JCECE Biology Sample Paper – 10

Duration: 60 Minutes **Maximum Marks: 50**

Instructions

- This paper contains **50** Multiple Choice Questions (Single Correct Answer), modelled on the Biology portion of **JCECE** entrance.
- Each correct answer carries **+1 mark**. There is -0.25 **mark** for each incorrect answer; unattempted questions get 0.
- Only **one** option is correct. Choose carefully.
- Syllabus level: **Class 11 and Class 12 NCERT Biology (Jharkhand JAC / CBSE aligned) – Botany and Zoology.**
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited.

Q1. Viruses and viroids are not placed in any of Whittaker's five kingdoms. The principal reason for keeping viruses outside the five-kingdom system is that they:

(A) possess only RNA and never DNA as genetic material

(B) are acellular (non-cellular) and obligate intracellular parasites that are inert outside a host

(C) are larger than bacteria and so cannot be classified

(D) lack any kind of nucleic acid in their structure

Q2. A *genus* and a *family* are two ranks of the taxonomic hierarchy. Which statement correctly distinguishes a genus from a family?

(A) a family is more specific (narrower) than a genus

(B) a genus and a family always contain exactly the same species

(C) a genus is a group of closely related species, while a family is a group of related genera

(D) a genus is always larger and more inclusive than a family

Q3. Liverworts and mosses are both bryophytes, yet they differ in body form. Which feature correctly distinguishes a typical *moss* gametophyte from a *liverwort*?

(A) the moss gametophyte is always a flat, dorsiventral thallus

(B) the moss plant body is a vascular sporophyte with true roots

(C) the liverwort bears multicellular rhizoids and erect leafy shoots

(D) the moss has an erect leafy gametophyte with multicellular rhizoids, while a liverwort is often a flattened thallus with unicellular rhizoids

Q4. Among the vertebrate classes, the one whose members are characterised by the body covered with feathers, presence of a beak without teeth, and the forelimbs modified into wings is:

(A) Aves (birds)

(B) Mammalia

(C) Amphibia

(D) Reptilia

Q5. Parenchyma is the most generalised simple permanent tissue of plants. Which of the following is NOT a function performed by parenchyma cells?

(A) storage of food such as starch

(B) photosynthesis when the cells contain chloroplasts (chlorenchyma)

(C) secretion and storage in glandular forms

(D) providing mechanical strength through thick lignified walls

Q6. Adipose tissue is a specialised form of loose connective tissue. Its chief biological role in the mammalian body is to:

(A) transport oxygen and carbon dioxide

(B) conduct nerve impulses rapidly

(C) store fat, act as an insulator, and serve as an energy reserve

(D) connect a muscle to a bone

Q7. In the structure of a dicotyledonous seed (for example, gram or bean), the tiny pore through which water is first absorbed and through which the radicle later emerges is the:

(A) hilum

(B) micropyle

(C) raphe

(D) testa

Q8. The circulatory system of the cockroach is of the open type. The blood (haemolymph) that flows freely in the body spaces (haemocoel) of the cockroach is:

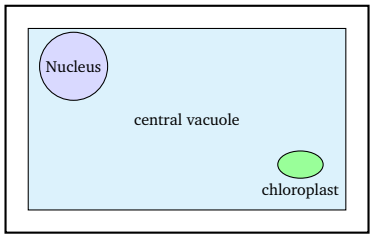
(A) bright red because it is rich in haemoglobin

(B) enclosed entirely within closed blood vessels

(C) the main carrier of oxygen to the tissues

(D) colourless and does not transport respiratory gases, which are carried by tracheae

Q9. In the plant cell shown below, the large central organelle bounded by a single membrane (the tonoplast) occupies most of the cell volume. The principal function of this central vacuole is to:



(A) synthesise ATP through aerobic respiration

(B) assemble ribosomal subunits for protein synthesis

(C) carry out photosynthesis using chlorophyll

(D) store cell sap, ions and wastes, and maintain turgor pressure

Q10. In secondary active transport, a carrier protein moves two solutes simultaneously. When the carrier transports both solutes across the membrane in the *same* direction, the process is called:

(A) symport

(B) antiport

(C) uniport

(D) simple diffusion

Q11. A single nucleotide, the building block of nucleic acids, is made up of three components joined together. These three components are:

(A) three fatty acids and one glycerol molecule

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

(C) an amino group, a carboxyl group, and a side chain

(D) two monosaccharides joined by a glycosidic bond

Q12. Most enzymes are proteins, but certain biological catalysts are made of RNA. An RNA molecule that itself acts as a biocatalyst is called a:

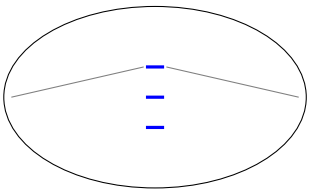
(A) holoenzyme

(B) coenzyme

(C) apoenzyme

(D) ribozyme

Q13. The figure shows a dividing cell with chromosomes lined up at the equator (mitotic metaphase). The long preparatory stage that occurs *before* a cell enters this division, during which the cell grows and replicates its DNA, is:



mitotic metaphase

(A) interphase, comprising the G_1, S and G_2 phases

(B) anaphase, when chromatids move apart

(C) telophase, when daughter nuclei reform

(D) cytokinesis, when the cytoplasm divides

Q14. Meiosis is a reduction division that takes place only in specific reproductive cells. In a flowering plant, meiosis occurs in the:

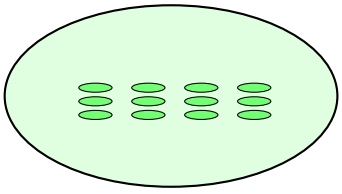
(A) root tip and shoot tip meristems

(B) pollen mother cells and the megaspore mother cell

(C) ordinary vegetative leaf cells

(D) endosperm cells of the seed

Q15. The chloroplast shown carries the grana where the light reactions take place. The assimilatory powers produced by the light reaction and later used in the Calvin cycle are:



grana (thylakoids)

(A) glucose and oxygen

(B) carbon dioxide and water

(C) ATP and NADPH (along with O_2 from water)

(D) only oxygen gas

Q16. The respiratory pathway is best described as an *amphibolic* pathway rather than a purely catabolic one, because it:

(A) only breaks down glucose and never builds anything

(B) operates exclusively in the absence of oxygen

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

(D) involves no enzymes at any step

Q17. Water moving across the root cortex can travel through cell walls and intercellular spaces without crossing any cell membrane. This continuum of cell walls and spaces through which water moves is the:

(A) apoplast pathway

(B) symplast pathway

(C) vacuolar pathway

(D) transmembrane active pathway

Q18. In the root nodules of legumes, the enzyme nitrogenase reduces atmospheric N_2 to ammonia. Since nitrogenase is destroyed by oxygen, the nodule protects it with a pink, oxygen-scavenging pigment called:

(A) chlorophyll

(B) phytochrome

(C) leghaemoglobin

(D) anthocyanin

Q19. A plant growth regulator is sprayed on sugarcane to increase the length of the stem (internodes) and is also used to break the dormancy of buds and seeds and to promote bolting. This hormone is:

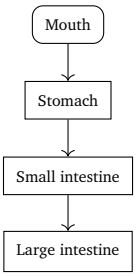
(A) abscisic acid

(B) gibberellin

(C) ethylene

(D) abscisic acid combined with ethylene

Q20. The flow diagram shows the human alimentary canal. In the *stomach*, the hydrochloric acid of the gastric juice plays a key role chiefly by:



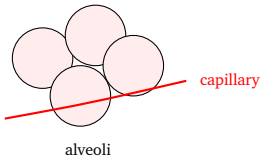
(A) emulsifying fats into tiny droplets

(B) completing the digestion of starch into glucose

(C) neutralising the acid coming from the small intestine

(D) providing the acidic pH that activates pepsinogen to pepsin and killing many ingested microbes

Q21. Air is drawn into the alveoli shown during inspiration. Inspiration is brought about chiefly by the:



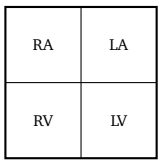
(A) contraction of the diaphragm and external intercostal muscles, increasing the thoracic volume

(B) relaxation of the diaphragm, decreasing the thoracic volume

(C) contraction of the internal intercostal muscles only

(D) passive recoil of the lungs with no muscle activity

Q22. The four-chambered human heart is shown. The *cardiac output* of an adult heart is best defined as:



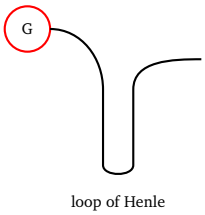
(A) the volume of blood in the heart at the end of diastole

(B) the number of heartbeats per minute alone

(C) the volume of blood pumped out by a ventricle in one beat

(D) the volume of blood pumped out by each ventricle per minute (stroke volume $\times$ heart rate)

Q23. In the nephron shown, blood entering the glomerulus marked 'G' is filtered under high pressure. The amount of filtrate formed by the kidneys per minute, which in a healthy person is about 125 mL/min, is the:



(A) renal threshold

(B) glomerular filtration rate (GFR)

(C) tubular maximum

(D) osmotic concentration

Q24. In skeletal muscle contraction, the immediate trigger that exposes the binding sites on the actin filament for the myosin heads is the:

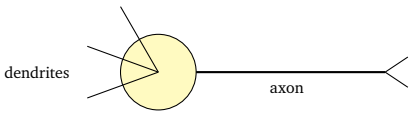
(A) breakdown of the myosin filament

(B) entry of sodium ions into the muscle fibre

(C) removal of all ATP from the sarcomere

(D) release of calcium ions from the sarcoplasmic reticulum, which bind troponin and shift tropomyosin

Q25. In the neuron diagram, impulses are carried away from the cell body along the long process and may reach an effector through the autonomic nervous system. The autonomic nervous system characteristically controls:



(A) involuntary functions such as heartbeat, gut movement and gland secretion

(B) only the voluntary movements of skeletal muscles

(C) only conscious sensory perception

(D) the conscious thinking and reasoning of the cerebrum

Q26. The primary male sex hormone, secreted by the Leydig (interstitial) cells of the testis, which controls the development of male secondary sexual characters and spermatogenesis, is:

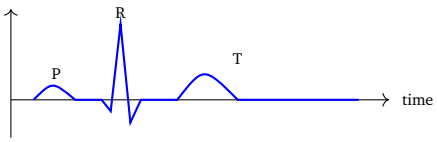
(A) oestrogen

(B) testosterone

(C) progesterone

(D) prolactin

Q27. In the electrocardiogram (ECG) trace shown, a healthy heart gives a regular pattern of P, QRS and T waves. A change in the *shape or timing* of these ECG waves is clinically useful because it:



(A) directly measures the oxygen content of the blood

(B) helps to detect abnormalities or diseases of the heart, such as arrhythmias

(C) measures the exact volume of blood pumped per beat

(D) records the breathing rate of the lungs

Q28. At a chemical synapse, the arrival of an impulse at the axon terminal causes the release of a chemical messenger from synaptic vesicles into the synaptic cleft. A common excitatory neurotransmitter released here is:

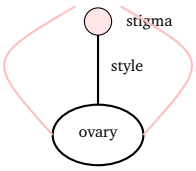
(A) insulin

(B) haemoglobin

(C) acetylcholine

(D) pepsin

Q29. The longitudinal section of a flower is shown. After double fertilization, the parts of the ovule and ovary mature. The fertilized *ovule* as a whole develops into the:



(A) seed

(B) fruit

(C) flower

(D) pollen grain

Q30. In sexual reproduction, the fusion of one male gamete with the egg cell (female gamete) to form a diploid zygote is specifically termed:

(A) triple fusion

(B) pollination

(C) parthenogenesis

(D) syngamy

Q31. In the human female, the normal site where a sperm fertilizes the secondary oocyte is the:

(A) uterus (endometrium)

(B) ampullary region of the fallopian tube (oviduct)

(C) cervix

(D) vagina

Q32. The first milk secreted by the mammary glands of a mother in the days just after childbirth, which is rich in antibodies and provides passive immunity to the newborn, is called:

(A) amniotic fluid

(B) progesterone

(C) colostrum

(D) the corpus luteum

Q33. Among contraceptive measures, the diaphragm, cervical cap and condom belong to one common category because they all work by:

(A) physically preventing the sperm and egg from meeting (barrier methods)

(B) changing the hormone levels of the body

(C) permanently blocking the vas deferens by surgery

(D) preventing implantation by an intra-uterine device

Q34. In a Mendelian *reciprocal cross*, Mendel crossed tall (female) $\times$ dwarf (male) and also dwarf (female) $\times$ tall (male). The important conclusion drawn from getting identical results in both directions was that:

(A) the trait was inherited only through the mother

(B) the inheritance of the trait was independent of which parent contributed which allele

(C) dwarfness was always dominant over tallness

(D) the F_1 plants were all dwarf

Q35. In some genes, a particular allele in the homozygous condition causes the death of the organism, distorting the expected Mendelian ratio. Such an allele is called a:

(A) dominant allele

(B) codominant allele

(C) lethal allele

(D) multiple allele

Q36. When two dominant (or two recessive) linked alleles are present together on the *same* chromosome and tend to be inherited together, the genes are said to be in the:

(A) repulsion (trans) configuration

(B) independent assortment state

(C) crossing-over state only

(D) coupling (cis) configuration

Q37. Thalassaemia is an autosomally inherited blood disorder. The basic defect in thalassaemia is a:

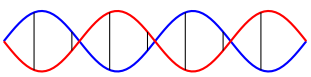
(A) reduced or absent synthesis of one of the globin chains of haemoglobin

(B) substitution of a single amino acid (valine for glutamic acid) in the beta chain

(C) complete absence of the blood-clotting factor VIII

(D) presence of an extra copy of chromosome 21

Q38. The DNA double helix shown must be packaged into the tiny nucleus. In a eukaryotic chromosome, the negatively charged DNA is wound around a core of positively charged basic proteins called:



DNA double helix

(A) ribosomes

(B) phospholipids

(C) histones, forming the nucleosome

(D) cellulose fibres

Q39. During DNA replication, the lagging strand is synthesised discontinuously as a series of short DNA segments that are later joined by DNA ligase. These short segments are called:

(A) introns

(B) Okazaki fragments

(C) RNA primers

(D) replicons

Q40. In the sequence of human evolution, the immediate ancestor that was about 1.5–1.8 m tall, walked erect, used stone tools and is regarded as the first to make and use fire, was:

(A) *Australopithecus*

(B) *Ramapithecus*

(C) *Dryopithecus*

(D) *Homo erectus*

Q41. In the life cycle of the malarial parasite *Plasmodium*, the sexual phase (gametocyte formation and fertilization) takes place inside the:

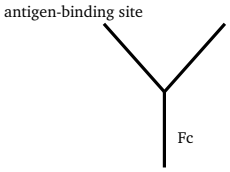
(A) body of the female *Anopheles* mosquito

(B) liver cells of the human host

(C) red blood cells of the human host

(D) human salivary glands

Q42. The Y-shaped antibody molecule is shown. On a *second* exposure to the same antigen, the immune system produces antibodies that are much faster and far greater in amount than on the first exposure. This stronger, quicker reply is the:



(A) primary immune response

(B) secondary (anamnestic) immune response, mediated by memory cells

(C) innate (non-specific) response

(D) an allergic (hypersensitivity) response

Q43. In the baking industry, the dough is leavened (made to rise) by a microorganism that ferments sugars and releases carbon dioxide gas. This microorganism is:

(A) *Lactobacillus*

(B) *Aspergillus niger*

(C) *Saccharomyces cerevisiae* (baker's yeast)

(D) *Rhizobium*

Q44. In a plant-breeding programme, after collecting and evaluating the germplasm, the breeder cross-hybridises selected parents and then must *select* the superior recombinants. The chief purpose of this selection step is to:

(A) pick out plants combining the desired characters and test them for yield and quality

(B) destroy all the variability that was collected

(C) release the variety commercially without any testing

(D) prevent any recombination between the parents

Q45. The recognition sites cut by most restriction endonucleases are *palindromic* sequences. A palindromic sequence in DNA is one that:

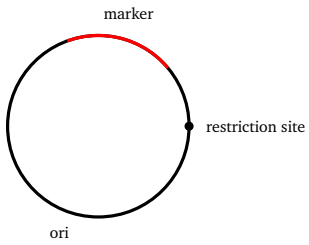
(A) contains only adenine and thymine bases

(B) is the same length on both strands but reads a random order

(C) cannot be cut by any enzyme

(D) reads the same in the $5' \rightarrow 3'$ direction on both strands about a central axis

Q46. The plasmid cloning vector is shown with a region marked 'ori'. For a piece of foreign DNA linked to this vector to be copied (replicated) inside the host bacterium, the vector must contain this 'origin of replication', because the ori is the sequence that:



(A) allows blue-white selection of transformed colonies

(B) is recognised and cut by the restriction enzyme

(C) controls the initiation of replication and the copy number of the linked DNA

(D) codes for resistance to an antibiotic

Q47. In Bt cotton, the introduced bacterial *cry* gene gives protection against bollworms because the Cry protein it produces:

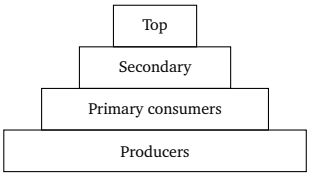
(A) is an inactive protoxin that, once eaten by the insect, is activated in the alkaline gut and destroys its midgut lining

(B) directly poisons the cotton plant's own cells

(C) acts as a fertilizer that boosts cotton yield

(D) kills the insect only by a strong smell that repels it

Q48. The ecological pyramid shown represents successive trophic levels. According to Lindeman's ten per cent law, the energy that is transferred and stored at each successive trophic level, relative to the level below it, is about:



(A) 90 per cent of the energy of the previous level

(B) 50 per cent of the energy of the previous level

(C) 10 per cent of the energy of the previous level

(D) 100 per cent of the energy of the previous level

Q49. When resources are limited, a population grows fast at first and then slows as it nears the carrying capacity, giving a characteristic S-shaped (sigmoid) curve. This pattern of population growth is called:

(A) exponential (geometric) growth

(B) logistic (Verhulst–Pearl) growth

(C) zero population growth at all times

(D) negative growth only

Q50. Among the many benefits that biodiversity provides, services such as pollination of crops by insects, purification of air and water, and the cycling of nutrients are best classed as:

(A) purely aesthetic and recreational value only

(B) direct economic products such as timber and medicine

(C) value of no practical use to humans

(D) ecosystem services (indirect, broadly ecological benefits)

Detailed Solutions

Q1.

Solution

Concept — Position of viruses: Viruses are non-cellular entities made of a nucleic acid (DNA or RNA) enclosed in a protein coat; they multiply only inside a living host and are inert (crystallisable) outside it. They lack the cellular organisation that Whittaker's kingdoms are built on.

Step 1 — Why they are excluded: the five kingdoms classify *cellular* organisms; viruses are acellular and obligate intracellular parasites.

Step 2 — Confirm: being inert crystals outside a host, they sit on the borderline of living and non-living, so they are kept outside the scheme.

Why other options are wrong:

- (A) viruses may have DNA or RNA, so 'only RNA' is false.
- (C) viruses are far smaller than bacteria, not larger.
- (D) they do contain nucleic acid; that is their genetic material.

Final Answer: acellular obligate intracellular parasites $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q1

Q2.

Solution

Concept — Genus and family: A genus is a group of related species sharing common features; a family is the next higher category, grouping together related genera. Thus a family is broader (more inclusive) than a genus.

Step 1 — Place the ranks: hierarchy goes species $<$ genus $<$ family.

Step 2 — State the relation: genus = group of closely related species; family = group of related genera.

Why other options are wrong:

- (A) a family is broader, not narrower, than a genus.
- (B) a genus and a family need not contain the same species.
- (D) a family, not a genus, is the larger and more inclusive rank.

Final Answer: genus = related species, family = related genera $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q2

Q3.

Solution

Concept — Liverwort vs moss: Both are bryophytes with a dominant gametophyte. A liverwort gametophyte is typically a dorsiventral, flattened thallus bearing unicellular rhizoids, whereas a moss gametophyte is an erect, leafy axis bearing multicellular rhizoids.

Step 1 — Recall the moss body: the leafy gametophyte of a moss is erect with spirally arranged leaf-like structures and multicellular rhizoids.

Step 2 — Contrast the liverwort: it is often a flat green thallus with unicellular rhizoids.

Why other options are wrong:

- (A) the flat thallus form describes the liverwort, not the moss.
- (B) bryophytes lack true vascular tissue and true roots.
- (C) liverworts bear *unicellular* rhizoids and a thalloid (or simple leafy) body, not erect leafy shoots with multicellular rhizoids.

Final Answer: moss = erect leafy gametophyte with multicellular rhizoids $\Rightarrow$ D

Answer: (D) Go Back to Q3

Q4.

Solution

Concept — Class Aves: Birds (class Aves) have the body covered with feathers, jaws drawn into a toothless beak, forelimbs modified into wings, pneumatic (air-filled) bones, and they are warm-blooded.

Step 1 — Read the clues: feathers, beak without teeth, forelimbs as wings.

Step 2 — Match the class: these are the defining features of Aves.

Why other options are wrong:

- (B) mammals have hair and mammary glands, not feathers.
- (C) amphibians have a moist skin and no feathers or beak.
- (D) reptiles have dry scaly skin and clawed limbs, not wings or feathers.

Final Answer: Aves (birds) $\Rightarrow$ A

Answer: (A) Go Back to Q4

Q5.

Solution

Concept — Parenchyma: Parenchyma is made of thin-walled living cells with prominent intercellular spaces. It carries out storage, photosynthesis (chlorenchyma), secretion and gaseous exchange (aerenchyma). It does *not* provide mechanical support through thick lignified walls — that is the job of sclerenchyma.

Step 1 — List true parenchyma functions: storage, photosynthesis, secretion.

Step 2 — Spot the false one: thick lignified walls for mechanical strength belong to sclerenchyma, not parenchyma.

Why other options are wrong:

- (A) parenchyma stores starch and other food.
- (B) chlorophyll-containing parenchyma (chlorenchyma) photosynthesises.
- (C) glandular parenchyma secretes and stores substances.

Final Answer: thick lignified mechanical walls are NOT a parenchyma function $\Rightarrow$ D

Answer: (D) Go Back to Q5

Q6.

Solution

Concept — Adipose tissue: Adipose tissue is loose connective tissue packed with fat-storing cells (adipocytes). It stores neutral fat as an energy reserve, cushions organs and acts as a heat insulator beneath the skin.

Step 1 — Recall its cells: adipocytes are filled with fat droplets.

Step 2 — State its roles: fat storage, insulation, energy reserve.

Why other options are wrong:

- (A) oxygen and carbon dioxide transport is done by blood.
- (B) nerve impulses are conducted by nervous tissue.
- (D) connecting muscle to bone is the role of a tendon.

Final Answer: stores fat, insulates and gives an energy reserve $\Rightarrow$ C

Answer: (C) Go Back to Q6

Q7.

Solution

Concept — Seed structure: The seed coat bears a scar (hilum) where it was attached to the fruit, and just above the hilum a small pore, the micropyle, through which water enters at germination and the radicle first emerges.

Step 1 — Identify the water-entry pore: this is the micropyle.

Step 2 — Confirm: the radicle (embryonic root) comes out through the same micropyle.

Why other options are wrong:

- (A) the hilum is the scar of attachment, not the entry pore.
- (C) the raphe is a ridge formed by the fused funicle.
- (D) the testa is the outer protective seed coat.

Final Answer: micropyle $\Rightarrow$ B

Answer: (B) Go Back to Q7

Q8.

Solution

Concept — Cockroach blood: The cockroach has an open circulatory system; the colourless haemolymph bathes the organs in the haemocoel. It lacks respiratory pigment, so it does not transport oxygen; gases are carried directly to the tissues by the tracheal system.

Step 1 — Note the colour: the haemolymph is colourless (no haemoglobin).

Step 2 — Note its role: it distributes nutrients and collects wastes, but respiratory gases travel through tracheae, not the blood.

Why other options are wrong:

- (A) it is not red and has no haemoglobin.
- (B) the system is open, so blood is not confined to closed vessels.
- (C) oxygen is carried by the tracheae, not the haemolymph.

Final Answer: colourless haemolymph; gases carried by tracheae $\Rightarrow$ D

Answer: (D) Go Back to Q8

Q9.

Solution

Concept — Central vacuole: In a mature plant cell a single large vacuole bounded by the tonoplast holds the cell sap (water, ions, sugars, pigments and wastes). By taking up water it keeps the cell turgid and presses the cytoplasm against the wall.

Step 1 — Identify the organelle: the large single-membrane body filling the cell is the central vacuole.

Step 2 — State its job: storage of sap, ions and wastes, and maintenance of turgor pressure.

Why other options are wrong:

- (A) ATP by aerobic respiration is made in the mitochondrion.
- (B) ribosomal subunits are assembled in the nucleolus.
- (C) photosynthesis is carried out by the chloroplast.

Final Answer: stores sap and wastes and maintains turgor $\Rightarrow$ D

Answer: (D) Go Back to Q9

Q10.

Solution

Concept — Symport and antiport: In co-transport, a carrier moves two molecules at once. If both are carried in the *same* direction it is symport; if in *opposite* directions it is antiport; a uniport carries a single molecule.

Step 1 — Read the clue: both solutes move in the same direction.

Step 2 — Match the term: this is symport.

Why other options are wrong:

- (B) antiport moves the two solutes in opposite directions.
- (C) uniport transports only one type of molecule.
- (D) simple diffusion needs no carrier and no coupling.

Final Answer: symport $\Rightarrow$ A

Answer: (A) Go Back to Q10

Q11.

Solution

Concept — Nucleotide: A nucleotide is built from a nitrogenous base (purine or pyrimidine), a pentose sugar (ribose or deoxyribose) and one or more phosphate groups. A base joined only to the sugar (without phosphate) is a nucleoside.

Step 1 — List the three parts: base + pentose sugar + phosphate.

Step 2 — Confirm: chains of such nucleotides form DNA and RNA.

Why other options are wrong:

- (A) three fatty acids and glycerol describe a triglyceride (fat).
- (C) amino group, carboxyl group and side chain describe an amino acid.
- (D) two monosaccharides joined by a glycosidic bond form a disaccharide.

Final Answer: nitrogenous base, pentose sugar and phosphate $\Rightarrow$ B

Answer: (B) Go Back to Q11

Q12.

Solution

Concept — Ribozymes: Although most enzymes are proteins, some RNA molecules also act as biological catalysts. Such catalytic RNAs are called ribozymes (for example, the RNA component of the ribosome and self-splicing introns).

Step 1 — Read the clue: a catalyst made of RNA.

Step 2 — Match the term: this is a ribozyme.

Why other options are wrong:

- (A) a holoenzyme is the complete protein enzyme plus its cofactor.
- (B) a coenzyme is a small organic helper molecule, not an RNA catalyst.
- (C) an apoenzyme is the protein part of an enzyme without its cofactor.

Final Answer: ribozyme $\Rightarrow$ D

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Interphase: Before a cell divides it passes through interphase, the longest part of the cell cycle, made of G_1 (growth), S (DNA replication) and G_2 (growth and preparation). The actual M phase (mitosis) follows interphase.

Step 1 — Identify the preparatory stage: the cell grows and replicates its DNA during interphase.

Step 2 — Confirm: DNA is doubled in the S phase of interphase so that each chromosome has two chromatids before metaphase.

Why other options are wrong:

- (B) anaphase is a stage *within* division, not before it.
- (C) telophase is the closing stage of mitosis, after metaphase.
- (D) cytokinesis is the splitting of the cytoplasm, at the very end.

Final Answer: interphase (G_1, S, G_2) $\Rightarrow$ A

Answer: (A) Go Back to Q13

Q14.

Solution

Concept — Site of meiosis: In flowering plants meiosis takes place in the spore mother cells — the pollen mother cells (microspore mother cells) in the anther and the megaspore mother cell in the ovule — producing haploid microspores and the megaspore.

Step 1 — Recall the reproductive cells: only the spore mother cells undergo meiosis.

Step 2 — Name them: pollen mother cells and the megaspore mother cell.

Why other options are wrong:

- (A) root and shoot meristems divide by mitosis, not meiosis.
- (C) ordinary vegetative cells divide mitotically.
- (D) the endosperm is formed by triple fusion, not by meiosis.

Final Answer: pollen mother cells and megaspore mother cell $\Rightarrow$ B

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — Products of the light reaction: On the thylakoid membranes, light drives the photolysis of water (releasing O_2), the formation of ATP (photophosphorylation) and the reduction of $NADP^+$ to NADPH. ATP and NADPH are the assimilatory powers used in the Calvin cycle.

Step 1 — Recall the light-reaction outputs: ATP, NADPH and O_2.

Step 2 — Identify the assimilatory powers: ATP and NADPH carry energy and reducing power to the stroma.

Why other options are wrong:

- (A) glucose is a product of the dark (Calvin) reactions, not the light reaction.
- (B) carbon dioxide and water are raw materials, not light-reaction products.
- (D) oxygen alone is incomplete; ATP and NADPH are the assimilatory powers asked for.

Final Answer: ATP and NADPH (with O_2 from water) $\Rightarrow$ C

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Amphibolic pathway: Respiration is amphibolic because its intermediates are not only broken down for energy (catabolism) but are also withdrawn to build other molecules such as fatty acids and amino acids (anabolism).

Step 1 — Define amphibolic: a pathway that serves both catabolism and anabolism.

Step 2 — Apply it: acetyl CoA and Krebs-cycle acids can be drawn off for biosynthesis, so respiration is amphibolic.

Why other options are wrong:

- (A) it does more than just break down glucose; intermediates are also used for synthesis.
- (B) aerobic respiration needs oxygen; it is not anaerobic-only.
- (D) respiration is catalysed by many enzymes at every step.

Final Answer: serves both breakdown and synthesis $\Rightarrow$ C

Answer: (C) Go Back to Q16

Q17.

Solution

Concept — Apoplast and symplast: Water crosses the root in two ways. The apoplast is the continuous system of cell walls and intercellular spaces through which water moves without entering the cytoplasm; the symplast is the connected cytoplasm (through plasmodesmata).

Step 1 — Read the clue: movement through cell walls and spaces without crossing a membrane.

Step 2 — Match the pathway: this is the apoplast pathway.

Why other options are wrong:

- (B) the symplast pathway moves water through the living cytoplasm.
- (C) the vacuolar pathway passes from vacuole to vacuole, crossing membranes.
- (D) a transmembrane active pathway requires crossing membranes and energy.

Final Answer: apoplast pathway $\Rightarrow$ A

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Leghaemoglobin: The nitrogen-fixing enzyme nitrogenase is highly sensitive to oxygen. Root nodules contain leghaemoglobin, a pink iron-containing pigment that binds free oxygen and keeps the nodule interior nearly anaerobic, protecting nitrogenase.

Step 1 — Recall the oxygen problem: nitrogenase is inactivated by O_2.

Step 2 — Name the protector: leghaemoglobin acts as an oxygen scavenger.

Why other options are wrong:

- (A) chlorophyll is the green photosynthetic pigment of leaves.
- (B) phytochrome is the light-sensing pigment controlling photoperiodism.
- (D) anthocyanin is a water-soluble vacuolar pigment giving flower colours.

Final Answer: leghaemoglobin $\Rightarrow$ C

Answer: (C) Go Back to Q18

Q19.

Solution

Concept — Gibberellin: Gibberellins (such as GA_3) promote stem (internode) elongation, break the dormancy of buds and seeds, induce bolting in rosette plants, and increase the length and yield of sugarcane.

Step 1 — Read the clues: internode elongation in sugarcane, breaking dormancy and bolting.

Step 2 — Match the hormone: these are characteristic gibberellin effects.

Why other options are wrong:

- (A) abscisic acid is a growth inhibitor that promotes dormancy.
- (C) ethylene mainly promotes fruit ripening and abscission.
- (D) a mix of two inhibitory/ripening hormones cannot cause stem elongation and bolting.

Final Answer: gibberellin $\Rightarrow$ B

Answer: (B) Go Back to Q19

Q20.

Solution

Concept — Gastric HCl: The parietal (oxyntic) cells of the stomach secrete hydrochloric acid. The acid creates the low pH needed to convert inactive pepsinogen into active pepsin and also kills most microbes that enter with food.

Step 1 — Recall the acid's roles: activation of pepsinogen and disinfection of food.

Step 2 — Pick the matching statement: acidic pH activates pepsin and kills microbes.

Why other options are wrong:

- (A) emulsification of fats is done by bile, not gastric acid.
- (B) starch digestion is completed in the small intestine by amylase, not by HCl.

- (C) HCl makes the stomach acidic; it does not neutralise acid.

Final Answer: acidic pH activates pepsin and kills microbes $\Rightarrow$ D

Answer: (D) Go Back to Q20

Q21.

Solution

Concept — Mechanism of inspiration: During inspiration the diaphragm contracts and flattens while the external intercostal muscles raise the ribs. This increases the volume of the thoracic cavity, lowering the intrapulmonary pressure below atmospheric pressure so air rushes into the alveoli.

Step 1 — Identify the active muscles: diaphragm and external intercostals contract.

Step 2 — Link to volume and pressure: thoracic volume rises, pressure falls, air enters.

Why other options are wrong:

- (B) relaxation of the diaphragm and reduced volume cause expiration, not inspiration.
- (C) the internal intercostals assist forced expiration, not normal inspiration.
- (D) inspiration is an active, muscle-driven process, not passive recoil.

Final Answer: diaphragm and external intercostals contract, raising thoracic volume $\Rightarrow$ A

Answer: (A) Go Back to Q21

Q22.

Solution

Concept — Cardiac output: Cardiac output is the volume of blood pumped out by each ventricle in one minute. It equals the stroke volume (about 70 mL per beat) multiplied by the heart rate (about 72 beats/min), giving roughly 5 litres per minute.

Step 1 — Write the formula: cardiac output = stroke volume $\times$ heart rate.

Step 2 — State the meaning: it is the per-minute output of a ventricle.

Why other options are wrong:

- (A) the end-diastolic volume is the blood present, not the amount pumped.
- (B) heart rate alone (without stroke volume) is not cardiac output.
- (C) blood pumped in one beat is the stroke volume, not the cardiac output.

Final Answer: stroke volume $\times$ heart rate (output per minute) $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q22

Q23.

Solution

Concept — Glomerular filtration rate: The glomerular filtration rate (GFR) is the amount of filtrate produced by both kidneys per minute. In a healthy adult it is about 125 mL/min (roughly 180 litres a day), most of which is later reabsorbed.

Step 1 — Read the clue: filtrate formed per minute, about 125 mL/min.

Step 2 — Match the term: this is the glomerular filtration rate (GFR).

Why other options are wrong:

- (A) the renal threshold is the plasma level above which a substance appears in urine.
- (C) the tubular maximum is the limit of tubular reabsorption/secretion.
- (D) osmotic concentration refers to solute concentration, not filtration rate.

Final Answer: glomerular filtration rate (GFR) $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q23

Q24.

Solution

Concept — Role of calcium in contraction: A nerve signal makes the sarcoplasmic reticulum release Ca^{2+} into the sarcoplasm. The calcium binds troponin, which shifts tropomyosin and uncovers the myosin-binding sites on actin, allowing cross-bridges to form and the filaments to slide.

Step 1 — Identify the trigger: release of Ca^{2+} from the sarcoplasmic reticulum.

Step 2 — Link to actin: Ca^{2+} on troponin moves tropomyosin and exposes the binding sites.

Why other options are wrong:

- (A) the myosin filament does not break down during contraction.
- (B) sodium entry depolarises the membrane but is not the direct trigger that exposes actin sites.
- (C) ATP is in fact required for cross-bridge cycling, not removed.

Final Answer: Ca^{2+} release binds troponin and shifts tropomyosin $\Rightarrow$ $\boxed{D}$

Answer: (D) Go Back to Q24

Q25.

Solution

Concept — Autonomic nervous system: The autonomic nervous system (sympathetic and parasympathetic divisions) controls the involuntary activities of the body — heartbeat, peristalsis of the gut, secretion of glands and the calibre of blood vessels — without conscious control.

Step 1 — Recall what it governs: involuntary visceral functions.

Step 2 — Give examples: heartbeat, gut movement, gland secretion.

Why other options are wrong:

- (B) voluntary skeletal-muscle movement is run by the somatic nervous system.
- (C) conscious sensory perception is a function of the somatic/sensory system.
- (D) thinking and reasoning are functions of the cerebrum, not the autonomic system.

Final Answer: controls involuntary functions like heartbeat and gut movement $\Rightarrow$ $\boxed{A}$

Answer: (A) Go Back to Q25

Q26.

Solution

Concept — Testosterone: The Leydig (interstitial) cells of the testis secrete testosterone, the chief male sex hormone. It stimulates spermatogenesis and the development of male secondary sexual characters (beard, deep voice, muscle growth).

Step 1 — Identify the source: Leydig cells of the testis.

Step 2 — Name the hormone: testosterone (an androgen).

Why other options are wrong:

- (A) oestrogen is the chief female sex hormone from the ovary.
- (C) progesterone is an ovarian hormone of the corpus luteum.
- (D) prolactin from the pituitary stimulates milk production.

Final Answer: testosterone $\Rightarrow$ B

Answer: (B) Go Back to Q26

Q27.

Solution

Concept — Clinical use of the ECG: A normal ECG has a fixed pattern of P (atrial depolarisation), QRS (ventricular depolarisation) and T (ventricular repolarisation) waves. A change in the shape or timing of these waves signals heart problems such as arrhythmias or a heart attack.

Step 1 — Recall the normal pattern: regular P, QRS and T waves.

Step 2 — State the diagnostic value: deviations reveal heart abnormalities (arrhythmias, ischaemia).

Why other options are wrong:

- (A) blood oxygen is measured by a pulse oximeter, not the ECG.
- (C) stroke volume is measured by other methods, not directly read from the ECG.
- (D) the ECG records electrical activity of the heart, not the breathing rate.

Final Answer: helps detect heart abnormalities such as arrhythmias $\Rightarrow$ B

Answer: (B) Go Back to Q27

Q28.

Solution

Concept — Neurotransmitter: At a chemical synapse the impulse cannot jump the cleft directly. Instead, depolarisation opens calcium channels, synaptic vesicles release a neurotransmitter such as acetylcholine into the cleft, and it binds receptors on the next neuron to pass the signal on.

Step 1 — Identify the chemical messenger: a neurotransmitter is released into the synaptic cleft.

Step 2 — Name a common one: acetylcholine is a typical excitatory neurotransmitter.

Why other options are wrong:

- (A) insulin is a hormone of the pancreas, not a synaptic transmitter.
- (B) haemoglobin is the oxygen-carrying pigment of red blood cells.
- (D) pepsin is a protein-digesting enzyme of the stomach.

Final Answer: acetylcholine $\Rightarrow$ $\boxed{C}$

Answer: (C) Go Back to Q28

Q29.

Solution

Concept — Seed and fruit formation: After double fertilization, the zygote forms the embryo and the ovule as a whole matures into the seed, while the ovary wall ripens into the fruit. The ovule therefore becomes the seed.

Step 1 — Track the ovule: the fertilized ovule develops into the seed.

Step 2 — Distinguish from the ovary: the ovary (not the ovule) develops into the fruit.

Why other options are wrong:

- (B) the fruit develops from the ovary wall, not from the ovule alone.
- (C) the flower is the whole reproductive shoot, not the product of one ovule.
- (D) a pollen grain is the male gametophyte, not derived from the ovule.

Final Answer: the ovule develops into the seed $\Rightarrow$ $\boxed{A}$

Answer: (A) Go Back to Q29

Q30.

Solution

Concept — Syngamy: Syngamy is the fusion of a single male gamete with the egg (female gamete) to form a diploid zygote. In angiosperms it occurs together with triple fusion as part of double fertilization.

Step 1 — Read the clue: male gamete fuses with the egg to form a zygote.

Step 2 — Name the event: this is syngamy (true fertilization).

Why other options are wrong:

- (A) triple fusion is the fusion of a male gamete with the two polar nuclei.
- (B) pollination is only the transfer of pollen to the stigma.
- (C) parthenogenesis is development of an egg without fertilization.

Final Answer: syngamy $\Rightarrow$ D

Answer: (D) Go Back to Q30

Q31.

Solution

Concept — Site of fertilization: The ovum released at ovulation is picked up by the fallopian tube. Fertilization normally occurs in the *ampulla* (the wider part) of the fallopian tube, after which the zygote travels to the uterus for implantation.

Step 1 — Locate the meeting point: sperm and oocyte meet in the oviduct.

Step 2 — Name the exact region: the ampullary region of the fallopian tube.

Why other options are wrong:

- (A) the uterus is the site of implantation, not of fertilization.
- (C) the cervix is the neck of the uterus and not the fertilization site.
- (D) the vagina receives the semen but is not where the egg is fertilized.

Final Answer: ampullary region of the fallopian tube $\Rightarrow$ B

Answer: (B) Go Back to Q31

Q32.

Solution

Concept — Colostrum: The yellowish first milk produced in the first few days after delivery is colostrum. It is rich in antibodies (especially IgA), giving the newborn passive immunity, and is high in proteins and low in fat.

Step 1 — Read the clue: first milk, rich in antibodies, gives passive immunity.

Step 2 — Name it: colostrum.

Why other options are wrong:

- (A) amniotic fluid surrounds the foetus in the womb; it is not milk.

- (B) progesterone is a pregnancy hormone, not a milk.
- (D) the corpus luteum is an ovarian structure that secretes progesterone.

Final Answer: colostrum $\Rightarrow$ C

Answer: (C) Go Back to Q32

Q33.

Solution

Concept — Barrier methods: Condoms, diaphragms and cervical caps are barrier contraceptives. They work by physically preventing the sperm from reaching the egg, so fertilization cannot occur. They do not alter hormones or require surgery.

Step 1 — Find the common mechanism: a physical barrier between sperm and egg.

Step 2 — Classify: these are barrier methods.

Why other options are wrong:

- (B) changing hormone levels describes oral contraceptive pills.
- (C) surgically blocking the vas deferens is vasectomy (sterilisation).
- (D) preventing implantation by a device describes the IUD, not a barrier.

Final Answer: physically keep sperm and egg apart (barrier methods) $\Rightarrow$ A

Answer: (A) Go Back to Q33

Q34.

Solution

Concept — Reciprocal cross: In a reciprocal cross the sexes of the parents carrying the contrasting traits are swapped. Mendel found that the result was the same whichever parent contributed which allele, showing that the inheritance of the trait did not depend on the parental sex.

Step 1 — Compare the two crosses: tall $\times$ dwarf and dwarf $\times$ tall give identical F_1 and F_2.

Step 2 — Draw the conclusion: inheritance is independent of which parent gave which allele.

Why other options are wrong:

- (A) identical results in both directions rule out maternal-only inheritance.
- (C) tallness (not dwarfness) was dominant in Mendel's pea crosses.
- (D) the F_1 plants were all tall, not dwarf.

Final Answer: inheritance is independent of the parental source of the allele $\Rightarrow$ $\boxed{B}$

Answer: (B) Go Back to Q34

Q35.

Solution

Concept — Lethal allele: A lethal allele causes the death of the organism when present in the homozygous (and sometimes heterozygous) condition. Because some genotypes die, the surviving offspring ratio departs from the usual Mendelian ratio (for example $2:1$ instead of $3:1$).

Step 1 — Read the clue: an allele that, when homozygous, causes death and alters the ratio.

Step 2 — Name it: a lethal allele.

Why other options are wrong:

- (A) a dominant allele simply masks the recessive; it need not be lethal.
- (B) codominant alleles both express fully; they do not kill the organism.
- (D) multiple alleles refer to more than two forms of a gene, not to lethality.

Final Answer: lethal allele $\Rightarrow$ $\boxed{C}$

Answer: (C) Go Back to Q35

Q36.

Solution

Concept — Coupling and repulsion: When two dominant alleles (or two recessive alleles) of linked genes lie on the same chromosome and are inherited together, they are in the coupling (cis) arrangement. When the dominant of one gene is paired with the recessive of the other on the same chromosome, they are in repulsion (trans).

Step 1 — Read the clue: two like alleles on the same chromosome, inherited together.

Step 2 — Name the arrangement: coupling (cis) configuration.

Why other options are wrong:

- (A) repulsion (trans) has the contrasting alleles on the same chromosome.
- (B) independent assortment applies to genes on different chromosomes.
- (C) crossing over is a separate process and not a static configuration.

Final Answer: coupling (cis) configuration $\Rightarrow$ D

Answer: (D) Go Back to Q36

Q37.

Solution

Concept — Thalassaemia: Thalassaemia is an autosomal recessive disorder in which the synthesis of one of the globin (alpha or beta) chains of haemoglobin is reduced or absent because of a gene defect. This leads to fewer normal haemoglobin molecules and anaemia.

Step 1 — Identify the defect: reduced or absent production of a globin chain.

Step 2 — Note the effect: the imbalance gives defective haemoglobin and anaemia.

Why other options are wrong:

- (B) a single amino-acid substitution (Glu$\rightarrow$Val) describes sickle-cell anaemia, not thalassaemia.
- (C) absence of clotting factor VIII describes haemophilia.
- (D) an extra chromosome 21 describes Down syndrome.

Final Answer: reduced or absent synthesis of a globin chain $\Rightarrow$ A

Answer: (A) Go Back to Q37

Q38.

Solution

Concept — Histones and nucleosomes: In eukaryotes the long, negatively charged DNA is wound around an octamer of positively charged basic proteins called histones. The DNA wrapped on a histone octamer forms a nucleosome, the repeating unit of chromatin.

Step 1 — Identify the packaging proteins: positively charged basic proteins, the histones.

Step 2 — Name the unit formed: DNA + histone octamer = nucleosome.

Why other options are wrong:

- (A) ribosomes are the sites of protein synthesis, not DNA-packing proteins.
- (B) phospholipids build membranes, not the chromatin core.
- (D) cellulose fibres form plant cell walls, not the nucleosome.

Final Answer: histones, forming the nucleosome $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q38

Q39.

Solution

Concept — Okazaki fragments: Because DNA polymerase synthesises only in the $5' \to 3'$ direction, the lagging strand is made in short pieces (Okazaki fragments) which are subsequently sealed together by DNA ligase to form a continuous strand.

Step 1 — Read the clue: short, discontinuous segments on the lagging strand joined by ligase.

Step 2 — Name them: Okazaki fragments.

Why other options are wrong:

- (A) introns are non-coding sequences removed during RNA splicing.
- (C) RNA primers initiate synthesis but are not the DNA segments themselves.
- (D) a replicon is a unit of replication, not a short fragment.

Final Answer: Okazaki fragments $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q39

Q40.

Solution

Concept — Human evolution: In the hominid line, *Homo erectus* (about 1.5–1.8 m tall) walked fully erect, had a larger brain, made and used stone tools, and is generally credited with the first use of fire. It came after *Australopithecus* and before *Homo sapiens*.

Step 1 — Read the clues: erect posture, tool use and the first use of fire.

Step 2 — Identify the ancestor: this is *Homo erectus*.

Why other options are wrong:

- (A) *Australopithecus* was a shorter ape-man that used stone tools but is not credited with fire.
- (B) *Ramapithecus* was an early ape-like ancestor, not a fire-user.
- (C) *Dryopithecus* was a still earlier ape, more ape-like than man-like.

Final Answer: *Homo erectus* $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q40

Q41.

Solution

Concept — Life cycle of *Plasmodium*: The malarial parasite has two hosts. The asexual phase occurs in the human (liver and red blood cells), but the sexual phase — the fusion of gametes and formation of the oocyst — takes place inside the body of the female *Anopheles* mosquito, the definitive host.

Step 1 — Recall the two hosts: human (asexual) and mosquito (sexual).

Step 2 — Locate the sexual phase: gamete fusion happens in the female *Anopheles* mosquito.

Why other options are wrong:

- (B) the liver is the site of the pre-erythrocytic asexual schizogony.
- (C) red blood cells host the asexual erythrocytic cycle, not fertilization.
- (D) the salivary glands store infective sporozoites; fertilization does not occur there.

Final Answer: body of the female *Anopheles* mosquito $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q41

Q42.

Solution

Concept — Secondary immune response: The first exposure to an antigen gives a slow, small primary response and leaves behind memory cells. A second exposure to the same antigen triggers a far faster and larger secondary (anamnestic) response, the basis of long-lasting immunity and booster vaccines.

Step 1 — Read the clue: second exposure gives a quicker, stronger antibody response.

Step 2 — Name it: the secondary (anamnestic) response, due to memory cells.

Why other options are wrong:

- (A) the primary response is the slow, weak first-exposure reply.
- (C) the innate response is non-specific and not antigen-memory based.
- (D) an allergic response is a hypersensitivity reaction, not the normal memory response.

Final Answer: secondary (anamnestic) immune response $\Rightarrow$ B

Answer: (B) Go Back to Q42

Q43.

Solution

Concept — Baker's yeast: *Saccharomyces cerevisiae* (baker's yeast) ferments the sugars in dough, releasing carbon dioxide that is trapped as bubbles and makes the bread rise (leavening). The same yeast is used in brewing and bread-making.

Step 1 — Identify the role: a microbe that ferments sugar and releases CO_2 to raise dough.

Step 2 — Name it: *Saccharomyces cerevisiae*.

Why other options are wrong:

- (A) *Lactobacillus* curdles milk into curd; it is not used to leaven bread.
- (B) *Aspergillus niger* is used to produce citric acid, not to bake bread.
- (D) *Rhizobium* is a nitrogen-fixing symbiont of legume roots.

Final Answer: *Saccharomyces cerevisiae* (baker's yeast) $\Rightarrow$ C

Answer: (C) Go Back to Q43

Q44.

Solution

Concept — Selection in plant breeding: After hybridisation, the breeder grows many recombinant plants and must select those that combine the desired traits (high yield, disease resistance, quality). These selected plants are then tested rigorously for performance over several seasons.

Step 1 — State the aim of selection: to pick plants with the desired combination of characters.

Step 2 — Note what follows: the selected lines are tested for yield and quality before release.

Why other options are wrong:

- (B) breeding aims to use variability, not destroy it.
- (C) a variety is released only after thorough testing, not without it.
- (D) recombination between parents is desired in breeding, not prevented.

Final Answer: pick plants combining desired characters and test them $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q44

Q45.

Solution

Concept — Palindromic sequence: A palindrome in DNA is a sequence that reads the same in the $5' \to 3'$ direction on both strands when read about a central point of symmetry. Restriction enzymes recognise such palindromic sites and cut both strands, often leaving sticky ends.

Step 1 — Define the palindrome: same base sequence $5' \to 3'$ on both strands.

Step 2 — Link to cutting: this symmetry lets a restriction enzyme cut both strands at the same site.

Why other options are wrong:

- (A) a palindrome is not restricted to A and T bases only.
- (B) equal length with a random order is not a palindrome; the order must be symmetric.
- (C) palindromic sites are precisely the sequences that enzymes *do* cut.

Final Answer: reads the same $5' \to 3'$ on both strands about a central axis $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q45

Q46.

Solution

Concept — Origin of replication (ori): The ori is the sequence of the vector at which DNA replication begins. Any DNA linked to a sequence containing an ori can be replicated inside the host, and the ori also controls the copy number of the plasmid.

Step 1 — Read the function asked: the site needed for the linked DNA to be copied.

Step 2 — Identify it: the ori initiates replication and sets the copy number.

Why other options are wrong:

- (A) selection of transformed cells is the job of selectable marker genes.
- (B) being cut by a restriction enzyme is the function of the recognition site, not the ori.
- (D) antibiotic resistance is coded by a marker gene, not by the ori.

Final Answer: controls initiation of replication and copy number $\Rightarrow$ C

Answer: (C) Go Back to Q46

Q47.

Solution

Concept — Bt cotton and the Cry protein: The *cry* gene from *Bacillus thuringiensis* produces an inactive protoxin (Cry protein). When a bollworm eats it, the alkaline pH of the insect's midgut converts it into the active toxin, which binds the gut lining, creates pores and kills the insect, while remaining harmless to the plant.

Step 1 — Note the protoxin form: the Cry protein is eaten as an inactive crystal protein.

Step 2 — Trace its activation: the alkaline insect gut activates it, and it destroys the midgut epithelium.

Why other options are wrong:

- (B) the toxin is harmless to the cotton plant's own cells.
- (C) the Cry protein is an insecticidal toxin, not a fertilizer.

- (D) it kills by destroying the gut lining, not merely by smell.

Final Answer: protoxin activated in the alkaline insect gut destroys the midgut ⇒ A

Answer: (A) Go Back to Q47

Q48.

Solution

Concept — Ten per cent law: Lindeman's ten per cent law states that, on average, only about 10 per cent of the energy at one trophic level is transferred and stored at the next higher level; the remaining 90 per cent is lost mainly as heat in respiration.

Step 1 — Recall the figure: roughly 10 per cent passes upward to the next level.

Step 2 — Apply it: each higher level holds about one-tenth of the energy below it.

Why other options are wrong:

- (A) about 90 per cent is *lost*, not transferred.
- (B) 50 per cent transfer is far too high.
- (D) 100 per cent transfer would violate the loss of energy as heat.

Final Answer: about 10 per cent of the previous level ⇒ C

Answer: (C) Go Back to Q48

Q49.

Solution

Concept — Logistic growth: When resources are limited, a population follows logistic (Verhulst–Pearl) growth: an initial lag, then rapid growth, which slows as numbers approach the carrying capacity (K), producing an S-shaped (sigmoid) curve.

Step 1 — Read the clue: growth slows near the carrying capacity, giving an S-shaped curve.

Step 2 — Name the pattern: logistic growth.

Why other options are wrong:

- (A) exponential growth gives a J-shaped curve with unlimited resources.
- (C) zero growth at all times is not described by a sigmoid curve.
- (D) negative growth means a declining population, not the sigmoid pattern.

Final Answer: logistic (Verhulst–Pearl) growth $\Rightarrow$ $\boxed{B}$

Answer: (B) Go Back to Q49

Q50.

Solution

Concept — Ecosystem services: Biodiversity provides indirect, broadly ecological benefits called ecosystem services — pollination, purification of air and water, climate regulation, and nutrient cycling. These are distinct from the direct economic products we harvest.

Step 1 — Read the examples: pollination, air and water purification, nutrient cycling.

Step 2 — Classify them: these are ecosystem services (indirect, broad ecological value).

Why other options are wrong:

- (A) aesthetic and recreational value is only one narrow benefit, not these processes.
- (B) timber and medicine are direct economic products, not the listed services.
- (C) these services are of great practical use to humans, so 'no use' is wrong.

Final Answer: ecosystem services (indirect ecological benefits) $\Rightarrow$ $\boxed{D}$

Answer: (D) Go Back to Q50

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	C	3	D	4	A	5	D
6	C	7	B	8	D	9	D	10	A
11	B	12	D	13	A	14	B	15	C
16	C	17	A	18	C	19	B	20	D
21	A	22	D	23	B	24	D	25	A
26	B	27	B	28	C	29	A	30	D
31	B	32	C	33	A	34	B	35	C
36	D	37	A	38	C	39	B	40	D
41	A	42	B	43	C	44	A	45	D
46	C	47	A	48	C	49	B	50	D