JCECE Biology Sample Paper – 2

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. Kingdom Monera includes all the prokaryotic organisms. Which one of the following features is a defining characteristic of every member of Monera?

(A) presence of a membrane-bound nucleus enclosing the DNA

(B) presence of membrane-bound organelles such as mitochondria

(C) absence of a true (membrane-bound) nucleus; the genetic material lies free in the cytoplasm

(D) presence of a large central vacuole and plastids

Q2. According to the rules of binomial nomenclature, when the scientific name of an organism is printed, the correct way to write it is:

(A) both the genus and species names begin with capital letters

(B) the species name begins with a capital letter and the genus with a small letter

(C) the name is written without italics and both words in capitals

(D) the genus name begins with a capital letter and the species name with a small letter, both in italics

Q3. Bryophytes are often called the 'amphibians of the plant kingdom' because they live in soil but depend on water for reproduction. In their life cycle, the dominant, conspicuous, photosynthetic plant body represents the:

(A) diploid sporophyte generation

(B) haploid gametophyte generation

(C) diploid zygote that grows directly into the plant

(D) triploid endosperm tissue

Q4. Members of phylum Coelenterata (Cnidaria) possess special stinging cells used for defence and capture of prey. These cells, which bear nematocysts, are the:

(A) cnidoblasts (cnidocytes)

(B) choanocytes

(C) flame cells

(D) nephridia

Q5. Among the simple permanent tissues of plants, the one made of living, thin-walled, isodiametric cells with intercellular spaces, which carries out photosynthesis, storage and secretion, is:

(A) parenchyma

(B) sclerenchyma

(C) collenchyma

(D) xylem

Q6. Connective tissues bind and support other tissues. The *fluid* connective tissue that circulates in the body and transports nutrients, gases and wastes is:

(A) cartilage

(B) bone

(C) areolar tissue

(D) blood

Q7. In ginger and turmeric the underground horizontal stem stores food and bears nodes, internodes and scale leaves. This type of underground *stem* modification is a:

(A) tap root

(B) bulb

(C) rhizome

(D) tuberous root

Q8. In the cockroach (*Periplaneta*), the blood-vascular system is of the open type and the colourless blood (haemolymph) does not carry respiratory pigment. Oxygen is instead supplied directly to the tissues by a network of air tubes called:

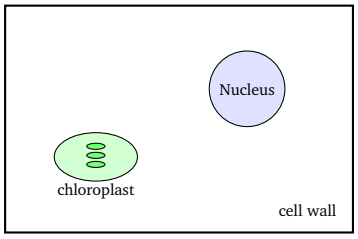
(A) tracheae

(B) gills

(C) Malpighian tubules

(D) nephridia

Q9. In the plant cell shown below, the green double-membrane organelle marked is the chloroplast. Within it, the stacked coin-like membranous sacs (each stack a granum) that bear the photosynthetic pigments are the:



(A) cristae of the chloroplast

(B) thylakoids stacked into grana

(C) ribosomes attached to the membrane

(D) the fluid stroma

Q10. The downhill movement of a solute across the plasma membrane through specific carrier (channel) proteins, *down* its concentration gradient and *without* the expenditure of ATP, is called:

(A) active transport

(B) endocytosis

(C) the sodium–potassium pump

(D) facilitated diffusion

Q11. The *primary* structure of a protein refers specifically to:

(A) the linear sequence of amino acids joined by peptide bonds

(B) the coiling of the chain into an α-helix

(C) the three-dimensional folding of a single polypeptide

(D) the assembly of several polypeptide subunits into one functional protein

Q12. The small region of an enzyme to which the substrate binds, and where the substrate is converted into product, is called the:

(A) allosteric site

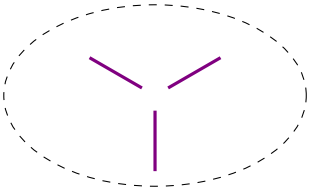
(B) peptide bond

(C) active site

(D) disulphide bridge

Q13. The figure shows a cell whose chromatin has just condensed into long, thread-like, double-stranded chromosomes while the nuclear envelope is

still breaking down. This is mitotic prophase. Each chromosome at this stage consists of:



condensed chromosomes

(A) a single chromatid only

(B) three chromatids joined at the centromere

(C) no centromere at all

(D) two sister chromatids joined at the centromere

Q14. During the pachytene sub-stage of prophase I of meiosis, the exchange of segments between the non-sister chromatids of homologous chromosomes takes place. This exchange, which increases genetic variation, is called:

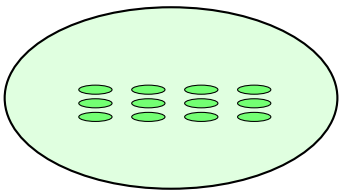
(A) synapsis

(B) crossing over

(C) disjunction

(D) independent assortment

Q15. The chloroplast shown carries two photosystems on its thylakoids. In the *non-cyclic* (Z-scheme) electron flow of the light reaction, electrons travel in the order:



grana (PS II and PS I)

(A) water $\rightarrow$ PS II $\rightarrow$ PS I $\rightarrow$ $NADP^+$

(B) $NADP^+$ $\rightarrow$ PS I $\rightarrow$ PS II $\rightarrow$ water

(C) PS I $\rightarrow$ PS II $\rightarrow$ water $\rightarrow$ $NADP^+$

(D) water $\rightarrow$ PS I $\rightarrow$ PS II $\rightarrow$ oxygen

Q16. In aerobic respiration, the citric acid (Krebs) cycle begins when a 2-carbon acetyl group (from acetyl CoA) combines with a 4-carbon acceptor molecule to form a 6-carbon compound. This 4-carbon acceptor is:

(A) oxaloacetic acid (OAA)

(B) pyruvic acid

(C) citric acid

(D) succinic acid

Q17. Pure water at standard temperature and pressure, kept in an open container, has a water potential (ψ_w) value of:

(A) a large positive value, greater than that of any solution

(B) always equal to the solute potential of the cell sap

(C) zero (the highest possible value of water potential)

(D) undefined, because pure water has no water potential

Q18. Atmospheric nitrogen (N_2) cannot be used directly by most plants. In the root nodules of leguminous plants, free nitrogen is converted into ammonia by the symbiotic bacterium:

(A) *Rhizobium*

(B) *Lactobacillus*

(C) *Saccharomyces*

(D) *Penicillium*

Q19. The plant growth regulator that promotes 'bolting' (rapid internode elongation) in rosette plants, breaks seed and bud dormancy, and was first isolated from a fungus, is:

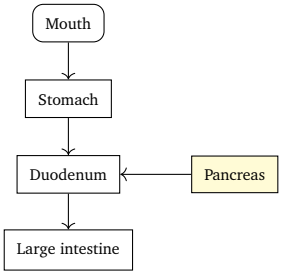
(A) abscisic acid

(B) auxin

(C) cytokinin

(D) gibberellin

Q20. The flow diagram shows the human alimentary canal. The *pancreas* pours its juice into the duodenum. The inactive pancreatic proenzyme trypsinogen is activated into trypsin by an intestinal enzyme called:



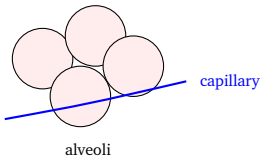
(A) pepsin

(B) ptyalin

(C) enterokinase (enteropeptidase)

(D) lipase

Q21. Gas exchange takes place across the walls of the alveoli shown. In the blood, the *largest* fraction of carbon dioxide (about 70%) is transported from the tissues to the lungs in the form of:



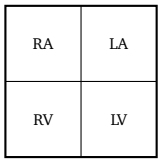
(A) oxyhaemoglobin

(B) bicarbonate ions (HCO_3^-) in the plasma

(C) carbon monoxide bound to haemoglobin

(D) gas dissolved freely in the plasma

Q22. The four-chambered human heart pumps blood that belongs to one of the ABO blood groups. A person with blood group 'O' is called the *universal donor* because the red cells of group O carry:



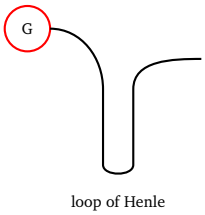
(A) both A and B antigens on their surface

(B) only the A antigen

(C) only the B antigen

(D) neither the A nor the B antigen

Q23. In the nephron shown, the cup labelled 'G' surrounds the glomerulus. Here blood is filtered under high pressure so that water and small solutes pass into the tubule while blood cells and large proteins are held back. This pressure-driven filtration is called:



(A) ultrafiltration (glomerular filtration)

(B) tubular reabsorption

(C) tubular secretion

(D) micturition

Q24. Skeletal (striated) muscle fibres show alternating dark and light bands. The repeating functional unit of the myofibril, lying between two successive Z-lines, is the:

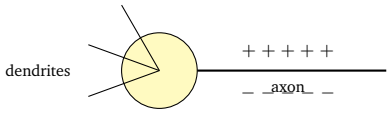
(A) sarcolemma

(B) sarcomere

(C) sarcoplasm

(D) myoglobin band

Q25. In the resting neuron shown, the axon membrane is polarised. In this *resting potential*, the membrane is:



(A) positively charged inside and negatively charged outside

(B) carrying an impulse, with sodium gates wide open

(C) negatively charged inside and positively charged outside, with more Na^+ outside and K^+ inside

(D) exactly equal in charge on both sides (no potential difference)

Q26. The thyroid gland needs the element iodine to make its hormones thyroxine (T_4) and tri-iodothyronine (T_3). A prolonged dietary deficiency of iodine in an adult leads to enlargement of the thyroid gland, a condition known as:

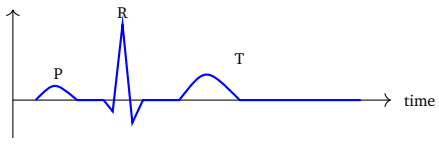
(A) diabetes mellitus

(B) simple goitre

(C) cretinism

(D) Addison's disease

Q27. The ECG trace shown accompanies the cardiac cycle. The phase in which both ventricles contract and pump blood into the aorta and pulmonary artery, with all valves momentarily set so that blood leaves the heart, is:



(A) ventricular systole

(B) atrial systole

(C) joint diastole

(D) the isoelectric resting phase only

Q28. According to the 'all-or-none' law of nerve and muscle, when a stimulus reaches or exceeds the threshold value, the fibre:

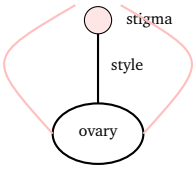
(A) responds in proportion to the strength of the stimulus

(B) gives no response at all, however strong the stimulus

(C) responds only to repeated weak stimuli (summation)

(D) gives a complete, maximal response that does not increase with a stronger stimulus

Q29. The longitudinal section of a flower is shown. Inside the *ovule*, a diploid megaspore mother cell undergoes meiosis to form four haploid megaspores. This process of formation of megaspores from the megaspore mother cell is called:



(A) microsporogenesis

(B) megasporogenesis

(C) pollination

(D) double fertilization

Q30. In the double fertilization of angiosperms, the *second* male gamete fuses with the two polar nuclei (the secondary nucleus). This second fusion, also called triple fusion, gives rise to the:

(A) diploid zygote

(B) haploid embryo

(C) primary endosperm (triploid) nucleus, which forms the nutritive endosperm

(D) seed coat

Q31. In the human female reproductive system, the normal site where the sperm meets and fertilises the ovum is the:

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

(B) lower part of the uterus (cervix)

(C) vagina

(D) ovary itself

Q32. In the human menstrual cycle, a sharp mid-cycle surge of one pituitary hormone triggers the rupture of the mature Graafian follicle and the release of the ovum. This 'LH surge' is caused by:

(A) progesterone

(B) antidiuretic hormone (ADH)

(C) insulin

(D) luteinising hormone (LH)

Q33. Among the spacing methods of contraception, the device that is inserted by a doctor into the uterus and works by increasing phagocytosis of sperms and making the uterus unsuitable for implantation is the:

(A) oral contraceptive pill

(B) intra-uterine device (IUD), e.g. copper-T

(C) condom

(D) vasectomy

Q34. When two heterozygous tall pea plants (Tt) are crossed, the F_1 offspring show a phenotypic ratio of 3 tall : 1 dwarf. The corresponding *genotypic* ratio of the same offspring is:

(A) $3 : 1$

(B) $9 : 3 : 3 : 1$

(C) $1\,\text{TT}: 2\,\text{Tt}: 1\,\text{tt}$

(D) $1 : 1$

Q35. Mendel's Law of Independent Assortment states that, during gamete formation, the alleles of one gene pair:

(A) are always inherited together with the alleles of another gene pair

(B) blend with one another to give an intermediate character

(C) separate only in the F_2 generation

(D) segregate independently of the alleles of another gene pair

Q36. The exchange of corresponding segments between non-sister chromatids of homologous chromosomes during meiosis produces new combinations of alleles. Such offspring that carry parental genes in new combinations are called:

(A) clones

(B) recombinants

(C) parental types

(D) mutants

Q37. In some insects such as grasshoppers, the females are XX while the males have only one sex chromosome (XO) and no Y. In this XX–XO mechanism, the females produce:

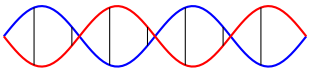
(A) two types of eggs, some with X and some with Y

(B) only one type of egg, all carrying a single X chromosome

(C) eggs that carry no sex chromosome at all

(D) eggs with two X chromosomes each

Q38. The DNA double helix is shown. The basic repeating unit (monomer) of a DNA strand is a nucleotide, which is made up of:



double helix

(A) only a nitrogenous base and a phosphate group

(B) only a sugar and a nitrogenous base

(C) a nitrogenous base, a deoxyribose (pentose) sugar and a phosphate group

(D) two nitrogenous bases joined by hydrogen bonds

Q39. The process by which the genetic information of a DNA template strand is copied into a complementary messenger RNA molecule is called:

(A) replication

(B) transcription

(C) translation

(D) splicing

Q40. The Hardy–Weinberg principle states that, in an ideal population, the allele and genotype frequencies remain constant from generation to generation. This genetic equilibrium is disturbed by all of the following EXCEPT:

(A) random mating in a large population with no other evolutionary force acting

(B) gene flow (migration) between populations

(C) natural selection favouring one genotype

(D) genetic drift in a very small population

Q41. Typhoid fever in humans is caused by a bacterium that enters the body through contaminated food and water and infects the intestine. The causative organism of typhoid is:

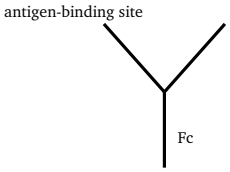
(A) *Plasmodium vivax*

(B) *Wuchereria bancrofti*

(C) *Salmonella typhi*

(D) *Entamoeba histolytica*

Q42. The Y-shaped antibody molecule is shown. When ready-made antibodies are given directly to a person (for example, the anti-tetanus serum given after an injury), the immunity produced is:



(A) active immunity, because the body makes its own antibodies

(B) innate (inborn) immunity present from birth

(C) long-lasting immunity with memory cells

(D) passive immunity, because the antibodies are supplied from outside

Q43. The first antibiotic, penicillin, was discovered by Alexander Fleming. It is obtained from the:

(A) mould *Penicillium notatum*

(B) bacterium *Lactobacillus*

(C) yeast *Saccharomyces cerevisiae*

(D) bacterium *Bacillus thuringiensis*

Q44. The sharp rise in India's food-grain (especially wheat and rice) production during the 1960s, achieved through high-yielding semi-dwarf varieties, irrigation and fertilizers, is known as the:

(A) white revolution

(B) green revolution

(C) blue revolution

(D) silver revolution

Q45. In recombinant DNA technology, a small, self-replicating, circular piece of extra-chromosomal DNA found in bacteria, widely used as a cloning vector to carry foreign genes into a host, is a:

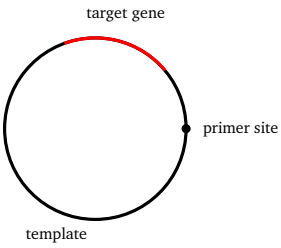
(A) ribosome

(B) restriction enzyme

(C) plasmid

(D) DNA ligase

Q46. The circular DNA shown is amplified in vitro by the polymerase chain reaction (PCR). The three steps of each PCR cycle, in the correct order, are:



(A) extension $\rightarrow$ annealing $\rightarrow$ denaturation

(B) annealing $\rightarrow$ denaturation $\rightarrow$ extension

(C) ligation $\rightarrow$ transformation $\rightarrow$ selection

(D) denaturation $\rightarrow$ annealing (primer binding) $\rightarrow$ extension

Q47. Human insulin produced by genetically engineered bacteria, marketed as 'humulin', consists of two short polypeptide chains, A and B, that are held together by:

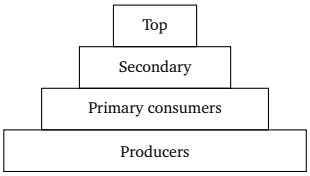
(A) disulphide (S–S) bridges

(B) peptide bonds along a single continuous chain

(C) hydrogen bonds between bases

(D) glycosidic linkages

Q48. The ecological pyramid shown has producers at the broad base and consumers above. In most terrestrial ecosystems, the pyramid of *numbers* and the pyramid of *biomass* are usually upright, but the pyramid of *energy* is:



(A) always inverted (broad at the top)

(B) always upright (it can never be inverted)

(C) sometimes inverted and sometimes upright, like the others

(D) a flat rectangle of equal levels

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

(A) exponential (J-shaped) growth

(B) zero growth at all times

(C) logistic (sigmoid, S-shaped) growth

(D) exponential decline of the population

Q50. Biodiversity hotspots are regions with very high species richness and a large number of endemic species that are under serious threat. Which of the following is recognised as a biodiversity hotspot of India?

(A) the Thar desert of Rajasthan

(B) the Gangetic plains

(C) the Sundarbans mudflats only

(D) the Western Ghats and Sri Lanka

Detailed Solutions

Q1.

Solution

Concept — Kingdom Monera: Monera contains all prokaryotes (bacteria, cyanobacteria, mycoplasma, archaebacteria). Prokaryotes lack a true membrane-bound nucleus and membrane-bound organelles.

Step 1 — Recall the prokaryotic feature: their DNA is a single naked circular molecule lying free in the cytoplasm (nucleoid), not enclosed by a nuclear membrane.

Step 2 — Match the option: 'absence of a true nucleus' is the defining feature of every Monera member.

Why other options are wrong:

- (A) a membrane-bound nucleus is a eukaryotic feature, absent in Monera.
- (B) membrane-bound organelles like mitochondria are absent in prokaryotes.
- (D) a large central vacuole and plastids are features of plant (eukaryotic) cells.

Final Answer: no true nucleus; DNA free in cytoplasm $\Rightarrow$ C

Answer: (C) Go Back to Q1

Q2.

Solution

Concept — Binomial nomenclature: Linnaeus's system gives each organism a two-word Latin name: the first word is the genus (capitalised) and the second is the specific epithet (small letter); both are printed in italics and underlined when handwritten.

Step 1 — Recall the capitalisation rule: genus = capital first letter, species = small first letter.

Step 2 — Recall the typeface rule: the whole name is italicised, e.g. *Homo sapiens*.

Why other options are wrong:

- (A) the species epithet must not be capitalised.

- (B) the rule is reversed; genus is capital, not species.
- (C) the name must be in italics, and only the genus is capitalised.

Final Answer: genus capital, species small, both italic $\Rightarrow$ D

Answer: (D) Go Back to Q2

Q3.

Solution

Concept — Bryophyte life cycle: In bryophytes the main plant body is the haploid (n) gametophyte, which is photosynthetic and dominant; the diploid sporophyte is small, short-lived and dependent on the gametophyte for nutrition.

Step 1 — Identify the dominant phase: the conspicuous green plant body = gametophyte.

Step 2 — Note its ploidy: it is haploid (n).

Why other options are wrong:

- (A) the sporophyte is diploid but small and dependent, not the dominant body.
- (C) the zygote is diploid and develops into the sporophyte, not directly into the plant body.
- (D) triploid endosperm occurs in angiosperms, not in bryophytes.

Final Answer: haploid gametophyte generation $\Rightarrow$ B

Answer: (B) Go Back to Q3

Q4.

Solution

Concept — Coelenterata: Cnidarians bear special stinging cells called cnidoblasts (cnidocytes) on their tentacles and body surface. Each contains a stinging organelle, the nematocyst, used for defence and capturing prey.

Step 1 — Recall the cell name: the stinging cells bearing nematocysts are cnidoblasts.

Step 2 — Note their role: they paralyse prey and anchor the animal.

Why other options are wrong:

- (B) choanocytes (collar cells) are the flagellated cells of sponges (Porifera).
- (C) flame cells are the excretory cells of flatworms (Platyhelminthes).
- (D) nephridia are the excretory organs of annelids like earthworm.

Final Answer: cnidoblasts (cnidocytes) $\Rightarrow$ A

Answer: (A) Go Back to Q4

Q5.

Solution

Concept — Simple permanent tissues: The three simple permanent tissues are parenchyma, collenchyma and sclerenchyma. Parenchyma consists of living, thin-walled, isodiametric cells with intercellular spaces and does photosynthesis, storage and secretion.

Step 1 — Read the clues: living, thin-walled, isodiametric, with intercellular spaces.

Step 2 — Match the tissue: these are the features of parenchyma.

Why other options are wrong:

- (B) sclerenchyma has thick, lignified walls and is usually dead; it gives mechanical support.
- (C) collenchyma has cells thickened at the corners and gives flexible support.
- (D) xylem is a complex tissue that conducts water, not a simple ground tissue.

Final Answer: parenchyma $\Rightarrow$ A

Answer: (A) Go Back to Q5

Q6.

Solution

Concept — Connective tissues: Connective tissues include loose (areolar, adipose), dense (tendon, ligament), specialised (cartilage, bone) and fluid (blood, lymph) types. Blood is a fluid connective tissue with a liquid matrix called plasma.

Step 1 — Read the clue: a *fluid* connective tissue that circulates and transports.

Step 2 — Match: blood, with its plasma matrix and cells, fits this description.

Why other options are wrong:

- (A) cartilage is a specialised connective tissue with a solid, pliable matrix.
- (B) bone is a hard, mineralised connective tissue, not fluid.
- (C) areolar tissue is a loose packing tissue, not a circulating fluid.

Final Answer: blood $\Rightarrow$ D

Answer: (D) Go Back to Q6

Q7.

Solution

Concept — Underground stem modifications: Stems may be modified underground for food storage and perennation as rhizomes (ginger, turmeric), tubers (potato), corms (*Colocasia*) and bulbs (onion). A rhizome is a horizontal stem bearing nodes, internodes and scale leaves.

Step 1 — Identify the organ: the structure has nodes, internodes and scale leaves, so it is a *stem*, not a root.

Step 2 — Name the modification: a horizontal underground stem = rhizome.

Why other options are wrong:

- (A) a tap root is a root, and lacks nodes and scale leaves.
- (B) a bulb (onion) is a reduced disc-like stem with fleshy leaves, not horizontal.
- (D) a tuberous root is a modified root, not a stem.

Final Answer: rhizome $\Rightarrow$ C

Answer: (C) Go Back to Q7

Q8.

Solution

Concept — Cockroach respiration: The cockroach has an open circulatory system, and its haemolymph carries no respiratory pigment. Respiration occurs through a network of tracheae that open out by spiracles and carry air directly to the tissues.

Step 1 — Recall the breathing organ: air-filled tubes = tracheae.

Step 2 — Note the route: air enters through spiracles and reaches cells via tracheoles.

Why other options are wrong:

- (B) gills are the breathing organs of aquatic animals like fish, not cockroach.
- (C) Malpighian tubules are excretory organs of the cockroach.
- (D) nephridia are excretory organs of the earthworm.

Final Answer: tracheae $\Rightarrow$ A

Answer: (A) Go Back to Q8

Q9.

Solution

Concept — Chloroplast structure: The chloroplast has a double membrane enclosing the stroma. Suspended in the stroma are flattened membranous sacs called thylakoids; stacks of thylakoids form the grana, which hold the chlorophyll and carry out the light reactions.

Step 1 — Identify the stacked sacs: the coin-like sacs stacked into grana are thylakoids.

Step 2 — Note their function: thylakoid membranes bear the pigments for light capture.

Why other options are wrong:

- (A) cristae are the in-folded inner membranes of the mitochondrion, not the chloroplast.
- (C) ribosomes are sites of protein synthesis, not the pigment-bearing stacks.
- (D) the stroma is the fluid ground substance, not the stacked sacs.

Final Answer: thylakoids stacked into grana $\Rightarrow$ B

Answer: (B) Go Back to Q9

Q10.

Solution

Concept — Facilitated diffusion: Facilitated diffusion is a *passive* transport in which a solute moves *down* its concentration gradient with the help of specific membrane carrier or channel proteins, but *without* using ATP.

Step 1 — Read the key words: 'down the gradient', 'carrier proteins', 'no ATP'.

Step 2 — Match: this is facilitated diffusion.

Why other options are wrong:

- (A) active transport moves solutes *against* the gradient and needs ATP.
- (B) endocytosis engulfs material in vesicles and is energy-requiring.
- (C) the Na–K pump is an example of active transport using ATP.

Final Answer: facilitated diffusion $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q10

Q11.

Solution

Concept — Protein structure: The primary structure is the exact linear sequence of amino acids linked by peptide bonds. Secondary structure is the local coiling (α-helix) or folding (β-sheet); tertiary is the overall 3-D fold; quaternary is the assembly of subunits.

Step 1 — Define primary structure: the order of amino acids in the chain.

Step 2 — Match the option: the linear sequence joined by peptide bonds.

Why other options are wrong:

- (B) coiling into an α-helix is the secondary structure.
- (C) the 3-D folding of one polypeptide is the tertiary structure.
- (D) the assembly of several subunits is the quaternary structure.

Final Answer: linear sequence of amino acids $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q11

Q12.

Solution

Concept — Active site: An enzyme has a specific pocket, the active site, formed by a few amino acids. The substrate binds here, an enzyme–substrate complex forms, and the substrate is converted into product.

Step 1 — Read the description: region where substrate binds and reacts.

Step 2 — Name it: the active site.

Why other options are wrong:

- (A) the allosteric site is a separate regulatory site, not where the substrate is converted.
- (B) a peptide bond links amino acids; it is not a binding site.
- (D) a disulphide bridge stabilises protein folding; it is not the substrate-binding pocket.

Final Answer: active site $\Rightarrow$ C

Answer: (C) Go Back to Q12

Q13.

Solution

Concept — Prophase chromosome: Because DNA was replicated in the preceding S phase, each chromosome entering mitosis already consists of two identical sister chromatids held together at the centromere. In prophase these condense into visible threads.

Step 1 — Recall the effect of S phase: replication doubles each DNA molecule.

Step 2 — Describe the prophase chromosome: two sister chromatids joined at one centromere.

Why other options are wrong:

- (A) a single chromatid would mean DNA was not replicated; this is wrong for prophase.
- (B) there are two, not three, chromatids per chromosome.
- (C) every chromosome has a centromere holding the chromatids together.

Final Answer: two sister chromatids joined at the centromere $\Rightarrow$ D

Answer: (D) Go Back to Q13

Q14.

Solution

Concept — Crossing over: During pachytene of prophase I, the paired homologous chromosomes (bivalents) exchange corresponding segments between their non-sister chromatids. This recombination, mediated by the enzyme recombinase, is called crossing over.

Step 1 — Read the clue: exchange of segments between non-sister chromatids of homologues.

Step 2 — Name it: crossing over.

Why other options are wrong:

- (A) synapsis is the pairing of homologues (at zygotene), not the exchange.
- (C) disjunction is the separation of homologues at anaphase I.
- (D) independent assortment is the random distribution of different chromosome pairs, not segment exchange.

Final Answer: crossing over $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — Z-scheme (non-cyclic) electron flow: In non-cyclic photophosphorylation, electrons released by the photolysis of water enter PS II, pass down an electron transport chain to PS I, and are finally handed to $NADP^+$ to make NADPH. Plotted on a redox scale this looks like a 'Z'.

Step 1 — Trace the source of electrons: water $\rightarrow$ PS II.

Step 2 — Trace the path: PS II $\rightarrow$ electron carriers $\rightarrow$ PS I $\rightarrow$ $NADP^+$.

Why other options are wrong:

- (B) and (C) reverse the flow; electrons do not run from $NADP^+$ or PS I back to water.
- (D) places PS I before PS II, which is incorrect for the Z-scheme.

Final Answer: water $\rightarrow$ PS II $\rightarrow$ PS I $\rightarrow$ $NADP^+$ $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q15

Q16.

Solution

Concept — Krebs cycle: In the mitochondrial matrix, the 2-carbon acetyl group of acetyl CoA condenses with the 4-carbon oxaloacetic acid (OAA) to form the 6-carbon citric acid. OAA is regenerated at the end of each turn of the cycle.

Step 1 — Identify the first reaction: acetyl CoA (2C) + acceptor (4C) $\rightarrow$ citrate (6C).

Step 2 — Name the 4-carbon acceptor: oxaloacetic acid.

Why other options are wrong:

- (B) pyruvic acid is converted to acetyl CoA before the cycle; it is not the acceptor.
- (C) citric acid is the *product* of this condensation, not the acceptor.
- (D) succinic acid is a later intermediate of the cycle.

Final Answer: oxaloacetic acid (OAA) $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q16

Q17.

Solution

Concept — Water potential: Water potential (ψ_w) measures the free energy of water. By convention, pure water at standard temperature and pressure is assigned $\psi_w = 0$, which is the highest value. Adding solutes lowers it to negative values.

Step 1 — Recall the reference state: pure water $\rightarrow \psi_w = 0$.

Step 2 — Note it is the maximum: any solution has $\psi_w < 0$.

Why other options are wrong:

- (A) pure water does not have a large positive value; its value is zero (the maximum).
- (B) it is not equal to the solute potential of cell sap, which is negative.
- (D) pure water does have a defined water potential, namely zero.

Final Answer: zero (the highest value) $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q17

Q18.

Solution

Concept — Biological nitrogen fixation: *Rhizobium* is a symbiotic bacterium that lives in the root nodules of legumes. Using the enzyme nitrogenase, it reduces atmospheric N_2 into ammonia, which the plant uses to make amino acids.

Step 1 — Identify the symbiont: the root-nodule bacterium of legumes is *Rhizobium*.

Step 2 — Note its action: it fixes N_2 into ammonia.

Why other options are wrong:

- (B) *Lactobacillus* ferments milk into curd; it does not fix nitrogen.
- (C) *Saccharomyces* (yeast) is used in baking and brewing.
- (D) *Penicillium* is a mould used to make the antibiotic penicillin.

Final Answer: *Rhizobium* $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q18

Q19.

Solution

Concept — Gibberellins: Gibberellins (e.g. GA_3) cause stem and internode elongation (bolting in cabbage/beet), break seed and bud dormancy, promote seed germination, and were first isolated from the fungus *Gibberella fujikuroi*.

Step 1 — Match the listed effects: bolting, breaking dormancy, fungal origin all point to gibberellin.

Step 2 — Conclude: the hormone is gibberellin.

Why other options are wrong:

- (A) abscisic acid promotes dormancy, the opposite of breaking it.
- (B) auxin chiefly causes cell elongation and apical dominance, not bolting from a fungus.
- (C) cytokinin promotes cell division and delays ageing of leaves.

Final Answer: gibberellin $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q19

Q20.

Solution

Concept — Activation of trypsinogen: The pancreas secretes inactive trypsinogen into the duodenum. There the intestinal enzyme enterokinase (enteropeptidase) converts trypsinogen into active trypsin, which then activates the other pancreatic proenzymes.

Step 1 — Identify the proenzyme and the activator: trypsinogen $\xrightarrow{\text{enterokinase}}$ trypsin.

Step 2 — Confirm the site: this activation occurs in the small intestine (duodenum).

Why other options are wrong:

- (A) pepsin is the stomach protease; it does not activate trypsinogen.
- (B) ptyalin is salivary amylase acting on starch in the mouth.
- (D) lipase digests fats; it is not the activator of trypsinogen.

Final Answer: enterokinase (enteropeptidase) $\Rightarrow$ C

Answer: (C) Go Back to Q20

Q21.

Solution

Concept — Carbon dioxide transport: CO_2 is carried in blood in three forms: about 70% as bicarbonate ions (HCO_3^-) in the plasma, about 20–25% as carbaminohaemoglobin, and about 7% dissolved in plasma. The bulk travels as bicarbonate.

Step 1 — Recall the major form: most CO_2 becomes HCO_3^- via carbonic anhydrase in RBCs.

Step 2 — Confirm the proportion: bicarbonate accounts for the largest fraction ($\sim$70%).

Why other options are wrong:

- (A) oxyhaemoglobin is the oxygen-carrying form, not CO_2.
- (C) carbon monoxide is a poisonous gas, not a normal transport form.
- (D) only $\sim$7% of CO_2 is carried dissolved in plasma.

Final Answer: bicarbonate ions in the plasma $\Rightarrow$ B

Answer: (B) Go Back to Q21

Q22.

Solution

Concept — ABO blood groups: The ABO system is based on the A and B antigens on red cells. Group O cells carry *neither* A nor B antigen, so they cause no clumping in any recipient; hence O is the universal donor (for packed cells).

Step 1 — Recall the antigens of group O: none (no A, no B antigen).

Step 2 — Link to donor status: with no antigens to be attacked, O red cells can go to any group.

Why other options are wrong:

- (A) both A and B antigens are present in group AB, the universal recipient.
- (B) only the A antigen is on group A cells.
- (C) only the B antigen is on group B cells.

Final Answer: neither A nor B antigen $\Rightarrow$ D

Answer: (D) Go Back to Q22

Q23.

Solution

Concept — Ultrafiltration: Blood entering the glomerulus is filtered under high hydrostatic pressure. Water, glucose, salts, urea and other small solutes pass into Bowman's capsule, while blood cells and large plasma proteins are retained. This is ultrafiltration (glomerular filtration).

Step 1 — Read the description: pressure filtration holding back cells and proteins.

Step 2 — Name it: ultrafiltration / glomerular filtration.

Why other options are wrong:

- (B) tubular reabsorption returns useful substances from the filtrate back to blood.
- (C) tubular secretion adds extra wastes (H^+, K^+) into the filtrate.
- (D) micturition is the act of passing urine out of the body.

Final Answer: ultrafiltration (glomerular filtration) $\Rightarrow$ A

Answer: (A) Go Back to Q23

Q24.

Solution

Concept — Sarcomere: A myofibril is divided into repeating units by the Z-lines. The segment between two consecutive Z-lines is the sarcomere, the functional contractile unit, made of overlapping actin (thin) and myosin (thick) filaments.

Step 1 — Read the clue: repeating unit between two Z-lines.

Step 2 — Name it: the sarcomere.

Why other options are wrong:

- (A) the sarcolemma is the plasma membrane of the muscle fibre.
- (C) the sarcoplasm is the cytoplasm of the muscle fibre.
- (D) 'myoglobin band' is not a structural unit; myoglobin is an oxygen-storing pigment.

Final Answer: sarcomere $\Rightarrow$ B

Answer: (B) Go Back to Q24

Q25.

Solution

Concept — Resting membrane potential: In a resting neuron the membrane is polarised: the inside is negative and the outside positive. The Na^+–K^+ pump keeps more Na^+ outside and more K^+ inside, and the membrane is more permeable to K^+, giving a potential of about -70 mV.

Step 1 — State the polarity: inside negative, outside positive.

Step 2 — State the ion distribution: Na^+ high outside, K^+ high inside.

Why other options are wrong:

- (A) reverses the polarity; the inside is negative, not positive, at rest.
- (B) an open-sodium-gate, impulse-carrying membrane describes the action potential, not rest.
- (D) a resting membrane is polarised, so a charge difference does exist.

Final Answer: inside negative, outside positive (Na^+ out, K^+ in) $\Rightarrow$ C

Answer: (C) Go Back to Q25

Q26.

Solution

Concept — Iodine and the thyroid: Iodine is needed to synthesise thyroxine (T_4) and T_3. When dietary iodine is deficient, the thyroid enlarges in an effort to trap more iodine, producing a swelling in the neck called simple (endemic) goitre.

Step 1 — Link cause and effect: low iodine $\rightarrow$ enlarged thyroid.

Step 2 — Name the condition: simple goitre.

Why other options are wrong:

- (A) diabetes mellitus is caused by lack of insulin, not iodine.
- (C) cretinism is the result of hypothyroidism in infants/children, not the neck swelling itself.
- (D) Addison's disease is due to deficient adrenal cortex hormones.

Final Answer: simple goitre $\Rightarrow$ B

Answer: (B) Go Back to Q26

Q27.

Solution

Concept — Ventricular systole: In ventricular systole both ventricles contract, ventricular pressure rises above that in the arteries, the semilunar valves open, and blood is pumped into the aorta and pulmonary artery; the AV valves stay shut. On the ECG this coincides with the QRS–T region.

Step 1 — Read the clue: both ventricles contracting and ejecting blood.

Step 2 — Name the phase: ventricular systole.

Why other options are wrong:

- (B) atrial systole is the contraction of the atria to fill the ventricles.
- (C) joint diastole is the relaxed, filling phase of all chambers.
- (D) the isoelectric phase is only a flat segment, not the pumping phase.

Final Answer: ventricular systole $\Rightarrow$ A

Answer: (A) Go Back to Q27

Q28.

Solution

Concept — All-or-none law: A nerve or muscle fibre either responds fully or not at all. If the stimulus is at or above threshold, the fibre gives its complete maximal response; a stronger stimulus does not produce a bigger response in that single fibre.

Step 1 — Recall the rule: threshold reached $\rightarrow$ full response; below threshold $\rightarrow$ no response.

Step 2 — Match the option: a complete maximal response that does not grow with stimulus strength.

Why other options are wrong:

- (A) a graded, proportional response contradicts the all-or-none law for a single fibre.
- (B) at or above threshold the fibre *does* respond.
- (C) summation of weak stimuli is a separate phenomenon, not the all-or-none response.

Final Answer: complete maximal response, independent of extra strength $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q28

Q29.

Solution

Concept — Megasporogenesis: The process of formation of megaspores from the diploid megaspore mother cell (MMC) by meiosis is called megasporogenesis. Usually four haploid megaspores form, of which one remains functional and develops into the embryo sac.

Step 1 — Read the definition: MMC $\xrightarrow{\text{meiosis}}$ four megaspores.

Step 2 — Name it: megasporogenesis.

Why other options are wrong:

- (A) microsporogenesis is the formation of microspores (pollen) in the anther.
- (C) pollination is the transfer of pollen to the stigma.
- (D) double fertilization is the fusion of male gametes inside the embryo sac.

Final Answer: megasporogenesis $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q29

Q30.

Solution

Concept — Triple fusion: In double fertilization, the second male gamete fuses with the two polar nuclei (or the diploid secondary nucleus). This triple fusion forms the triploid (3n) primary endosperm nucleus, which divides to form the nutritive endosperm.

Step 1 — Identify the second fusion: male gamete + two polar nuclei.

Step 2 — Name the product: the triploid primary endosperm nucleus (forms endosperm).

Why other options are wrong:

- (A) the diploid zygote forms from the *first* fusion (egg + male gamete).
- (B) the embryo is diploid and develops from the zygote, not from triple fusion.
- (D) the seed coat develops from the integuments, not from this fusion.

Final Answer: primary endosperm (triploid) nucleus $\Rightarrow$ C

Answer: (C) Go Back to Q30

Q31.

Solution

Concept — Site of fertilization: After ovulation, the ovum is picked up by the fallopian tube. Sperms deposited in the vagina travel up, and fertilization normally occurs in the *ampullary* region (the wide part) of the fallopian tube.

Step 1 — Recall where egg and sperm meet: in the oviduct, specifically the ampulla.

Step 2 — Confirm: the ampullary–isthmic junction is the usual site.

Why other options are wrong:

- (B) the cervix is the neck of the uterus, not the site of fertilization.
- (C) the vagina receives sperm but is not where fertilization happens.
- (D) the ovary releases the egg; fertilization occurs after the egg leaves it.

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

Answer: (A) Go Back to Q31

Q32.

Solution

Concept — LH surge and ovulation: The anterior pituitary secretes LH and FSH. A rapid mid-cycle rise in luteinising hormone (the LH surge), around day 14, induces rupture of the mature Graafian follicle and release of the ovum (ovulation).

Step 1 — Identify the hormone responsible: the LH surge.

Step 2 — Link to ovulation: this surge triggers follicle rupture.

Why other options are wrong:

- (A) progesterone, from the corpus luteum, maintains the endometrium *after* ovulation.
- (B) ADH controls water reabsorption in the kidney, not ovulation.
- (C) insulin controls blood glucose, not the menstrual cycle.

Final Answer: luteinising hormone (LH) $\Rightarrow$ D

Answer: (D) Go Back to Q32

Q33.

Solution

Concept — Intra-uterine devices: IUDs (such as the copper-releasing Cu-T) are inserted into the uterus by a doctor. They increase phagocytosis of sperms, the released Cu^{2+} ions suppress sperm motility, and they make the endometrium unsuitable for implantation.

Step 1 — Read the clues: inserted in the uterus, raises sperm phagocytosis, blocks implantation.

Step 2 — Name it: the intra-uterine device (IUD).

Why other options are wrong:

- (A) the oral pill is a hormonal method that mainly prevents ovulation.
- (C) the condom is a barrier method.
- (D) vasectomy is a permanent surgical sterilisation, not a uterine device.

Final Answer: intra-uterine device (copper-T) $\Rightarrow$ B

Answer: (B) Go Back to Q33

Q34.

Solution

Concept — Genotypic vs phenotypic ratio: The cross Tt $\times$ Tt gives, in the Punnett square, TT, Tt, Tt, tt. Grouping by phenotype gives 3 tall : 1 dwarf, but grouping by genotype gives $1\,\text{TT} : 2\,\text{Tt} : 1\,\text{tt}$.

Step 1 — Draw the cross: Tt $\times$ Tt $\rightarrow$ TT, Tt, Tt, tt.

Step 2 — Read the genotypes: one TT, two Tt, one tt $\Rightarrow 1 : 2 : 1$.

Why other options are wrong:

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

Final Answer: $1\,\text{TT}: 2\,\text{Tt}: 1\,\text{tt} \Rightarrow$ C

Answer: (C) Go Back to Q34

Q35.

Solution

Concept — Law of Independent Assortment: When a dihybrid is formed, the alleles of one gene pair segregate into the gametes independently of the alleles of another gene pair (when the genes are on different chromosomes), giving all possible gamete combinations equally.

Step 1 — Recall the law: one gene pair's segregation is independent of another's.

Step 2 — Match the option: alleles of one pair segregate independently of those of another pair.

Why other options are wrong:

- (A) being always inherited together describes linkage, not independent assortment.
- (B) blending is incomplete dominance, not Mendel's assortment.
- (C) segregation occurs during gamete formation, not only in F_2.

Final Answer: segregate independently of another gene pair $\Rightarrow$ D

Answer: (D) Go Back to Q35

Q36.

Solution

Concept — Recombinants: Crossing over reshuffles alleles between homologous chromosomes, producing gametes (and offspring) in which the alleles occur in combinations *different* from the parents. Such new-combination offspring are called recombinants.

Step 1 — Read the clue: parental genes appearing in new combinations.

Step 2 — Name them: recombinants.

Why other options are wrong:

- (A) clones are genetically identical copies, not new combinations.
- (C) parental types keep the original combination, opposite to recombinants.
- (D) mutants arise from changes in the DNA sequence itself, not from reshuffling existing alleles.

Final Answer: recombinants $\Rightarrow$ B

Answer: (B) Go Back to Q36

Q37.

Solution

Concept — XX–XO sex determination: In grasshoppers, females are XX (homogametic) and males are XO (only one X, no Y). Females, being XX, make only one kind of egg, each carrying a single X chromosome; males make two kinds of sperm (X-bearing and X-lacking).

Step 1 — Identify the homogametic sex: the female (XX).

Step 2 — Describe her eggs: all eggs carry one X chromosome.

Why other options are wrong:

- (A) there is no Y in this system, so no Y-bearing eggs exist.
- (C) eggs do carry a sex chromosome (one X), not none.
- (D) the egg is haploid and carries one X, not two.

Final Answer: only one type of egg, all carrying a single X $\Rightarrow$ B

Answer: (B) Go Back to Q37

Q38.

Solution

Concept — Nucleotide: A nucleotide, the monomer of nucleic acids, has three parts: a nitrogenous base, a pentose sugar (deoxyribose in DNA) and a phosphate group. (A base + sugar without phosphate is a nucleoside.)

Step 1 — List the three parts: base, deoxyribose sugar, phosphate.

Step 2 — Match the option: all three together make a nucleotide.

Why other options are wrong:

- (A) base + phosphate alone (no sugar) is not a nucleotide.
- (B) sugar + base without phosphate is a nucleoside, not a nucleotide.
- (D) two bases joined by hydrogen bonds form a base pair, not a single nucleotide.

Final Answer: base + deoxyribose sugar + phosphate $\Rightarrow$ C

Answer: (C) Go Back to Q38

Q39.

Solution

Concept — Transcription: Transcription is the synthesis of an RNA molecule using one strand of DNA (the template strand) as a guide, catalysed by RNA polymerase. The base sequence of the DNA is thus copied into messenger RNA.

Step 1 — Read the description: DNA template $\rightarrow$ complementary mRNA.

Step 2 — Name it: transcription.

Why other options are wrong:

- (A) replication copies DNA into DNA, not into RNA.
- (C) translation reads the mRNA to build a protein.
- (D) splicing removes introns from the primary transcript; it is not the copying step itself.

Final Answer: transcription $\Rightarrow$ B

Answer: (B) Go Back to Q39

Q40.

Solution

Concept — Hardy–Weinberg equilibrium: Allele frequencies stay constant only when there is no mutation, no gene flow (migration), no genetic drift, no natural selection, and mating is random in a large population. Any of these forces disturbs the equilibrium.

Step 1 — List the disturbing forces: gene flow, selection, drift, mutation, non-random mating.

Step 2 — Find the EXCEPTION: random mating in a large undisturbed population *maintains* equilibrium, so it is the exception.

Why other options are wrong:

- (B) gene flow (migration) changes allele frequencies, disturbing equilibrium.
- (C) natural selection favouring a genotype disturbs equilibrium.
- (D) genetic drift in small populations disturbs equilibrium.

Final Answer: random mating in a large undisturbed population $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q40

Q41.

Solution

Concept — Typhoid: Typhoid (enteric fever) is caused by the bacterium *Salmonella typhi*, which enters via contaminated food and water and infects the small intestine. Sustained high fever, weakness and intestinal symptoms are typical; it is confirmed by the Widal test.

Step 1 — Recall the pathogen: *Salmonella typhi* (a bacterium).

Step 2 — Note the route: faecal contamination of food/water.

Why other options are wrong:

- (A) *Plasmodium vivax* causes malaria.
- (B) *Wuchereria bancrofti* causes filariasis.
- (D) *Entamoeba histolytica* causes amoebiasis (amoebic dysentery).

Final Answer: *Salmonella typhi* $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q41

Q42.

Solution

Concept — Passive immunity: When ready-made antibodies are introduced into the body from outside (e.g. anti-tetanus serum, or antibodies passing from mother to foetus), the protection is immediate but short-lived and creates no memory. This is passive immunity.

Step 1 — Read the clue: antibodies supplied directly, not made by the body.

Step 2 — Name it: passive immunity.

Why other options are wrong:

- (A) active immunity is when the body itself makes antibodies after exposure to an antigen.
- (B) innate immunity is non-specific defence present from birth, not given as serum.
- (C) memory-based long-lasting immunity is a feature of active, not passive, immunity.

Final Answer: passive immunity (antibodies from outside) $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q42

Q43.

Solution

Concept — Penicillin: Penicillin, the first antibiotic, was discovered by Alexander Fleming from the mould *Penicillium notatum* (later produced on a large scale by Chain and Florey). Antibiotics are chemicals from microbes that kill or check the growth of other microbes.

Step 1 — Recall the source: the blue-green mould *Penicillium*.

Step 2 — Confirm: it produces penicillin, which kills bacteria.

Why other options are wrong:

- (B) *Lactobacillus* makes curd, not penicillin.
- (C) *Saccharomyces* (yeast) is used for bread and alcohol.
- (D) *Bacillus thuringiensis* provides the Bt insecticidal toxin, not penicillin.

Final Answer: mould *Penicillium notatum* $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q43

Q44.

Solution

Concept — Green revolution: The dramatic increase in India's food-grain production in the 1960s, achieved through high-yielding semi-dwarf wheat and rice varieties, fertilizers and irrigation, is called the green revolution (M. S. Swaminathan is its key Indian figure).

Step 1 — Link the trait: increased food-*grain* (wheat/rice) yield.

Step 2 — Name it: the green revolution.

Why other options are wrong:

- (A) the white revolution refers to increased milk production (Operation Flood).
- (C) the blue revolution refers to increased fish/aquaculture production.
- (D) the silver revolution refers to egg/poultry production.

Final Answer: green revolution $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q44

Q45.

Solution

Concept — Plasmid as a cloning vector: A plasmid is a small, circular, self-replicating piece of extra-chromosomal DNA found naturally in bacteria. Because it can replicate independently and accept foreign DNA, it is widely used as a cloning vector (e.g. pBR322).

Step 1 — Read the clues: small, circular, self-replicating, extra-chromosomal bacterial DNA.

Step 2 — Name it: a plasmid.

Why other options are wrong:

- (A) a ribosome is the site of protein synthesis, not a DNA vector.
- (B) a restriction enzyme cuts DNA; it is not a circular DNA molecule.
- (D) DNA ligase joins DNA fragments; it is an enzyme, not a vector.

Final Answer: plasmid $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q45

Q46.

Solution

Concept — PCR steps: Each cycle of the polymerase chain reaction has three steps in fixed order: (1) denaturation — heating to $\sim 94\,^{\circ}\text{C}$ to separate the two DNA strands; (2) annealing — cooling so the two primers bind to their complementary sequences; (3) extension — a thermostable Taq polymerase synthesises new strands.

Step 1 — Recall the order: denaturation $\rightarrow$ annealing $\rightarrow$ extension.

Step 2 — Confirm: repeating the cycle doubles the DNA each time.

Why other options are wrong:

- (A) reverses the order; extension cannot precede denaturation.
- (B) annealing cannot occur before the strands are denatured.
- (C) ligation–transformation–selection are steps of cloning, not of PCR.

Final Answer: denaturation $\rightarrow$ annealing $\rightarrow$ extension $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q46

Q47.

Solution

Concept — Humulin (human insulin): Mature insulin has two short polypeptide chains, A and B, linked together by disulphide (S–S) bridges. Eli Lilly produced humulin by making the two chains separately in *E. coli* and then joining them by these disulphide bonds.

Step 1 — Recall the structure: two chains, A and B.

Step 2 — Identify the link: they are held together by disulphide bridges.

Why other options are wrong:

- (B) the A and B chains are separate, not one continuous peptide chain.
- (C) hydrogen bonds between bases occur in DNA/RNA, not between insulin chains.
- (D) glycosidic linkages join sugars, not protein chains.

Final Answer: disulphide (S–S) bridges $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q47

Q48.

Solution

Concept — Pyramid of energy: Because energy is lost as heat at every transfer (only $\sim$10% passes to the next level), the amount of energy always decreases upward. Hence the pyramid of energy is *always upright* and can never be inverted, unlike the pyramids of number and biomass, which can be inverted.

Step 1 — Recall the 10% law: energy falls at each higher trophic level.

Step 2 — Conclude the shape: the energy pyramid is always upright.

Why other options are wrong:

- (A) it is never inverted, because energy cannot increase upward.
- (C) unlike number/biomass pyramids, the energy pyramid is never inverted.
- (D) it is a true pyramid (narrowing upward), not a flat rectangle.

Final Answer: always upright (never inverted) $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q48

Q49.

Solution

Concept — Logistic growth: When resources are limited, a population grows fast at first and then slows as it approaches the carrying capacity (K) of the habitat, tracing an S-shaped (sigmoid) curve. This is logistic (Verhulst–Pearl) growth.

Step 1 — Read the clue: rapid growth slowing near carrying capacity, S-shaped curve.

Step 2 — Name it: logistic (sigmoid) growth.

Why other options are wrong:

- (A) exponential (J-shaped) growth assumes unlimited resources and no levelling off.
- (B) zero growth would mean no change in population size, which contradicts the description.
- (D) exponential decline is a falling population, not the S-shaped rise described.

Final Answer: logistic (sigmoid) growth $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q49

Q50.

Solution

Concept — Biodiversity hotspots of India: Hotspots have exceptionally high species richness and many endemic species under threat. India's recognised hotspots include the Western Ghats and Sri Lanka, the Himalaya, and the Indo-Burma region.

Step 1 — Recall the Indian hotspots: Western Ghats–Sri Lanka, Eastern Himalaya, Indo-Burma.

Step 2 — Match the option: the Western Ghats and Sri Lanka.

Why other options are wrong:

- (A) the Thar desert has low species richness and is not a hotspot.
- (B) the Gangetic plains are agricultural lowlands, not a recognised hotspot.
- (C) the Sundarbans are an important mangrove region but are not by themselves listed as a biodiversity hotspot.

Final Answer: the Western Ghats and Sri Lanka $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q50

Answer Key

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