthetic groups and coenzymes.

Key fact: A *coenzyme* is an organic, non-protein molecule that binds *loosely* and transiently to the enzyme and usually carries chemical groups or electrons between reactions. Examples are NAD, NADP, FAD and coenzyme A, several of which are derived from vitamins. (A tightly, permanently bound organic cofactor is instead called a prosthetic group.)

Why other options are wrong:

- (A) The substrate is the reactant acted upon, not a helper molecule.
- (C) A competitive inhibitor blocks the active site and slows the reaction; (D) a zymogen is an inactive enzyme precursor.

Final Answer: NAD/FAD-type helper = coenzyme $\Rightarrow$ B

Answer: (B) Go Back to Q10

Q11.

Solution

Concept — Significance of mitosis: Mitosis is an equational division of somatic (body) cells in which one parent cell gives rise to two daughter cells, each with the same chromosome number and the same genetic constitution as the parent.

Key fact: Because the daughter cells are *genetically identical* to the parent, mitosis allows multicellular organisms to *grow*, to *repair* and replace damaged or worn-out cells, and to maintain a constant number of chromosomes generation after generation. This constancy is the essence of an equational division.

Why other options are wrong:

- (A) Halving of the chromosome number is a feature of *meiosis*, not mitosis.
- (B) Crossing over and (D) gamete formation also belong to meiosis.

Final Answer: Mitosis is an equational, identity-preserving division $\Rightarrow$ C

Answer: (C) Go Back to Q11

Q12.

Solution

Concept — Outcome of meiosis: Meiosis is a reductional division consisting of two successive divisions — meiosis I (which halves the chromosome number) and meiosis II (an equational division) — without any DNA replication in between.

Key fact: A single diploid (2n) mother cell therefore produces *four haploid (n) cells* at the end of meiosis. These become the gametes (or spores), and the halving of chromosome number ensures that the diploid number is restored at fertilisation.

Why other options are wrong:

- (A) Two diploid cells is the result of *mitosis*.
- (B) Two cells form only after meiosis I; the process is not complete then. (C) The cells are haploid, not diploid.

Final Answer: Meiosis yields four haploid cells $\Rightarrow$ D

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Ascent of sap: Water absorbed by the roots must rise to the top of even the tallest trees through the dead xylem vessels. The most widely accepted explanation is the cohesion–tension (transpiration-pull) theory of Dixon and Joly.

Key fact: As water evaporates from the mesophyll cells and escapes through the stomata (transpiration), it creates a negative pressure (tension) at the leaf end of the xylem. Because water molecules cohere strongly to one another (hydrogen bonding) and adhere to the xylem walls, this *transpiration pull* drags the unbroken water column upward from the roots.

Why other options are wrong:

- (B) Root pressure is a minor, often nocturnal force and cannot raise water in tall trees.
- (C) Xylem vessels are dead and cannot "pump"; (D) capillarity in soil is far too weak to account for the ascent.

Final Answer: The driving force is the transpiration pull $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q13

Q14.

Solution

Concept — The light reaction: On the thylakoid membranes, light energy absorbed by the two photosystems drives electron transport and the photolysis of water. This stage converts light energy into chemical energy.

Key fact: The light reaction produces three things: molecular *oxygen* (from the splitting of water), and the two energy-rich molecules *ATP* (from photophosphorylation) and *NADPH* (from the reduction of $NADP^+$). The ATP and NADPH are then used as the "assimilatory power" to fix CO_2 in the light-independent Calvin cycle.

Why other options are wrong:

- (A) Glucose and starch are products of the Calvin cycle (dark reaction), not the light reaction.
- (C) CO_2 and water are raw materials/products of respiration, not light-reaction products; (D) pyruvate and lactic acid belong to respiration/fermentation.

Final Answer: Light-reaction products = ATP and NADPH $\Rightarrow$ B

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — Fermentation (anaerobic respiration): When oxygen is unavailable, cells reoxidise NADH and obtain a little energy by partially breaking down glucose. The pyruvate formed in glycolysis is converted into different end-products in different organisms.

Key fact: In *yeast*, alcoholic fermentation converts pyruvic acid into *ethanol (ethyl alcohol) and carbon dioxide*. In contrast, in our overworked muscles and in lactic-acid bacteria, pyruvate is reduced to lactic acid. Both pathways yield only a net 2 ATP per glucose.

Why other options are wrong:

- (A) Complete oxidation to CO_2 and water requires *oxygen* (aerobic respiration), not fermentation.
- (B) Lactic acid is the product in muscle/bacteria, not in yeast; (D) glucose and oxygen are reactants of photosynthesis/respiration, not fermentation products.

Final Answer: Yeast fermentation gives ethanol + CO_2 $\Rightarrow$ C

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Abscisic acid, the stress hormone: Among the five major plant growth regulators, abscisic acid (ABA) is largely a *growth inhibitor* that helps the plant withstand unfavourable conditions.

Key fact: *ABA* closes the stomata under water stress (reducing transpirational water loss), promotes bud and seed *dormancy*, and induces ageing and abscission. Because it is produced in large amounts during drought, cold and salinity stress, it is rightly called the "stress hormone".

Why other options are wrong:

- (A) Auxin controls apical dominance and rooting — a growth promoter.

- (B) Gibberellins promote stem elongation and break dormancy (opposite of ABA); (C) cytokinins promote cell division and delay senescence.

Final Answer: Stress hormone closing stomata = ABA $\Rightarrow$ D

Answer: (D) Go Back to Q16

Q17.

Solution

Concept — Site of absorption: Although digestion begins in the mouth and stomach, the absorption of the final products of digestion (glucose, amino acids, fatty acids, vitamins, water) occurs mainly in one region of the gut.

Key fact: The *small intestine*, especially its long, coiled middle and lower parts, is the principal site of absorption. Its inner lining is thrown into circular folds bearing millions of finger-like *villi* (and microvilli), which enormously increase the surface area and contain a rich blood and lymph supply to carry away the absorbed nutrients.

Why other options are wrong:

- (B) Rugae are folds of the *stomach* wall, mainly for distension, not nutrient absorption.
- (C) Taste buds detect taste on the tongue; (D) gastric pits open into gastric glands that secrete gastric juice.

Final Answer: Absorption occurs through the villi of the small intestine $\Rightarrow$ A

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Mechanism of breathing: Breathing in is brought about by muscular changes that enlarge the chest cavity, lowering the pressure inside the lungs so that air flows in along the pressure gradient.

Key fact: During *inspiration*, the dome-shaped *diaphragm contracts and flattens*, and the *external intercostal muscles contract* to lift the ribs and sternum upward and outward. Together these *increase the volume of the thoracic cavity*, decreasing intrapulmonary pressure below atmospheric pressure, so air rushes into the lungs.

Why other options are wrong:

- (A) Relaxation that decreases thoracic volume describes *expiration*, not inspiration.
- (C) Forcing air out is expiration; (D) breathing is an active muscular process, not purely passive.

Final Answer: Muscles contract and enlarge the thorax during inspiration $\Rightarrow$ B

Answer: (B) Go Back to Q18

Q19.

Solution

Concept — Double circulation in mammals: Mammals have a four-chambered heart that completely separates oxygenated and deoxygenated blood, allowing blood to pass through the heart twice in one full circuit.

Key fact: *Double circulation* consists of two circuits. The *pulmonary circuit* carries deoxygenated blood from the right ventricle to the lungs and returns oxygenated blood to the left atrium; the *systemic circuit* carries oxygenated blood from the left ventricle to the whole body and returns deoxygenated blood to the right atrium. This keeps the two types of blood from mixing and makes circulation efficient.

Why other options are wrong:

- (A) In single circulation (fish) blood passes through the heart only once per circuit.
- (B) Open circulation (insects) has blood flowing in body cavities; (C) "incomplete circulation" refers to the partial mixing in amphibians/reptiles, not the mammalian pattern.

Final Answer: Two circuits, heart entered twice = double circulation $\Rightarrow$ D

Answer: (D) Go Back to Q19

Q20.

Solution

Concept — The three steps of urine formation: The nephron forms urine by glomerular filtration, selective reabsorption and tubular secretion, acting in sequence along its length.

Key fact: *Tubular secretion* is the active transfer of substances such as H^+, K^+, ammonia and certain drugs *from the peritubular blood into the filtrate* (mainly in

the distal convoluted tubule and collecting duct). It removes extra wastes and is crucial for maintaining the acid–base (pH) balance of the blood.

Why other options are wrong:

- (A) Glomerular filtration moves fluid *out of* the blood into the Bowman's capsule, not selective secretion of ions.
- (B) Reabsorption returns useful substances *to* the blood; (D) micturition is the expulsion of stored urine from the bladder, not a step inside the nephron.

Final Answer: Active addition of H^+/K^+/ammonia = tubular secretion $\Rightarrow$ C

Answer: (C) Go Back to Q20

Q21.

Solution

Concept — The reflex arc: A reflex action is a rapid, automatic, involuntary response to a stimulus, controlled mainly by the spinal cord. The fixed nerve pathway it follows is the reflex arc.

Key fact: The five components of a reflex arc, in order, are: *receptor* (detects the stimulus) $\rightarrow$ *sensory (afferent) neuron* (carries the impulse to the CNS) $\rightarrow$ *spinal cord / interneuron* (the coordinating centre) $\rightarrow$ *motor (efferent) neuron* (carries the impulse out) $\rightarrow$ *effector* (a muscle or gland that responds). This is exactly the sequence shown in the figure.

Why other options are wrong:

- (B) Reverses the direction; the impulse cannot travel from effector back to receptor.
- (C) A spinal reflex bypasses the brain and the order is wrong; (D) the sequence does not begin at a receptor and is jumbled.

Final Answer: Receptor $\rightarrow$ sensory $\rightarrow$ spinal cord $\rightarrow$ motor $\rightarrow$ effector $\Rightarrow$ A

Answer: (A) Go Back to Q21

Q22.

Solution

Concept — The endocrine pancreas: The islets of Langerhans contain α-cells and β-cells whose hormones act antagonistically to keep blood glucose within narrow limits.

Key fact: *Glucagon*, secreted by the α-*cells*, is a hyperglycemic hormone — it *raises* the blood glucose level by stimulating glycogenolysis (breakdown of liver glycogen to glucose) and gluconeogenesis. It thus opposes the action of insulin.

Why other options are wrong:

- (A) Insulin (β-cells) *lowers* blood glucose — the opposite effect.
- (C) Thyroxine controls basal metabolic rate; (D) calcitonin lowers blood calcium, not glucose.

Final Answer: The glucose-raising α-cell hormone = glucagon $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q22

Q23.

Solution

Concept — Structure of the ovule: The ovule (megasporangium) is the structure inside the ovary that develops into the seed after fertilisation. It has a stalk (funicle), a nutritive tissue (nucellus), one or two protective *integuments*, and the embryo sac.

Key fact: The integuments do not completely enclose the ovule; they leave a small opening at one end called the *micropyle*. It is through this micropyle that the pollen tube usually enters the embryo sac to deliver the male gametes during fertilisation; later it allows water to enter during seed germination.

Why other options are wrong:

- (A) The funicle is the stalk attaching the ovule to the placenta.
- (B) The hilum is the scar where the funicle is attached; (D) the chalaza is the basal region opposite the micropyle where the integuments and nucellus meet.

Final Answer: The pore for pollen-tube entry = micropyle $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q23

Q24.

Solution

Concept — Post-fertilisation changes: Once double fertilisation is complete, the floral parts that have done their job wither, while the ovule and ovary undergo definite, well-defined transformations.

Key fact: The fertilised *ovule develops into the seed* (the integuments harden into the seed coat and the zygote grows into the embryo), and the *ovary develops into the fruit* (its wall becomes the pericarp). The endosperm nourishes the developing embryo. Sepals, petals, stamens, style and stigma usually fall off.

Why other options are wrong:

- (A) The ovary becomes the fruit, not the seed.
- (B) The ovule becomes the seed, not the fruit; (C) the stigma simply withers — it does not form a seed.

Final Answer: Ovule $\rightarrow$ seed and ovary $\rightarrow$ fruit $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q24

Q25.

Solution

Concept — The male reproductive tract: Sperms produced in the testis are not mature when formed; they pass through a series of ducts where they mature, are stored and are finally conveyed out.

Key fact: The correct route is *testis* $\rightarrow$ *epididymis* $\rightarrow$ *vas deferens* $\rightarrow$ *ejaculatory duct* $\rightarrow$ *urethra*. Sperms made in the seminiferous tubules of the testis move into the highly coiled *epididymis* (where they mature and are stored), then up the muscular *vas deferens*, and finally out through the urethra during ejaculation.

Why other options are wrong:

- (B) The vas deferens comes *after* the epididymis, not before it.
- (C),(D) These sequences reverse the natural direction of sperm flow.

Final Answer: Testis $\rightarrow$ epididymis $\rightarrow$ vas deferens $\rightarrow$ urethra $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q25

Q26.

Solution

Concept — Sexually transmitted diseases (STDs): Infections such as gonorrhoea, syphilis and AIDS spread chiefly through unprotected sexual contact with an infected person; some also spread through infected blood or from mother to child.

Key fact: Since there are no vaccines for most STDs and treatment can be difficult, *prevention* is the key. Avoiding sex with unknown or multiple partners, practising safe sex (using condoms), and using only sterilised needles and screened blood are the most effective ways to prevent these diseases.

Why other options are wrong:

- (A) Taking antibiotics regularly does not prevent viral STDs like AIDS and promotes resistance.
- (C) Effective vaccines are not available for most of these (notably AIDS and syphilis); (D) avoiding blood donation does not stop sexual transmission.

Final Answer: Safe-sex practices best prevent STDs $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q26

Q27.

Solution

Concept — Monohybrid cross: A cross between two heterozygotes ($Tt \times Tt$) is the classic Mendelian monohybrid cross. Reading the Punnett square gives both the genotypic and the phenotypic ratios of the F_2 generation.

Key fact: The four boxes give TT, Tt, Tt and tt — that is, 1 homozygous tall : 2 heterozygous tall : 1 homozygous dwarf. Hence the *genotypic ratio is* $1:2:1$. (The phenotypic ratio, with T dominant, is the familiar 3 tall $:1$ dwarf.)

Why other options are wrong:

- (A) $3:1$ is the *phenotypic* ratio, not the genotypic ratio asked for.
- (B) $1:1$ is the ratio of a test cross ($Tt \times tt$); (C) $9:3:3:1$ is the dihybrid phenotypic ratio.

Final Answer: Monohybrid genotypic ratio $= 1:2:1 \Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q27

Q28.

Solution

Concept — Pleiotropy: Usually we think of one gene controlling one character, but a single gene can sometimes affect many different, seemingly unrelated, characters at once.

Key fact: *Pleiotropy* is the phenomenon in which a single gene produces multiple phenotypic effects. In *phenylketonuria* a single mutated gene (for the enzyme phenylalanine hydroxylase) causes mental retardation, reduced hair and skin pigmentation, and other defects together — a textbook example of pleiotropy.

Why other options are wrong:

- (A) Incomplete dominance is the blending of two alleles of *one* gene (e.g. pink *Mirabilis*).
- (B) Co-dominance is the simultaneous expression of both alleles (e.g. AB blood group); (D) polygenic inheritance is *many* genes affecting *one* trait — the reverse of pleiotropy.

Final Answer: One gene, many traits = pleiotropy $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q28

Q29.

Solution

Concept — Sex-linked inheritance: Genes located on the X chromosome show a characteristic pattern of inheritance because males (XY) have only one X chromosome while females (XX) have two.

Key fact: *Haemophilia* is an *X-linked recessive* disorder in which a clotting factor is missing, so even minor injuries lead to prolonged bleeding. A single defective allele expresses itself in a male (who has no second X to mask it), so the disease appears far more often in males; females are usually carriers.

Why other options are wrong:

- (B) There is no Y-linked dominant inheritance for haemophilia; the gene is on the X chromosome.
- (C) It is recessive, not dominant; (D) it is nuclear (X-linked), not mitochondrial.

Final Answer: Haemophilia is X-linked recessive $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q29

Q30.

Solution

Concept — The nucleotide: DNA and RNA are polynucleotides — long chains built from repeating monomer units called nucleotides. Knowing the three parts of a nucleotide is fundamental to molecular biology.

Key fact: Each *nucleotide* is made of three components joined together: a *pentose (five-carbon) sugar* (deoxyribose in DNA, ribose in RNA), a *phosphate group*, and a *nitrogenous base* (a purine — adenine or guanine; or a pyrimidine — cytosine, thymine or uracil). The sugar and phosphate form the backbone; the bases project inward and pair across the helix.

Why other options are wrong:

- (A) A nucleotide has only *one* base, not three.
- (C) It has a single phosphate (in a polynucleotide) and one sugar; (D) amino acids are units of proteins, not nucleic acids.

Final Answer: Sugar + phosphate + base = a nucleotide $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q30

Q31.

Solution

Concept — Translation and the genetic code: During protein synthesis, the sequence of bases in mRNA is read in groups of three (codons), and transfer RNA (tRNA) brings the correct amino acids by base-pairing with these codons.

Key fact: Each tRNA carries a specific triplet of bases called the *anticodon*, which is *complementary* to the mRNA codon. The anticodon recognises and base-pairs with the codon at the ribosome, ensuring that the amino acid specified by that codon is added to the growing polypeptide chain in the correct order.

Why other options are wrong:

- (A) The promoter is the DNA site where RNA polymerase binds to start transcription.
- (B) The operator is a regulatory DNA sequence in an operon; (D) a replicon is a unit of DNA replication. None pair with a codon.

Final Answer: The tRNA triplet complementary to the codon = anticodon $\Rightarrow$ C

Answer: (C) Go Back to Q31

Q32.

Solution

Concept — Origin of life by chemical evolution: Oparin and Haldane independently proposed that life arose from non-living matter through a slow chemical evolution in the oceans of a primitive Earth whose atmosphere was reducing (rich in CH_4, NH_3, H_2 and water vapour, with no free O_2).

Key fact: The *Miller–Urey experiment* (1953) tested this idea. By passing electric sparks (simulating lightning) through a sealed flask containing CH_4, NH_3, H_2 and water vapour, Stanley Miller obtained simple organic molecules including *amino acids*. This provided experimental support for the chemical (abiogenic) origin of the building blocks of life.

Why other options are wrong:

- (A) Mendel's work established the laws of heredity, not the origin of life.
- (B) Darwin's observations led to the theory of evolution by natural selection; (C) Pasteur *disproved* spontaneous generation of life from non-living matter under present conditions.

Final Answer: Oparin–Haldane was supported by the Miller–Urey experiment $\Rightarrow$ D

Answer: (D) Go Back to Q32

Q33.

Solution

Concept — Pneumonia: Pneumonia is an acute infection of the lungs in which the alveoli and bronchioles fill with fluid, mucus and dead cells, seriously impairing gas exchange and causing fever, chills, cough and difficulty in breathing.

Key fact: It is caused mainly by *bacteria* (most commonly *Streptococcus pneumoniae*, and also *Haemophilus influenzae*) or by *viruses*; fungi can cause it less often. It spreads through droplets and by sharing utensils with an infected person.

Why other options are wrong:

- (B) A vitamin C deficiency causes scurvy, not pneumonia.

- (C) A mosquito-borne protozoan causes malaria, not pneumonia; (D) UV radiation is linked to skin damage, not pneumonia.

Final Answer: Pneumonia is caused by bacteria/viruses $\Rightarrow$ A

Answer: (A) Go Back to Q33

Q34.

Solution

Concept — HIV and AIDS: AIDS (Acquired Immuno-Deficiency Syndrome) is caused by the Human Immunodeficiency Virus (HIV), a *retrovirus* that carries RNA as its genetic material and the enzyme reverse transcriptase.

Key fact: After entering the body, HIV specifically infects and multiplies inside the *helper T-lymphocytes* (T_H cells, the CD4 cells), progressively destroying them. As the helper-T count falls, the body's immune defence collapses, leaving the patient vulnerable to opportunistic infections and certain cancers.

Why other options are wrong:

- (A) HIV does not target red blood cells, which lack a nucleus and CD4 receptors.
- (C) Platelets are concerned with clotting, not immunity; (D) HIV's main target is the immune cells, not liver hepatocytes.

Final Answer: HIV destroys helper T-lymphocytes $\Rightarrow$ B

Answer: (B) Go Back to Q34

Q35.

Solution

Concept — Biofertilisers: Biofertilisers are living organisms that enrich the nutrient quality of the soil naturally, providing an eco-friendly alternative to chemical fertilisers.

Key fact: The main biofertilisers are nitrogen-fixers and nutrient-mobilisers: *Rhizobium* (symbiotic in legume root nodules), free-living *Azotobacter*, *cyanobacteria* (such as *Nostoc* and *Anabaena*, important in paddy fields), and *mycorrhiza* (a fungus–root association that improves phosphorus and water uptake). All add nutrients without polluting the soil.

Why other options are wrong:

- (A) *Penicillium* and *Streptomyces* are antibiotic producers, not biofertilisers.
- (B) *Bacillus thuringiensis* is a biopesticide and *Trichoderma* a biocontrol agent; (D) *Lactobacillus* and *Saccharomyces* are used in food/fermentation.

Final Answer: *Rhizobium*, *Azotobacter*, cyanobacteria, mycorrhiza $\Rightarrow$ C

Answer: (C) Go Back to Q35

Q36.

Solution

Concept — Ends produced by restriction enzymes: Restriction endonucleases recognise specific palindromic sequences and cut both strands of DNA. The geometry of the cut determines the kind of end produced.

Key fact: When the enzyme cuts both strands *at the same point*, exactly in the middle of the palindrome, the fragments have no single-stranded overhang and are called *blunt (flush) ends*. When the enzyme makes *staggered* cuts (a few bases apart), it leaves short single-stranded overhangs called sticky or cohesive ends, which readily base-pair with complementary ends.

Why other options are wrong:

- (A),(B) Sticky/cohesive ends result from staggered cuts, not a central straight cut.
- (C) A 5′ overhang is one type of sticky end; the question describes a clean central cut, giving blunt ends.

Final Answer: A central straight cut gives blunt ends $\Rightarrow$ D

Answer: (D) Go Back to Q36

Q37.

Solution

Concept — Transgenic animals: A transgenic animal carries a foreign (manipulated) gene introduced deliberately into its genome. Such animals are produced for research, for medical products and to improve livestock.

Key fact: The transgenic cow *"Rosie"* produced human-protein-enriched milk: her milk contained the human protein alpha-lactalbumin, making it nutritionally more balanced for human babies than ordinary cow's milk. Likewise, transgenic animals are used as "molecular pharms" to produce useful proteins such as human blood-

clotting factors.

Why other options are wrong:

- (B) Transgenic cows are not made to digest cellulose differently; that is unrelated to "Rosie".
- (C) No animal can survive without food; (D) transgenic technology does not allow reproduction without fertilisation.

Final Answer: "Rosie" yields milk with a useful human protein $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q37

Q38.

Solution

Concept — ELISA as a diagnostic tool: ELISA (Enzyme-Linked Immunosorbent Assay) is based on the specific binding of an antigen to its antibody, coupled with an enzyme that produces a visible colour change to report the binding.

Key fact: ELISA detects a pathogen or disease by identifying the presence of *specific antigens* (molecules of the pathogen) *or specific antibodies* (made by the patient against the pathogen) in a blood or fluid sample. It is widely used to diagnose infections such as HIV/AIDS, hepatitis and dengue at an early stage.

Why other options are wrong:

- (A) ELISA detects molecular markers, not whole living bacteria, and works even when the pathogen cannot be cultured.
- (C) It does not detect red blood cells; (D) it is not used for heavy-metal ions.

Final Answer: ELISA detects specific antigens or antibodies $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q38

Q39.

Solution

Concept — The ten per cent law: As energy flows from one trophic level to the next in a food chain, a large part is lost as heat in respiration and in life processes, so only a small fraction is stored and passed on.

Key fact: According to *Lindeman's ten per cent law*, only about *10%* of the energy at one trophic level is fixed as biomass and made available to the next higher level; the remaining ~90% is lost. In the figure, 1000 J in producers becomes 100 J in herbivores and only 10 J in carnivores. This is why food chains are usually limited to four or five links.

Why other options are wrong:

- (A) 1% greatly under-states the transfer.
- (B) 50% and (D) 90% over-state it — in fact about 90% is *lost*, not transferred.

Final Answer: About 10% of energy passes to the next level $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q39

Q40.

Solution

Concept — Ex-situ conservation: Biodiversity can be conserved either in the natural habitat (in-situ, e.g. national parks, sanctuaries, biosphere reserves) or away from the natural habitat under human care (ex-situ).

Key fact: *Ex-situ conservation* means protecting endangered species *outside* their natural homes. Zoological parks (zoos), botanical gardens, wildlife safari parks, *seed banks*, *gene banks*, pollen banks and cryopreservation are all ex-situ methods that keep organisms, seeds or genetic material safe for breeding and future reintroduction.

Why other options are wrong:

- (A) In-situ conservation protects species *within* their natural habitat — the opposite approach.
- (B) Biosphere reserves and (C) national parks are in-situ methods, protecting whole ecosystems in nature.

Final Answer: Zoos, seed banks and gene banks = ex-situ conservation $\Rightarrow$ $\boxed{\text{D}}$

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	D	20	C
21	A	22	B	23	C	24	D	25	A
26	B	27	D	28	C	29	A	30	B
31	C	32	D	33	A	34	B	35	C
36	D	37	A	38	B	39	C	40	D