KIITEE Biology Sample Paper – 8

Duration: 50 Minutes **Maximum Marks: 160**

Instructions

- This paper contains **40** Multiple Choice Questions (Single Correct Answer), modelled on the Biology portion of **KIITEE** entrance.
- Each correct answer carries **+4 marks**. There is -1 **mark per wrong answer**; unattempted questions score **0**.
- Only **one** option is correct. Choose carefully.
- Syllabus level: **Class 11 & 12 (10+2) Biology — Diversity of Life, Cell Biology, Plant & Human Physiology, Reproduction, Genetics & Evolution, Biotechnology and Ecology.**
- The test is computer based. Personal calculators, log tables, mobile phones, and other electronic gadgets are strictly prohibited.

Q1. Members of the class Chlorophyceae, such as *Chlamydomonas* and *Spirogyra*, are commonly called green algae. The feature that places them in this class is that they:

(A) Store their food mainly as the carbohydrate laminarin

(B) Possess the red pigment phycoerythrin in abundance

(C) Contain chlorophyll a and b and store food as starch

(D) Completely lack a cell wall

Q2. Slime moulds (Myxomycetes) are saprophytic protists. Under favourable conditions the body moves and engulfs food, forming a creeping multinucleate mass called a:

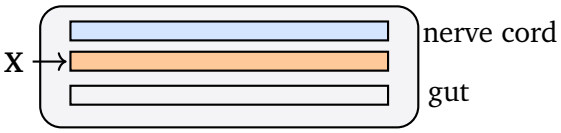
(A) Plasmodium

(B) Mycelium

(C) Protonema

(D) Coenobium

Q3. All chordates possess, at some stage of life, a flexible supporting rod on the dorsal side, labelled **X** in the diagram below. Structure **X** is the:



(A) Dorsal hollow nerve cord

(B) Alimentary canal (gut)

(C) Ventral heart

(D) Notochord

Q4. Simple cuboidal epithelium, made of cube-like cells, characteristically forms the lining of:

(A) The air sacs (alveoli) of the lungs

(B) The ducts of glands and the tubules of the kidney

(C) The inner surface of blood vessels

(D) The moist surface of the buccal cavity

Q5. Adipose tissue is a specialised loose connective tissue whose chief function in the body is to:

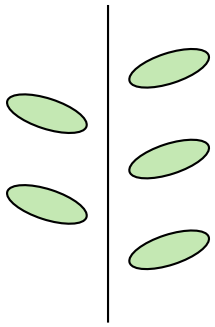
(A) Conduct nerve impulses rapidly

(B) Transport oxygen to body cells

(C) Contract to produce movement

(D) Store fat as a reserve of energy

Q6. The diagram shows the arrangement of leaves on a stem in which only one leaf arises at each node, on alternate sides of the stem. This type of phyllotaxy is called:



(A) Alternate

(B) Opposite

(C) Whorled

(D) Decussate

Q7. In a mature plant cell the large central vacuole is separated from the surrounding cytoplasm by a selectively permeable membrane called the:

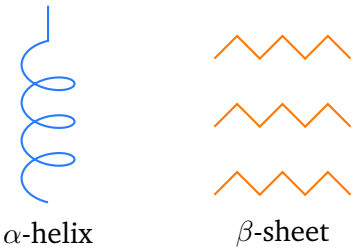
(A) Plasmalemma

(B) Tonoplast

(C) Cell wall

(D) Nuclear envelope

Q8. The diagram shows two regular folding patterns of a polypeptide chain — a coiled α-helix and a pleated β-sheet — both stabilised by hydrogen bonds between backbone groups. Together these patterns represent the _____ structure of a protein.



(A) Primary

(B) Quaternary

(C) Secondary

(D) Tertiary

Q9. The G_2/M checkpoint of the cell cycle chiefly verifies that:

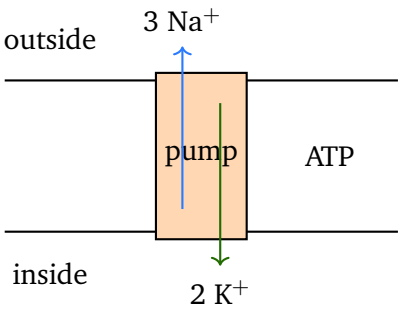
(A) The cell has grown to a sufficient size in G_1

(B) Sister chromatids have already separated correctly

(C) Enough nutrients are available for the cell to enter G_1

(D) DNA replication is complete and undamaged before mitosis begins

Q10. The Na^+/K^+ pump shown in the membrane is a primary active transporter. For every molecule of ATP it hydrolyses, the pump moves:



(A) 3 Na^+ out of the cell and 2 K^+ into the cell

(B) 2 Na^+ out of the cell and 3 K^+ into the cell

(C) 3 K^+ out of the cell and 2 Na^+ into the cell

(D) Equal numbers of Na^+ and K^+ in the same direction

Q11. Spraying gibberellic acid on a rosette plant such as cabbage causes a sudden marked elongation of the stem before flowering. This response, called bolting, shows that gibberellins promote:

(A) Closure of stomata under water stress

(B) Ripening and abscission of fruits

(C) Elongation of the internodes (stem)

(D) Inhibition of seed germination

Q12. A plant grown in magnesium-deficient soil develops yellowing of its leaves (chlorosis). This happens because magnesium is:

(A) The central metal atom of the cytochrome pigment

(B) An essential structural component of the chlorophyll molecule

(C) Required directly to open the stomatal pore

(D) A constituent of every amino acid

Q13. In the mesophyll cells of a C_4 plant, atmospheric CO_2 is first fixed into a four-carbon acid (oxaloacetate). The enzyme catalysing this primary fixation is:

(A) RuBisCO

(B) Pyruvate kinase

(C) Carbonic anhydrase

(D) PEP carboxylase

Q14. The complete aerobic oxidation of one molecule of glucose (glycolysis + Krebs cycle + electron transport chain) yields a net of about:

(A) 36 to 38 ATP

(B) 2 ATP

(C) 4 ATP

(D) 15 ATP

Q15. The strongly acidic hydrochloric acid of the gastric juice, which provides the low pH needed for pepsin to act, is secreted by the:

(A) Chief (zymogen) cells

(B) Parietal (oxyntic) cells

(C) Mucous neck cells

(D) Goblet cells

Q16. Pulmonary surfactant, a lipoprotein secreted by the type-II alveolar cells, is important because it:

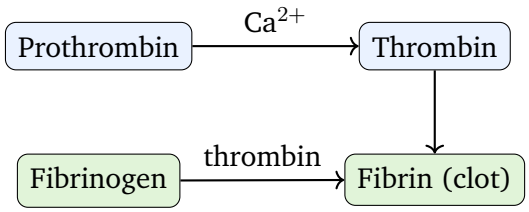
(A) Carries oxygen from the alveoli directly into the blood

(B) Destroys bacteria that enter the alveoli

(C) Lowers surface tension and prevents the alveoli from collapsing

(D) Converts carbon dioxide into bicarbonate ions

Q17. In the clotting cascade shown below, the soluble plasma protein fibrinogen is converted into the insoluble fibrin meshwork of the clot. The enzyme that catalyses this final conversion is:



(A) Thrombin

(B) Pepsin

(C) Heparin

(D) Plasmin

Q18. The amount of filtrate formed by the kidneys of a healthy adult per minute, known as the glomerular filtration rate (GFR), is approximately:

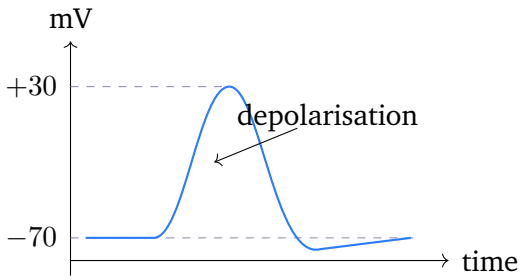
(A) 1.5 mL/min

(B) 25 mL/min

(C) 1200 mL/min

(D) 125 mL/min

Q19. The graph shows a nerve action potential. The steep rising (depolarisation) phase, during which the membrane potential shifts from -70 mV towards $+30$ mV, is caused by:



(A) Efflux of K^+ through voltage-gated potassium channels

(B) Influx of Na^+ through voltage-gated sodium channels

(C) Active pumping of Na^+ out of the axon

(D) Influx of Cl^- into the axon

Q20. The pancreas is described as a heterocrine (dual) gland because it:

(A) Secretes only digestive enzymes into the gut

(B) Releases only hormones into the blood

(C) Acts both as an exocrine gland (enzymes) and an endocrine gland (hormones)

(D) Secretes bile that emulsifies fats

Q21. Each coxal (hip) bone of the pelvic girdle is formed by the fusion of three bones. These three bones are the:

(A) Femur, tibia and fibula

(B) Scapula, clavicle and sternum

(C) Humerus, radius and ulna

(D) Ilium, ischium and pubis

Q22. In some plants, such as certain grasses and *Citrus*, seeds are formed without fertilisation, giving rise to offspring genetically identical to the mother plant. This phenomenon is called:

(A) Apomixis

(B) Parthenocarpy

(C) Self-incompatibility

(D) Double fertilisation

Q23. Freshly ejaculated mammalian sperm cannot fertilise an egg straight away; they must first undergo physiological changes inside the female reproductive tract. This process is called:

(A) Spermiation

(B) Spermiogenesis

(C) Capacitation

(D) Implantation

Q24. The vigorous contractions of the uterine wall at the time of childbirth (parturition) are stimulated mainly by the hormone:

(A) Relaxin alone

(B) Oxytocin

(C) Progesterone

(D) Prolactin

Q25. GIFT (Gamete Intra-Fallopian Transfer) is an assisted reproductive technique that involves:

(A) Transfer of an early embryo into the uterus

(B) Transfer of a zygote into the fallopian tube

(C) Injection of a single sperm directly into the ovum

(D) Transfer of an ovum collected from a donor into the fallopian tube of a recipient

Q26. Mendel's law of dominance explains why the F_1 hybrid (Tt) obtained by crossing a pure tall (TT) with a pure dwarf (tt) pea plant is tall. The law states that:

(A) In a heterozygote, only the dominant allele expresses itself in the phenotype

(B) The two alleles of a gene blend to give an intermediate phenotype

(C) Alleles of different genes always segregate together

(D) Recessive alleles are gradually lost from a population

Q27. When one gene at a particular locus suppresses or masks the expression of another gene present at a different locus, the gene interaction is called:

(A) Pleiotropy

(B) Epistasis

(C) Codominance

(D) Incomplete dominance

Q28. The chromosomal theory of inheritance, proposing that Mendelian factors (genes) are located on chromosomes which behave as pairs during meiosis, was put forward by:

(A) Gregor Mendel

(B) T.H. Morgan

(C) Sutton and Boveri

(D) Watson and Crick

Q29. The genetic code is described as degenerate because:

(A) A single amino acid may be specified by more than one codon

(B) One codon can code for several different amino acids

(C) Some codons fail to code for any amino acid

(D) The code differs from one organism to another

Q30. Phenylketonuria (PKU) is an inborn error of metabolism in which the affected individual lacks the enzyme that converts:

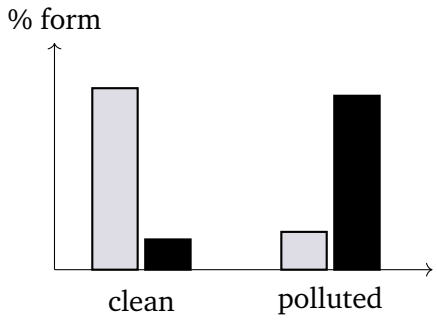
(A) Tyrosine into melanin

(B) Galactose into glucose

(C) Homogentisic acid into maleylacetoacetate

(D) Phenylalanine into tyrosine

Q31. The graph shows how the proportion of the dark (melanic) form of the peppered moth rose in soot-covered industrial areas while the light form declined. This change in the population is a classic example of:



(A) Inheritance of acquired characters

(B) Natural selection

(C) Genetic drift in a small population

(D) Reproductive isolation

Q32. Amoebiasis (amoebic dysentery), marked by abdominal pain and stools containing mucus and blood, is caused by the protozoan:

(A) *Plasmodium vivax*

(B) *Trypanosoma gambiense*

(C) *Entamoeba histolytica*

(D) *Giardia lamblia*

Q33. Which of the following is a free-living fungus widely used as a biological control agent against several plant pathogens?

(A) *Trichoderma*

(B) *Puccinia*

(C) *Phytophthora*

(D) *Ustilago*

Q34. Which of the following is an example of the physical (anatomical) barrier of innate immunity in humans?

(A) Interferons released by virus-infected cells

(B) Phagocytosis carried out by macrophages

(C) The acidic pH of the stomach contents

(D) The intact skin and mucous membranes

Q35. In the commonly used cloning vector pBR322, the genes amp^R and tet^R, which confer resistance to ampicillin and tetracycline, act as:

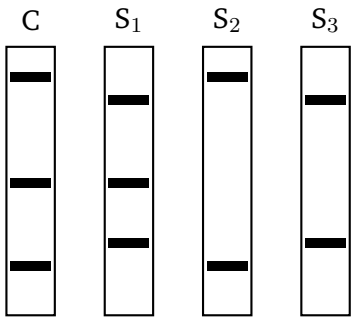
(A) Origins of replication

(B) Selectable markers

(C) Recognition sites for RNA polymerase

(D) Restriction sites for cutting the DNA

Q36. DNA fingerprinting, shown below as a pattern of bands unique to each individual, is based on differences in the number of copies of short, tandemly repeated DNA sequences known as:



(A) Single-copy structural genes

(B) Introns of housekeeping genes

(C) Variable number of tandem repeats (VNTRs)

(D) Palindromic restriction sites

Q37. In India, the statutory body that examines the safety of genetically modified organisms and decides whether they may be released for public use is the:

(A) ICMR (Indian Council of Medical Research)

(B) NBPGR (National Bureau of Plant Genetic Resources)

(C) CSIR (Council of Scientific and Industrial Research)

(D) GEAC (Genetic Engineering Appraisal Committee)

Q38. An interaction between two species in which one species is harmed (its growth or survival reduced) while the other is neither benefited nor harmed is called:

(A) Amensalism

(B) Commensalism

(C) Mutualism

(D) Predation

Q39. During decomposition, detritivores break down the detritus into smaller particles. This first step of the decomposition process is called:

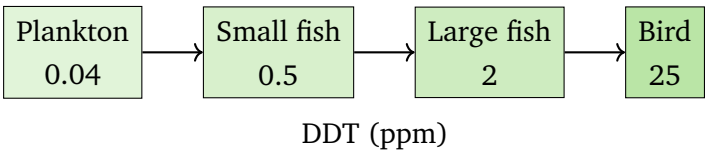
(A) Leaching

(B) Catabolism

(C) Fragmentation

(D) Humification

Q40. The food chain shown below indicates that the concentration of DDT increases from about 0.04 ppm in plankton to about 25 ppm in fish-eating birds. This progressive increase along successive trophic levels is called:



DDT (ppm)

(A) Bioremediation

(B) Biomagnification

(C) Eutrophication

(D) Bioaccumulation within a single organism

Detailed Solutions

Q1.

Solution

Concept — Chlorophyceae (green algae): The classes of algae are separated mainly by their photosynthetic pigments and stored food.

Step 1 — Recall their pigments: Green algae contain chlorophyll a and chlorophyll b, which give them a grass-green colour.

Step 2 — Recall their stored food: They store carbohydrate as starch, just like higher plants, often around a pyrenoid.

Why other options are wrong:

- Option A: laminarin is the stored food of brown algae (Phaeophyceae).
- Option B: phycoerythrin is the dominant pigment of red algae (Rhodophyceae).
- Option D: green algae have a definite cellulose cell wall.

Final Answer: Green algae have chlorophyll a and b and store starch $\Rightarrow$ C

Answer: (C) Go Back to Q1

Q2.

Solution

Concept — Slime moulds: Myxomycetes are saprophytic protists that move and feed by engulfing organic matter.

Step 1 — Identify the feeding stage: The actively moving, naked, multinucleate mass of protoplasm is called a plasmodium.

Step 2 — Note what it does: The plasmodium creeps over decaying matter, engulfing it; under dryness it forms fruiting bodies bearing spores.

Why other options are wrong:

- Option B: a mycelium is the thread-like body of true fungi.
- Option C: a protonema is an early stage of a moss.
- Option D: a coenobium is a colony of fixed cell number in some green algae.

Final Answer: The creeping multinucleate mass is a plasmodium $\Rightarrow$ A

Answer: (A) Go Back to Q2

Q3.

Solution

Concept — Phylum Chordata: The defining chordate features are a notochord, a dorsal hollow nerve cord, pharyngeal gill slits and a post-anal tail.

Step 1 — Read the diagram: Structure X is the flexible rod lying on the dorsal side, below the nerve cord and above the gut.

Step 2 — Identify it: A flexible dorsal supporting rod present at some stage in every chordate is the notochord.

Why other options are wrong:

- Option A (nerve cord) is the hollow tube shown above X.
- Option B (gut) is the lower tube.
- Option C: the chordate heart is ventral and is not the dorsal rod.

Final Answer: The dorsal supporting rod is the notochord $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q3

Q4.

Solution

Concept — Cuboidal epithelium: Cube-shaped epithelial cells line surfaces involved in secretion and absorption in tubes and ducts.

Step 1 — Match shape to site: Simple cuboidal epithelium forms the lining of gland ducts and of the tubules (e.g. proximal convoluted tubule) of the kidney.

Step 2 — Relate to function: Its moderate height suits secretion and limited absorption in these tubular structures.

Why other options are wrong:

- Option A (alveoli) are lined by thin squamous epithelium for diffusion.
- Option C (blood vessel lining) is squamous endothelium.
- Option D (buccal cavity) is lined by squamous epithelium.

Final Answer: Cuboidal epithelium lines gland ducts and kidney tubules $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q4

Q5.

Solution

Concept — Adipose tissue: Adipose tissue is a loose connective tissue packed with fat-storing cells (adipocytes).

Step 1 — Identify the function: Its adipocytes store fat (triglycerides) as a long-term energy reserve.

Step 2 — Note its other roles: Stored fat also insulates the body against heat loss and cushions internal organs.

Why other options are wrong:

- Option A: nerve impulse conduction is the role of nervous tissue.
- Option B: oxygen transport is carried out by blood.
- Option C: contraction for movement is the role of muscle tissue.

Final Answer: Adipose tissue stores fat as an energy reserve $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q5

Q6.

Solution

Concept — Phyllotaxy: Phyllotaxy is the pattern in which leaves are arranged on the stem; the main types are alternate, opposite and whorled.

Step 1 — Read the diagram: The figure shows a single leaf borne at each node, with successive leaves on alternate sides of the stem.

Step 2 — Name the pattern: One leaf per node placed alternately is alternate phyllotaxy (as in china rose and sunflower).

Why other options are wrong:

- Option B (opposite) has two leaves at each node, facing each other.
- Option C (whorled) has three or more leaves at each node.
- Option D (decussate) is a special opposite type with pairs at right angles.

Final Answer: One leaf per node on alternate sides is alternate phyllotaxy $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q6

Q7.

Solution

Concept — Plant cell vacuole: The central vacuole stores cell sap and maintains turgor; it is enclosed by its own membrane.

Step 1 — Name the membrane: The single membrane bounding the vacuole is the tonoplast.

Step 2 — Note its property: The tonoplast is selectively permeable and helps concentrate ions and metabolites inside the vacuole.

Why other options are wrong:

- Option A (plasmalemma) is the outer cell membrane, not the vacuolar one.
- Option C (cell wall) is the rigid non-living outer covering.
- Option D (nuclear envelope) surrounds the nucleus.

Final Answer: The vacuolar membrane is the tonoplast $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q7

Q8.

Solution

Concept — Levels of protein structure: Proteins have primary, secondary, tertiary and quaternary structures.

Step 1 — Read the diagram: The figure shows a coiled α-helix and a pleated β-sheet, both arising from regular hydrogen bonding of the polypeptide backbone.

Step 2 — Identify the level: Such local regular folding (α-helix / β-sheet) is the secondary structure of a protein.

Why other options are wrong:

- Option A (primary) is just the linear sequence of amino acids.
- Option B (quaternary) is the assembly of two or more polypeptide chains.
- Option D (tertiary) is the overall three-dimensional folding of a whole chain.

Final Answer: The α-helix and β-sheet make up the secondary structure $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q8

Q9.

Solution

Concept — Cell-cycle checkpoints: Checkpoints are control points that stop the cycle until specific conditions are met.

Step 1 — Locate the G_2/M checkpoint: It operates at the end of G_2, just before the cell enters mitosis (M phase).

Step 2 — State what it checks: It verifies that DNA replication has been completed accurately and that the DNA is undamaged before mitosis is allowed to begin.

Why other options are wrong:

- Option A (cell size/growth) is checked at the G_1 checkpoint.
- Option B (chromatid separation) is monitored by the spindle (metaphase) checkpoint.
- Option C (nutrient availability for G_1 entry) is a G_1, not a G_2/M, concern.

Final Answer: The G_2/M checkpoint confirms complete, undamaged DNA before mitosis $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q9

Q10.

Solution

Concept — Sodium–potassium pump: The Na^+/K^+ ATPase is a primary active transporter that moves both ions against their gradients using ATP.

Step 1 — State the stoichiometry: For each ATP hydrolysed, the pump expels 3 Na^+ out of the cell and imports 2 K^+ into the cell.

Step 2 — Note the consequence: Because three positive ions leave for every two that enter, the cell interior is kept negative, helping maintain the resting membrane potential.

Why other options are wrong:

- Option B reverses the correct numbers of Na^+ and K^+.
- Option C reverses both the ions and their directions.
- Option D wrongly moves both ions the same way; the pump is an antiporter.

Final Answer: The pump moves 3 Na^+ out and 2 K^+ in per ATP $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q10

Q11.

Solution

Concept — Gibberellins: Gibberellins are growth-promoting hormones best known for causing dramatic stem elongation.

Step 1 — Define bolting: Bolting is the sudden elongation of the internodes of a rosette plant just before flowering.

Step 2 — Link to the hormone: Applied gibberellic acid triggers this internodal elongation, showing gibberellins promote stem (internode) growth.

Why other options are wrong:

- Option A (stomatal closure under stress) is the role of abscisic acid.
- Option B (fruit ripening/abscission) is mainly due to ethylene.
- Option D: gibberellins actually break dormancy and promote germination, not inhibit it.

Final Answer: Bolting shows gibberellins promote internodal (stem) elongation $\Rightarrow$ C

Answer: (C) Go Back to Q11

Q12.

Solution

Concept — Mineral deficiency: The visible symptom of a nutrient deficiency reflects the role of that element in the plant.

Step 1 — Identify magnesium's role: Magnesium is the central metal atom that sits at the core of the chlorophyll molecule.

Step 2 — Explain the symptom: Without enough magnesium, chlorophyll cannot be made, so the leaves turn yellow (chlorosis).

Why other options are wrong:

- Option A: cytochromes carry iron, not magnesium, at their centre.
- Option C: stomatal opening depends mainly on potassium ions.
- Option D: nitrogen, not magnesium, is the element common to all amino acids.

Final Answer: Mg deficiency causes chlorosis because Mg is part of chlorophyll $\Rightarrow$ B

Answer: (B) Go Back to Q12

Q13.

Solution

Concept — C_4 pathway: In C_4 plants, CO_2 is first trapped in the mesophyll before being handed to the Calvin cycle in the bundle-sheath.

Step 1 — Identify the primary acceptor: The CO_2 acceptor in mesophyll cells is phosphoenolpyruvate (PEP).

Step 2 — Identify the enzyme: PEP carboxylase fixes CO_2 onto PEP to form the four-carbon oxaloacetate; it has a high affinity for CO_2 and no oxygenase activity.

Why other options are wrong:

- Option A (RuBisCO) acts later in the bundle-sheath Calvin cycle.
- Option B (pyruvate kinase) is a glycolytic enzyme.
- Option C (carbonic anhydrase) only interconverts CO_2 and bicarbonate; it does not fix carbon.

Final Answer: Primary CO_2 fixation in C_4 mesophyll is by PEP carboxylase $\Rightarrow$ D

Answer: (D) Go Back to Q13

Q14.

Solution

Concept — Aerobic respiration yield: Complete oxidation of glucose combines glycolysis, the Krebs cycle and the electron transport chain.

Step 1 — Add the contributions: Glycolysis nets 2 ATP, the Krebs cycle nets 2 ATP, and oxidative phosphorylation of the NADH and $FADH_2$ produced yields the bulk of the rest.

Step 2 — State the total: The net yield comes to about 36 to 38 ATP per glucose molecule.

Why other options are wrong:

- Option B (2 ATP) is only the net of glycolysis.
- Option C (4 ATP) is the gross ATP of glycolysis.

- Option D (15 ATP) is far short of the full aerobic total.

Final Answer: Full aerobic oxidation of glucose yields about 36–38 ATP $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q14

Q15.

Solution

Concept — Gastric glands: Different cells of the gastric glands secrete different components of gastric juice.

Step 1 — Identify the acid-secreting cell: Hydrochloric acid is secreted by the parietal (oxyntic) cells.

Step 2 — Note its purpose: The HCl produces the low pH that activates pepsinogen to pepsin and kills ingested microbes.

Why other options are wrong:

- Option A: chief (zymogen) cells secrete pepsinogen, not acid.
- Option C: mucous neck cells secrete protective mucus.
- Option D: goblet cells secrete mucus in the intestine, not gastric acid.

Final Answer: Gastric HCl is secreted by the parietal (oxyntic) cells $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q15

Q16.

Solution

Concept — Pulmonary surfactant: Surfactant is a lipoprotein film lining the inner surface of the alveoli.

Step 1 — State its action: It reduces the surface tension of the fluid film coating the alveoli.

Step 2 — State the benefit: Lower surface tension stops the tiny alveoli from collapsing during expiration and makes the lungs easier to inflate.

Why other options are wrong:

- Option A: oxygen movement into blood is by diffusion, not by surfactant.
- Option B: defence against bacteria is the job of alveolar macrophages.
- Option D: bicarbonate formation involves carbonic anhydrase in red cells.

Final Answer: Surfactant lowers surface tension and prevents alveolar collapse $\Rightarrow$ C

Answer: (C) Go Back to Q16

Q17.

Solution

Concept — Blood clotting: Clotting ends with the formation of an insoluble fibrin mesh from soluble fibrinogen.

Step 1 — Read the cascade: Prothrombin is first converted (with Ca^{2+}) into the active enzyme thrombin.

Step 2 — Identify the final step: Thrombin then converts fibrinogen into fibrin, the threads of which trap blood cells to form the clot.

Why other options are wrong:

- Option B (pepsin) is a gastric protein-digesting enzyme.
- Option C (heparin) is an anticoagulant; it prevents clotting.
- Option D (plasmin) dissolves clots, it does not form fibrin.

Final Answer: Fibrinogen is converted to fibrin by thrombin $\Rightarrow$ A

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Glomerular filtration rate: GFR is the volume of filtrate formed by all the nephrons of both kidneys per minute.

Step 1 — Recall the value: In a healthy adult the GFR is about 125 mL per minute.

Step 2 — Put it in context: This works out to roughly 180 litres of filtrate per day, of which nearly all is reabsorbed.

Why other options are wrong:

- Option A (1.5 mL/min) is closer to the rate of urine formation, not filtration.
- Option B (25 mL/min) is far too low.
- Option C (1200 mL/min) is about the renal blood flow, not the GFR.

Final Answer: Normal GFR is about 125 mL/min $\Rightarrow$ D

Answer: (D) Go Back to Q18

Q19.

Solution

Concept — Action potential: A nerve impulse is a brief reversal of membrane polarity driven by gated ion channels.

Step 1 — Read the graph: The steep rising phase takes the potential from the resting -70 mV up to about $+30$ mV.

Step 2 — Identify the ionic cause: On reaching threshold, voltage-gated sodium channels open and Na^+ rushes into the axon, making the inside positive (depolarisation).

Why other options are wrong:

- Option A (K^+ efflux) causes the falling repolarisation phase, not the rise.
- Option C (pumping Na^+ out) restores gradients slowly; it does not depolarise.
- Option D (Cl^- influx) tends to hyperpolarise, not depolarise.

Final Answer: Depolarisation is due to Na^+ influx through voltage-gated channels $\Rightarrow$ B

Answer: (B) Go Back to Q19

Q20.

Solution

Concept — Composite (heterocrine) gland: A gland that performs both exocrine and endocrine functions is called heterocrine.

Step 1 — Exocrine role of pancreas: Its acini secrete digestive enzymes (pancreatic juice) into the duodenum through a duct.

Step 2 — Endocrine role of pancreas: Its islets of Langerhans secrete the hormones insulin and glucagon directly into the blood.

Why other options are wrong:

- Options A and B each describe only one of the two functions.
- Option D: bile is secreted by the liver, not the pancreas.

Final Answer: The pancreas is heterocrine, being both exocrine and endocrine $\Rightarrow$ C

Answer: (C) Go Back to Q20

Q21.

Solution

Concept — Pelvic girdle: The pelvic girdle attaches the hind limbs to the axial skeleton and is made of two coxal (hip) bones.

Step 1 — Name the components: Each coxal bone is formed by the fusion of three bones — the ilium, ischium and pubis.

Step 2 — Locate their meeting point: These three meet at the acetabulum, the socket that receives the head of the femur.

Why other options are wrong:

- Option A names the bones of the leg (limb), not the girdle.
- Option B names bones of the pectoral girdle and chest.
- Option C names the bones of the forelimb.

Final Answer: Each hip bone is the fused ilium, ischium and pubis $\Rightarrow$ D

Answer: (D) Go Back to Q21

Q22.

Solution

Concept — Asexual seed formation: Some flowering plants form seeds without the fusion of gametes.

Step 1 — Define apomixis: Apomixis is the formation of seeds without fertilisation; the embryo develops from a diploid cell of the ovule.

Step 2 — Note the outcome: Such seeds give offspring genetically identical to the mother plant, useful for fixing hybrid vigour.

Why other options are wrong:

- Option B (parthenocarpy) is fruit formation without fertilisation, giving seedless fruits.
- Option C (self-incompatibility) prevents self-pollen from fertilising.

- Option D (double fertilisation) is the normal sexual event, the opposite of apomixis.

Final Answer: Seed formation without fertilisation is apomixis $\Rightarrow$ A

Answer: (A) Go Back to Q22

Q23.

Solution

Concept — Capacitation: Ejaculated sperm need final maturation before they can fertilise an egg.

Step 1 — Define the process: Capacitation is the set of physiological changes the sperm undergo in the female reproductive tract.

Step 2 — Note the result: Only after capacitation can the sperm undergo the acrosomal reaction and penetrate the egg.

Why other options are wrong:

- Option A (spermiation) is the release of sperm from the seminiferous tubules.
- Option B (spermiogenesis) is the shaping of spermatids into sperm in the testis.
- Option D (implantation) is the embedding of the blastocyst in the uterus.

Final Answer: Final maturation of sperm in the female tract is capacitation $\Rightarrow$ C

Answer: (C) Go Back to Q23

Q24.

Solution

Concept — Parturition: Childbirth is brought about by powerful contractions of the uterine muscles, controlled by a neuroendocrine reflex.

Step 1 — Identify the key hormone: Oxytocin, released from the posterior pituitary, stimulates strong contractions of the uterine wall.

Step 2 — Note the feedback: The contractions push the foetus down, which triggers more oxytocin release in a positive feedback loop until delivery.

Why other options are wrong:

- Option A: relaxin softens the cervix and pelvic ligaments but does not drive contractions.
- Option C: progesterone keeps the uterus quiet during pregnancy; its fall allows labour.
- Option D: prolactin stimulates milk production after birth.

Final Answer: Uterine contractions of parturition are driven by oxytocin $\Rightarrow$ B

Answer: (B) Go Back to Q24

Q25.

Solution

Concept — Assisted reproductive technologies: Different ART methods transfer different stages (gamete, zygote or embryo) to different sites.

Step 1 — Define GIFT: GIFT (Gamete Intra-Fallopian Transfer) transfers an ovum, collected from a donor, into the fallopian tube of a woman who cannot produce ova but can support fertilisation and development.

Step 2 — Note where fertilisation occurs: Because gametes are placed in the tube, fertilisation then takes place inside the recipient's body.

Why other options are wrong:

- Option A (embryo into uterus) describes embryo transfer / IUT.
- Option B (zygote into fallopian tube) describes ZIFT, not GIFT.
- Option C (single sperm into ovum) describes ICSI.

Final Answer: GIFT transfers a donor ovum into the recipient's fallopian tube $\Rightarrow$ D

Answer: (D) Go Back to Q25

Q26.

Solution

Concept — Law of dominance: Mendel's first principle explains the appearance of one parental form in the F_1 hybrid.

Step 1 — State the law: In a heterozygote carrying two contrasting alleles, only the dominant allele is expressed in the phenotype, while the recessive remains hidden.

Step 2 — Apply it: The Tt hybrid is tall because the dominant T allele masks the recessive t allele.

Why other options are wrong:

- Option B describes blending/incomplete dominance, which Mendel did not observe in these traits.
- Option C describes (incorrectly) independent assortment.
- Option D is a population-genetics idea unrelated to the law of dominance.

Final Answer: In a heterozygote only the dominant allele shows in the phenotype $\Rightarrow$ A

Answer: (A) Go Back to Q26

Q27.

Solution

Concept — Gene interaction: Sometimes one gene influences the expression of another at a different locus.

Step 1 — Define epistasis: Epistasis is the interaction in which one gene (the epistatic gene) masks or suppresses the expression of another gene (the hypostatic gene) at a separate locus.

Step 2 — Note its effect: It modifies the expected dihybrid ratios (for example, 9:3:4 or 12:3:1).

Why other options are wrong:

- Option A (pleiotropy) is one gene affecting many traits, not one gene masking another.
- Option C (codominance) is the simultaneous full expression of both alleles of one gene.
- Option D (incomplete dominance) gives an intermediate phenotype for a single gene.

Final Answer: One gene masking another at a different locus is epistasis $\Rightarrow$ B

Answer: (B) Go Back to Q27

Q28.

Solution

Concept — Chromosomal theory of inheritance: This theory linked Mendel's factors to the behaviour of chromosomes.

Step 1 — Identify the proposers: Walter Sutton and Theodor Boveri independently proposed that genes lie on chromosomes.

Step 2 — State the parallel: They noted that the pairing and separation of chromosomes during meiosis exactly parallels the segregation and independent assortment of Mendel's factors.

Why other options are wrong:

- Option A (Mendel) gave the laws of inheritance but not the chromosomal basis.
- Option B (Morgan) later proved the theory using linkage in *Drosophila*.
- Option D (Watson and Crick) described the structure of DNA.

Final Answer: The chromosomal theory was proposed by Sutton and Boveri $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q28

Q29.

Solution

Concept — Properties of the genetic code: The code has 64 codons but only 20 amino acids, leading to redundancy.

Step 1 — Define degeneracy: The code is degenerate because most amino acids are specified by more than one codon (for example, leucine has six codons).

Step 2 — Note the limit: Despite this, each codon still codes for only one amino acid, so the code remains unambiguous.

Why other options are wrong:

- Option B describes ambiguity, which the code is not.
- Option C describes the (separate) existence of stop codons, not degeneracy.
- Option D is wrong because the code is nearly universal.

Final Answer: Degeneracy means one amino acid has more than one codon $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q29

Q30.

Solution

Concept — Phenylketonuria: PKU is an autosomal recessive inborn error of amino-acid metabolism.

Step 1 — Identify the missing enzyme: The affected person lacks phenylalanine hydroxylase, which normally converts phenylalanine to tyrosine.

Step 2 — Note the consequence: Phenylalanine and its derivatives accumulate and are excreted in urine, causing mental impairment if untreated.

Why other options are wrong:

- Option A: failure to make melanin from tyrosine is albinism.
- Option B: inability to convert galactose to glucose is galactosaemia.
- Option C: a block at homogentisic acid is alkaptonuria.

Final Answer: In PKU phenylalanine cannot be converted to tyrosine $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q30

Q31.

Solution

Concept — Industrial melanism: The peppered moth case is a textbook demonstration of evolution in action.

Step 1 — Read the graph: In clean areas the light form is common; in soot-blackened (polluted) areas the dark form dominates.

Step 2 — Explain the shift: On dark, soot-covered bark the dark moths are better camouflaged, survive predation more, and reproduce more — the environment selects for them. This is natural selection.

Why other options are wrong:

- Option A (inheritance of acquired characters) is Lamarckism, since rejected.
- Option C (genetic drift) is random change, not the directional change driven by predation here.
- Option D (reproductive isolation) concerns speciation, not this colour shift.

Final Answer: The peppered-moth shift is a case of natural selection $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q31

Q32.

Solution

Concept — Protozoan diseases: Different protozoa cause different human diseases.

Step 1 — Identify the pathogen: Amoebiasis (amoebic dysentery) is caused by *Entamoeba histolytica*, which lives in the large intestine.

Step 2 — Note the spread: It spreads through food and water contaminated with the cysts, often carried by houseflies.

Why other options are wrong:

- Option A (*Plasmodium vivax*) causes malaria.
- Option B (*Trypanosoma*) causes sleeping sickness.
- Option D (*Giardia*) causes giardiasis, a different intestinal infection.

Final Answer: Amoebiasis is caused by *Entamoeba histolytica* $\Rightarrow$ C

Answer: (C) Go Back to Q32

Q33.

Solution

Concept — Biological control: Biocontrol uses living organisms to suppress pests and pathogens instead of chemicals.

Step 1 — Identify the agent: *Trichoderma* is a free-living soil fungus widely used as a biocontrol agent against several fungal plant pathogens.

Step 2 — Note its action: It colonises roots and parasitises or out-competes harmful fungi, protecting the crop.

Why other options are wrong:

- Option B (*Puccinia*) is itself the rust pathogen of cereals.
- Option C (*Phytophthora*) causes late blight, a plant disease.
- Option D (*Ustilago*) causes smut disease in crops.

Final Answer: The biocontrol fungus is *Trichoderma* $\Rightarrow$ A

Answer: (A) Go Back to Q33

Q34.

Solution

Concept — Innate immunity: Innate immunity is non-specific and present from birth; it has physical, physiological, cellular and cytokine barriers.

Step 1 — Identify the physical barrier: The intact skin and the mucous membranes lining the respiratory, digestive and urinogenital tracts form the first physical barrier that blocks the entry of microbes.

Step 2 — Classify the others: The remaining options are different types of innate defence, not the physical barrier.

Why other options are wrong:

- Option A (interferons) is a cytokine barrier.
- Option B (phagocytosis by macrophages) is a cellular barrier.
- Option C (stomach acidity) is a physiological barrier.

Final Answer: Skin and mucous membranes are the physical barrier of innate immunity $\Rightarrow$ D

Answer: (D) Go Back to Q34

Q35.

Solution

Concept — Cloning vector pBR322: A good vector carries selectable markers so that transformed cells can be picked out.

Step 1 — Identify the markers: In pBR322 the genes amp^R and tet^R give the host resistance to ampicillin and tetracycline, acting as selectable markers.

Step 2 — Note their use: Only cells that have taken up the plasmid survive on the antibiotic medium, allowing the selection of transformants.

Why other options are wrong:

- Option A: the origin of replication (*ori*) is a separate sequence.
- Option C: RNA-polymerase binding sites are promoters, not resistance genes.
- Option D: restriction sites are the cut points for enzymes, not the markers.

Final Answer: amp^R and tet^R of pBR322 are selectable markers $\Rightarrow$ B

Answer: (B) Go Back to Q35

Q36.

Solution

Concept — DNA fingerprinting: This technique compares highly variable, repetitive regions of DNA between individuals.

Step 1 — Read the gel: Each individual shows a unique pattern of bands, because the lengths of the repeat regions differ from person to person.

Step 2 — Name the sequences: These short, tandemly repeated sequences that vary in copy number are the variable number of tandem repeats (VNTRs), also called minisatellites.

Why other options are wrong:

- Option A (single-copy genes) shows little person-to-person variation.
- Option B (introns of housekeeping genes) is not the basis of the test.
- Option D (palindromic restriction sites) are the enzyme cut points, not the repeats compared.

Final Answer: DNA fingerprinting is based on VNTRs $\Rightarrow$ C

Answer: (C) Go Back to Q36

Q37.

Solution

Concept — Biosafety regulation in India: The release of genetically modified organisms is controlled by a designated regulatory body.

Step 1 — Identify the body: The Genetic Engineering Appraisal Committee (GEAC) examines the safety of GM research and approves the use of GMOs for public services.

Step 2 — Note its scope: GEAC decides on field trials and commercial release of GM crops and products.

Why other options are wrong:

- Option A (ICMR) directs medical research, not GMO approval.
- Option B (NBPGR) conserves plant genetic resources (germplasm).
- Option C (CSIR) runs general scientific and industrial research laboratories.

Final Answer: GMO safety in India is appraised by the GEAC $\Rightarrow$ D

Answer: (D) Go Back to Q37

Q38.

Solution

Concept — Population interactions: Interactions are classified by the effect (+, −, 0) on each partner.

Step 1 — Read the signs: One species is harmed (−) while the other is unaffected (0).

Step 2 — Name the interaction: A (−/0) interaction is amensalism, for example a fungus releasing a chemical that kills nearby bacteria.

Why other options are wrong:

- Option B (commensalism) is (+/0): one benefits, the other is unaffected.
- Option C (mutualism) is (+/+): both benefit.
- Option D (predation) is (+/−): predator gains, prey is killed.

Final Answer: A (−/0) interaction is amensalism ⇒ A

Answer: (A) Go Back to Q38

Q39.

Solution

Concept — Decomposition: Decomposition breaks down dead organic matter (detritus) through a series of steps.

Step 1 — Identify the first step: Detritivores (such as earthworms) break the detritus into smaller particles; this step is called fragmentation.

Step 2 — Place it in the sequence: Fragmentation is followed by leaching, catabolism, humification and finally mineralisation.

Why other options are wrong:

- Option A (leaching) is the washing down of soluble nutrients into the soil.
- Option B (catabolism) is the enzymatic breakdown of detritus into simpler compounds.
- Option D (humification) is the formation of dark amorphous humus.

Final Answer: Breaking detritus into smaller particles is fragmentation ⇒ C

Answer: (C) Go Back to Q39

Q40.

Solution

Concept — Biomagnification: Certain stable, fat-soluble pollutants build up to higher concentrations at each successive trophic level.

Step 1 — Read the food chain: DDT rises from 0.04 ppm in plankton to about 25 ppm in the fish-eating birds at the top.

Step 2 — Name the phenomenon: This increase in pollutant concentration along successive trophic levels is biomagnification.

Why other options are wrong:

- Option A (bioremediation) is the use of organisms to clean up pollutants.
- Option C (eutrophication) is nutrient over-enrichment of water bodies.
- Option D (bioaccumulation in one organism) is build-up within a single organism over time, not the rise across trophic levels.

Final Answer: Rising DDT along the food chain is biomagnification $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q40

Answer Key

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