AIIMS B.Sc Nursing Biology

Sample Paper – 7

Duration: 36 Minutes **Maximum Marks: 30**

Instructions

- This paper contains **30 Multiple Choice Questions (single correct answer)**, modelled on the Biology section of the **AIIMS B.Sc Nursing** entrance.
- Each correct answer carries **+1 mark**. $\frac{1}{3}$ **mark is deducted** for every wrong answer, and an unattempted question gets **0 marks**.
- Only **one** option is correct. The paper covers botany, human physiology, genetics, and ecology.
- Personal calculators, mobile phones, and other electronic gadgets are strictly prohibited.

Q1. The two blood cells shown below are drawn to the same scale. Cell X is a mature mammalian red blood cell and cell Y is a white blood cell. The feature that makes the mature red blood cell (X) unusual is that it:

(A) lacks a nucleus

(B) lacks a cell membrane

(C) has many nuclei

(D) is the largest cell in blood

Q2. The double, porous membrane that encloses the nucleus and separates the genetic material from the cytoplasm is called the:

(A) plasma membrane

(B) nuclear membrane (nuclear envelope)

(C) cell wall

(D) tonoplast

Q3. In the underground storage organs of a plant, such as a potato tuber, starch is stored inside colourless plastids called:

(A) chloroplasts

(B) chromoplasts

(C) leucoplasts

(D) mitochondria

Q4. The most abundant organic polymer found in living cells, built up from amino acid units, is:

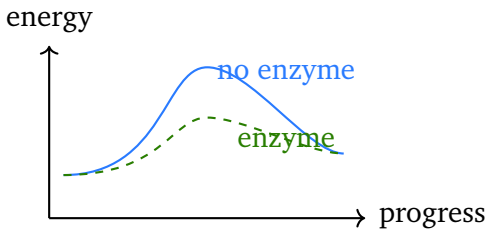
(A) starch

(B) cellulose

(C) glycogen

(D) protein

Q5. The energy graph below compares a reaction with and without an enzyme. The dashed curve is the enzyme-catalysed path. Enzymes speed up a reaction because they:



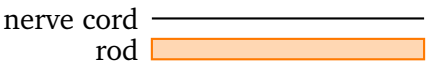
(A) lower the activation energy

(B) raise the activation energy

(C) increase the energy of the products

(D) are themselves used up in the reaction

Q6. The diagram below shows a long, flexible supporting rod (shaded) running along the back of an animal, below the nerve cord. The presence of this rod is the defining feature of which phylum?



(A) Arthropoda

(B) Chordata

(C) Mollusca

(D) Annelida

Q7. An animal that has dry, scaly skin and cannot regulate its own body temperature (cold-blooded) most likely belongs to the class:

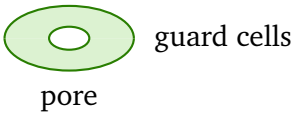
(A) Mammalia

(B) Aves

(C) Reptilia

(D) Amphibia

Q8. The labelled pore on the lower surface of the leaf, bordered by two bean-shaped guard cells, is the main route by which gases enter and leave the leaf. This pore is the:



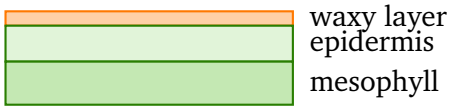
(A) lenticel

(B) root hair

(C) vein

(D) stoma (stomata)

Q9. The cross-section of a leaf below shows a thin, waxy, waterproof layer (shaded) coating the upper epidermis that reduces water loss. This layer is the:



(A) cuticle

(B) cortex

(C) pith

(D) phloem

Q10. The plant hormone that mainly promotes cell division and delays the ageing (senescence) of leaves is:

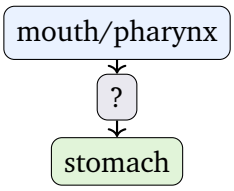
(A) abscisic acid

(B) cytokinin

(C) ethylene

(D) gibberellin

Q11. In the simplified diagram of the human food pipe below, the muscular tube marked with the question mark carries swallowed food from the pharynx down to the stomach. This tube is the:



(A) trachea

(B) small intestine

(C) oesophagus

(D) larynx

Q12. The substance secreted by the gastric glands of the stomach that kills most bacteria in food and activates pepsinogen into pepsin is:

(A) bile

(B) mucus

(C) sodium bicarbonate

(D) hydrochloric acid

Q13. The digestive juice secreted by the pancreas, which contains enzymes acting on carbohydrates, proteins, and fats, is the:

(A) gastric juice

(B) bile juice

(C) pancreatic juice

(D) saliva

Q14. The normal resting heart rate of a healthy adult human is about:

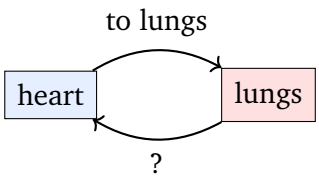
(A) 36 beats per minute

(B) 72 beats per minute

(C) 120 beats per minute

(D) 200 beats per minute

Q15. In the schematic of pulmonary circulation below, blood travelling along the vessel marked with the question mark carries oxygenated blood from the lungs back to the heart. This vessel is the:



(A) pulmonary artery

(B) vena cava

(C) pulmonary veins

(D) aorta

Q16. When a person's kidneys fail, the waste products of the blood are removed by an artificial filtering procedure carried out by a machine. This procedure is called:

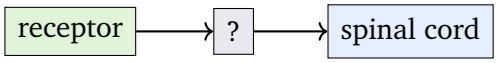
(A) transfusion

(B) transplantation

(C) osmosis

(D) dialysis

Q17. In the reflex pathway shown below, the neuron carrying the impulse from the skin receptor towards the spinal cord (central nervous system) is the type marked with the question mark. This neuron is a:



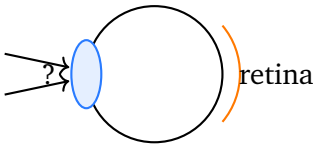
(A) motor neuron

(B) relay (inter) neuron

(C) sensory neuron

(D) secretory cell

Q18. In the diagram of the human eye below, the transparent biconvex structure marked with the question mark bends incoming light rays so that they meet (focus) on the retina. This structure is the:



(A) cornea

(B) iris

(C) pupil

(D) lens

Q19. The main female sex hormone, secreted by the ovary, that controls the development of female secondary sexual characters is:

(A) testosterone

(B) insulin

(C) oestrogen

(D) adrenaline

Q20. After fertilization, the early embryo travels to the uterus and becomes fixed in its inner wall. This attachment of the embryo to the wall of the uterus is called:

(A) ovulation

(B) fertilization

(C) gestation

(D) implantation

Q21. The seed shown in section below contains a single cotyledon (seed leaf). A plant whose seed has only one cotyledon is called a monocot. The number of cotyledons in this seed is:

single cotyledon

(A) one

(B) two

(C) three

(D) many

Q22. Which one of the following animals is well known for its remarkable ability to regenerate (re-grow) lost body parts, so that a cut piece can grow into a complete new individual?

(A) earthworm

(B) Planaria

(C) housefly

(D) frog

Q23. A cell that contains two complete sets of chromosomes, one set from each parent, is described as:

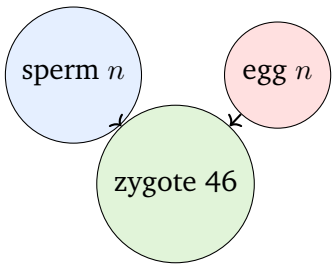
(A) haploid

(B) monoploid

(C) diploid

(D) polyploid

Q24. The diagram shows fertilization in humans. A sperm and an egg, each carrying n chromosomes, fuse to form a zygote with 46 chromosomes. The number of chromosomes (n) in a human gamete is:



(A) 46

(B) 92

(C) 24

(D) 23

Q25. The main source of variation among the offspring of a species, which provides the raw material on which evolution acts, is:

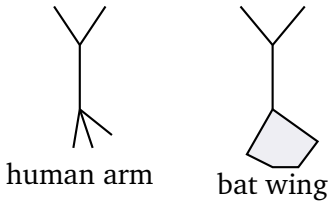
(A) sexual reproduction (and mutation)

(B) binary fission

(C) budding

(D) vegetative propagation

Q26. The limbs shown below (the human arm and the wing of a bat) have the same basic internal bone arrangement but perform different functions. Such organs, which point to a common ancestor, are called:



(A) analogous organs

(B) homologous organs

(C) vestigial organs

(D) vital organs

Q27. The antibodies that defend the body against invading germs (antigens) are produced by a particular type of white blood cell called:

(A) red blood cells

(B) platelets

(C) lymphocytes

(D) nerve cells

Q28. Kwashiorkor, a deficiency disease seen in children with a swollen belly and stunted growth, is caused by a lack of which nutrient in the diet?

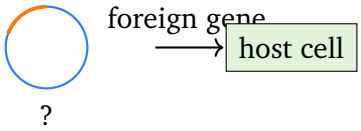
(A) vitamin C

(B) iron

(C) iodine

(D) protein

Q29. In the gene-cloning scheme below, the circular DNA molecule that carries the foreign gene into the host bacterial cell is marked with the question mark. This DNA molecule is called a:



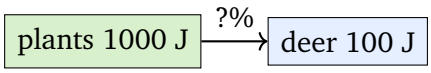
(A) vector

(B) enzyme

(C) ribosome

(D) antibody

Q30. In the energy flow shown below, the percentage of energy that is passed on from one trophic level to the next in a food chain (the ten per cent law) is about:



(A) 1 percent

(B) 50 percent

(C) 10 percent

(D) 90 percent

Detailed Solutions

Q1.

Solution

Concept — The mature mammalian red blood cell: Red blood cells (erythrocytes) carry oxygen using the pigment haemoglobin. In mammals, the cell loses its nucleus as it matures. This unusual feature makes more room for haemoglobin and gives the cell its biconcave disc shape, increasing the surface area for gas exchange.

Step 1 — Read the figure: cell X is a small biconcave disc with no central nucleus, while cell Y (WBC) has a clear stained nucleus.

Step 2 — Identify the unusual feature: the absence of a nucleus in the mature mammalian RBC is what sets it apart from almost every other body cell.

Why each other option is wrong:

- (B) The RBC does have a cell membrane; only the nucleus is lost.
- (C) Having many nuclei is not a feature of RBCs; some other cells (like striated muscle) are multinucleate.
- (D) The RBC is actually one of the smaller blood cells; white blood cells are larger.

Key point: Mature mammalian RBCs lack a nucleus (and most organelles); this maximises haemoglobin content but limits their lifespan to about 120 days.

Final Answer: Lacks a nucleus $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q1

Q2.

Solution

Concept — The nuclear envelope: The nucleus is bounded by a double membrane known as the nuclear membrane or nuclear envelope. It has tiny pores (nuclear pores) through which materials such as RNA pass between the nucleus and the cytoplasm, keeping the genetic material separate yet in communication with the rest of the cell.

Step 1 — Identify the description: a double, porous membrane around the nucleus.

Step 2 — Name it: this is the nuclear membrane (nuclear envelope).

Why each other option is wrong:

- (A) The plasma membrane is the single outer boundary of the whole cell, not of the nucleus.
- (C) The cell wall is a rigid non-living layer outside plant, fungal, and bacterial cells.
- (D) The tonoplast is the membrane surrounding the plant vacuole, not the nucleus.

Key point: The nuclear envelope is a *double* membrane with pores; it encloses the DNA and is continuous with the endoplasmic reticulum.

Final Answer: Nuclear membrane $\Rightarrow$ B

Answer: (B) Go Back to Q2

Q3.

Solution

Concept — Leucoplasts: Plastids are plant organelles that come in three main types. Leucoplasts are colourless plastids that store food. The type that stores starch (amyloplasts) is abundant in underground storage organs such as potato tubers and the roots of many plants.

Step 1 — Identify the function: colourless plastids that store starch.

Step 2 — Name them: these are leucoplasts.

Why each other option is wrong:

- (A) Chloroplasts are green plastids that carry out photosynthesis, found in leaves.
- (B) Chromoplasts are coloured plastids (red, orange, yellow) that give colour to fruits and flowers.
- (D) Mitochondria are not plastids at all; they carry out respiration.

Key point: Three plastids: chloroplast (green, photosynthesis), chromoplast (coloured, fruits/flowers), leucoplast (colourless, storage). Starch storage = leucoplast.

Final Answer: Leucoplasts $\Rightarrow$ C

Answer: (C) Go Back to Q3

Q4.

Solution

Concept — Proteins as polymers of amino acids: Proteins are large molecules made by linking many amino acids together with peptide bonds. They make up enzymes, muscle fibres, antibodies, and much of the cell's structure, so by mass they are the most abundant organic polymer in living cells.

Step 1 — Read the clue: the polymer is built from amino acid units.

Step 2 — Name it: a polymer of amino acids is a protein.

Why each other option is wrong:

- (A) Starch is a storage carbohydrate made of glucose units, not amino acids.
- (B) Cellulose is a structural carbohydrate (in plant cell walls) made of glucose, not amino acids.
- (C) Glycogen is the animal storage carbohydrate, again a polymer of glucose.

Key point: Amino acids $\rightarrow$ proteins. Proteins are the most abundant organic molecules in cells; carbohydrates (starch, cellulose, glycogen) are polymers of glucose, not amino acids.

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

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Enzymes and activation energy: Every chemical reaction needs a minimum amount of energy to start, called the activation energy. Enzymes are biological catalysts that provide an alternative pathway with a *lower* activation energy, so the reaction proceeds much faster. The enzyme itself is not used up and can be re-used.

Step 1 — Read the graph: the dashed (enzyme) curve has a lower peak than the solid (no-enzyme) curve.

Step 2 — Interpret it: a lower peak means a smaller activation-energy barrier, so the enzyme lowers the activation energy.

Why each other option is wrong:

- (B) Raising the activation energy would slow the reaction, the opposite of what enzymes do.

- (C) Enzymes do not change the energy of the products; the start and end energy levels are the same on both curves.
- (D) Enzymes are not consumed; they are released unchanged and used again.

Key point: Enzymes speed reactions by lowering the activation energy; they do not alter the overall energy change or get used up.

Final Answer: Lower the activation energy $\Rightarrow$ A

Answer: (A) Go Back to Q5

Q6.

Solution

Concept — The notochord and phylum Chordata: A notochord is a long, flexible rod of supporting tissue that runs along the back of the body, just below the nerve cord, at some stage of life. Its presence is one of the defining features of the phylum Chordata, which includes fishes, amphibians, reptiles, birds, and mammals.

Step 1 — Read the figure: the shaded rod lies below the nerve cord along the back; this is the notochord.

Step 2 — Match the phylum: an animal with a notochord belongs to the phylum Chordata.

Why each other option is wrong:

- (A) Arthropoda (insects, crabs) have a jointed exoskeleton and no notochord.
- (C) Mollusca (snails, octopus) have a soft body, often with a shell, and no notochord.
- (D) Annelida (earthworms) have a segmented body but no notochord.

Key point: Notochord, a dorsal nerve cord, and pharyngeal gill slits are the hallmark features of Chordata. The notochord is the defining one.

Final Answer: Chordata $\Rightarrow$ B

Answer: (B) Go Back to Q6

Q7.

Solution

Concept — Class Reptilia: Reptiles such as lizards, snakes, and crocodiles have dry skin covered with horny scales that prevents water loss, allowing them to live on land. They are cold-blooded (ectothermic), meaning their body temperature changes with the surroundings.

Step 1 — List the clues: dry scaly skin and cold-blooded.

Step 2 — Match the class: both features point to the class Reptilia.

Why each other option is wrong:

- (A) Mammals are warm-blooded and have skin with hair and sweat glands.
- (B) Aves (birds) are warm-blooded and have feathers, not dry scales over the body.
- (D) Amphibians have moist, slimy skin used in breathing and are cold-blooded but not scaly.

Key point: Dry, scaly skin + cold-blooded = reptiles. Warm-blooded animals are only birds and mammals.

Final Answer: Reptilia $\Rightarrow$ C

Answer: (C) Go Back to Q7

Q8.

Solution

Concept — Stomata: The surface of a leaf has many tiny pores called stomata (singular: stoma). Each stoma is bordered by two bean-shaped guard cells that open and close it. Gases such as carbon dioxide and oxygen move in and out of the leaf mainly through these stomata, and water vapour also escapes here during transpiration.

Step 1 — Read the figure: a small pore flanked by two guard cells is a stoma.

Step 2 — Match the function: gases enter and leave the leaf mainly through the stomata.

Why each other option is wrong:

- (A) Lenticels allow gas exchange through woody stems, not the main route in a leaf.

- (B) Root hairs absorb water and minerals from the soil; they are not gas pores.
- (C) Veins transport water and food within the leaf but do not exchange gases with the air.

Key point: Stomata are guarded leaf pores for gas exchange and transpiration; guard cells control their opening and closing.

Final Answer: Stoma (stomata) $\Rightarrow$ D

Answer: (D) Go Back to Q8

Q9.

Solution

Concept — The cuticle: The outer surface of leaves and young stems is covered by a thin, waxy, waterproof layer called the cuticle. It is secreted by the epidermal cells and greatly reduces the loss of water by evaporation, helping the plant conserve water.

Step 1 — Read the figure: the thin waxy layer coating the upper epidermis is the cuticle.

Step 2 — Match the function: a waterproof layer that cuts down water loss is the cuticle.

Why each other option is wrong:

- (B) The cortex is a layer of ground tissue inside the stem or root, not a surface wax.
- (C) The pith is the central storage tissue of a stem, not a protective coating.
- (D) The phloem is a transport tissue that carries food (sugars), not a waterproof layer.

Key point: The cuticle is a waxy waterproof coat over the epidermis that reduces transpiration; it is thicker in plants of dry habitats.

Final Answer: Cuticle $\Rightarrow$ A

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Cytokinins: Cytokinins are plant hormones that mainly promote cell division (cytokinesis) in growing regions. They also help delay the ageing of leaves, promote the growth of side shoots, and work together with auxins to control growth.

Step 1 — Identify the role: the hormone that promotes cell division and delays leaf senescence.

Step 2 — Name it: cytokinin.

Why each other option is wrong:

- (A) Abscisic acid is a growth inhibitor; it promotes dormancy and closes stomata under stress.
- (C) Ethylene is a gaseous hormone that mainly ripens fruits and promotes ageing.
- (D) Gibberellin mainly promotes stem elongation and seed germination, not chiefly cell division.

Key point: Cytokinin = cell division; auxin = cell elongation/apical dominance; gibberellin = stem growth; ABA = inhibition; ethylene = ripening.

Final Answer: Cytokinin $\Rightarrow$ B

Answer: (B) Go Back to Q10

Q11.

Solution

Concept — The oesophagus: The oesophagus (food pipe) is a long muscular tube that connects the pharynx (throat) to the stomach. It pushes swallowed food downward by waves of muscular contraction called peristalsis. No digestion of food takes place in the oesophagus; it only transports food.

Step 1 — Read the figure: the tube between mouth/pharynx and the stomach is marked with the question mark.

Step 2 — Name it: the tube carrying food from the pharynx to the stomach is the oesophagus.

Why each other option is wrong:

- (A) The trachea (windpipe) carries air to the lungs, not food.

- (B) The small intestine comes *after* the stomach and is where most digestion and absorption occur.
- (D) The larynx is the voice box at the top of the trachea, part of the air passage.

Key point: Order of the food path: mouth → pharynx → oesophagus → stomach → small intestine → large intestine. Peristalsis moves food along.

Final Answer: Oesophagus ⇒ C

Answer: (C) Go Back to Q11

Q12.

Solution

Concept — Hydrochloric acid in the stomach: The gastric glands of the stomach secrete hydrochloric acid (HCl). It makes the stomach contents strongly acidic, which kills most bacteria swallowed with food and converts the inactive enzyme pepsinogen into its active form, pepsin, so that protein digestion can begin.

Step 1 — Identify the two jobs: kills bacteria and activates pepsin.

Step 2 — Name the substance: only hydrochloric acid does both in the stomach.

Why each other option is wrong:

- (A) Bile is made by the liver and helps emulsify fats in the small intestine; it is not made in the stomach.
- (B) Mucus protects the stomach lining from the acid; it does not kill bacteria or activate pepsin.
- (C) Sodium bicarbonate is alkaline and is released in the small intestine to neutralise acid, the opposite role.

Key point: Stomach HCl gives a low pH that both sterilises food and activates pepsinogen → pepsin; mucus shields the stomach wall from this acid.

Final Answer: Hydrochloric acid ⇒ D

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Pancreatic juice: The pancreas secretes pancreatic juice into the small intestine. This juice contains a full set of digestive enzymes: amylase (acts on carbohydrates), trypsin (acts on proteins), and lipase (acts on fats), making it one of the most complete digestive juices in the body.

Step 1 — Identify the source: the juice secreted by the pancreas.

Step 2 — Name it: this is the pancreatic juice.

Why each other option is wrong:

- (A) Gastric juice is secreted by the stomach, not the pancreas.
- (B) Bile juice is made by the liver and acts only on fats (emulsification); it has no enzymes.
- (D) Saliva is secreted by the salivary glands in the mouth.

Key point: Pancreatic juice contains amylase, trypsin, and lipase, so it acts on all three food types in the small intestine.

Final Answer: Pancreatic juice $\Rightarrow$ C

Answer: (C) Go Back to Q13

Q14.

Solution

Concept — Normal resting heart rate: In a healthy resting adult, the heart beats about 70 to 75 times per minute, taken as roughly 72 beats per minute. Each beat pumps blood around the body. The rate rises during exercise or excitement and falls during rest or sleep.

Step 1 — Recall the value: the average resting adult heart rate is about 72 beats per minute.

Step 2 — Choose the closest option: 72 beats per minute.

Why each other option is wrong:

- (A) 36 beats per minute is too low (bradycardia) for a normal resting adult.
- (C) 120 beats per minute is a fast rate seen during heavy exercise, not at rest.
- (D) 200 beats per minute is far above the normal range and would be abnormal at rest.

Key point: Normal resting adult heart rate $\approx$ 72 beats/min; it increases with exercise and is higher in children.

Final Answer: 72 beats per minute $\Rightarrow$ B

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — Pulmonary veins: In pulmonary circulation, blood is pumped from the heart to the lungs and back. The pulmonary *artery* carries deoxygenated blood from the heart to the lungs, where it picks up oxygen. The pulmonary *veins* then return this oxygenated blood from the lungs to the left atrium of the heart.

Step 1 — Read the figure: the arrow from the lungs back to the heart is marked with the question mark.

Step 2 — Name the vessel: the vessel carrying oxygenated blood from the lungs to the heart is the pulmonary veins.

Why each other option is wrong:

- (A) The pulmonary artery carries deoxygenated blood *to* the lungs, the opposite direction.
- (B) The vena cava brings deoxygenated blood from the body into the right atrium.
- (D) The aorta carries oxygenated blood from the heart to the rest of the body, not from the lungs.

Key point: Pulmonary veins are special: they are the only veins that carry oxygenated blood, returning it from the lungs to the heart.

Final Answer: Pulmonary veins $\Rightarrow$ C

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Dialysis: When the kidneys fail, waste products such as urea build up in the blood. Dialysis is an artificial process in which the patient's blood is passed through a machine (artificial kidney) where it is filtered across a selectively permeable membrane to remove these wastes, and the cleaned blood is returned to the body.

Step 1 — Identify the situation: an artificial method to filter blood when kidneys fail.

Step 2 — Name it: this procedure is dialysis.

Why each other option is wrong:

- (A) Transfusion is the transfer of whole blood from a donor; it does not filter wastes.
- (B) Transplantation is the surgical replacement of the kidney itself, a different treatment.
- (C) Osmosis is the movement of water across a membrane; it is a principle involved, not the named medical procedure.

Key point: Dialysis = artificial filtering of blood when kidneys fail, using a dialysing membrane to remove urea and excess salts.

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

Answer: (D) Go Back to Q16

Q17.

Solution

Concept — Sensory neurons: Nerve cells are of three types. Sensory (afferent) neurons carry impulses *from* receptors (in skin, eyes, ears, etc.) towards the central nervous system. Motor (efferent) neurons carry impulses *away* from the CNS to muscles or glands, and relay neurons link the two inside the CNS.

Step 1 — Read the figure: the neuron runs from the receptor towards the spinal cord (the CNS).

Step 2 — Match the type: a neuron carrying impulses from a receptor to the CNS is a sensory neuron.

Why each other option is wrong:

- (A) A motor neuron carries impulses away from the CNS to an effector (muscle/gland), the opposite direction.
- (B) A relay (inter) neuron lies within the CNS, connecting sensory and motor neurons.
- (D) A secretory cell releases substances; it is not a nerve cell that conducts impulses to the CNS.

Key point: Sensory = receptor → CNS; motor = CNS → effector; relay = within the CNS. Direction of the impulse identifies the type.

Final Answer: Sensory neuron ⇒ C

Answer: (C) Go Back to Q17

Q18.

Solution

Concept — The lens of the eye: The eye lens is a transparent, biconvex, flexible structure behind the pupil. It fine-tunes the bending of light so that the rays meet exactly on the retina, forming a sharp image. The lens changes its shape (accommodation) to focus on near and far objects.

Step 1 — Read the figure: the biconvex structure behind the front of the eye, bending the incoming rays towards the retina, is the lens.

Step 2 — Match the function: the part that focuses light onto the retina is the lens.

Why each other option is wrong:

- (A) The cornea is the transparent front layer; it does most of the initial bending but is not the adjustable focusing part shown.
- (B) The iris is the coloured ring that controls the size of the pupil; it does not focus light.
- (C) The pupil is the central hole through which light enters; it is an opening, not a focusing structure.

Key point: The lens focuses light onto the retina and changes shape for accommodation; a stiff or cloudy lens causes focusing defects (e.g. cataract).

Final Answer: Lens ⇒ D

Answer: (D) Go Back to Q18

Q19.

Solution

Concept — Oestrogen: Oestrogen is the main female sex hormone, secreted by the ovaries. It controls the development of female secondary sexual characters (such as breast development and the broadening of the hips) and, with progesterone, regulates the menstrual cycle.

Step 1 — Identify the gland and sex: the female sex hormone made by the ovary.

Step 2 — Name it: oestrogen.

Why each other option is wrong:

- (A) Testosterone is the *male* sex hormone, secreted by the testes.
- (B) Insulin is secreted by the pancreas and controls blood glucose, not sexual characters.
- (D) Adrenaline is the emergency hormone from the adrenal gland.

Key point: Ovary → oestrogen (and progesterone); testis → testosterone. Oestrogen drives female secondary sexual characters.

Final Answer: Oestrogen ⇒ C

Answer: (C) Go Back to Q19

Q20.

Solution

Concept — Implantation: After fertilization in the fallopian tube, the zygote divides repeatedly to form a ball of cells (embryo) as it moves to the uterus. There it sinks into and becomes fixed in the thick, blood-rich lining of the uterus. This embedding of the embryo in the uterine wall is called implantation, after which the placenta develops.

Step 1 — Identify the event: the embryo getting attached to the wall of the uterus.

Step 2 — Name it: this is implantation.

Why each other option is wrong:

- (A) Ovulation is the release of the egg from the ovary, which happens *before* fertilization.
- (B) Fertilization is the fusion of sperm and egg, which occurs earlier in the fallopian tube.

- (C) Gestation is the whole period of pregnancy, not the moment of attachment.

Key point: Sequence: ovulation → fertilization → implantation → gestation. Implantation is specifically the embryo fixing into the uterine wall.

Final Answer: Implantation ⇒ D

Answer: (D) Go Back to Q20

Q21.

Solution

Concept — Cotyledons in monocots: A cotyledon (seed leaf) is part of the embryo inside a seed and often stores food for the young plant. Flowering plants are divided into monocots and dicots by the number of cotyledons. Monocots, such as maize, wheat, and rice, have only *one* cotyledon in their seed.

Step 1 — Read the figure: the seed section shows a single cotyledon (marked 1).

Step 2 — State the number: a monocot seed has one cotyledon.

Why each other option is wrong:

- (B) Two cotyledons are found in dicots (e.g. gram, bean, pea), not monocots.
- (C) Three cotyledons are not a normal feature of flowering-plant seeds.
- (D) Many cotyledons occur in gymnosperms (e.g. pine), not in monocots.

Key point: Monocot = one cotyledon (and parallel leaf veins); dicot = two cotyledons (and net-like veins).

Final Answer: One ⇒ A

Answer: (A) Go Back to Q21

Q22.

Solution

Concept — Regeneration in Planaria: Regeneration is the re-growth of lost or damaged body parts. Planaria, a flatworm, is famous for this ability: if its body is cut into pieces, each piece can grow into a complete new worm. This is possible because its body has many unspecialised cells that can develop into any cell type.

Step 1 — Identify the ability asked: re-growing a whole animal from a cut piece.

Step 2 — Name the animal: Planaria shows this remarkable regeneration (so does the starfish).

Why each other option is wrong:

- (A) An earthworm can re-grow some segments but cannot form a whole new worm from a small piece the way Planaria can.
- (C) A housefly cannot regenerate lost body parts into a new individual.
- (D) A frog cannot regenerate a whole body from a cut piece (an adult cannot even regrow a limb).

Key point: Planaria (and Hydra, and starfish) are classic examples of regeneration, where a fragment can grow into a complete new organism.

Final Answer: Planaria $\Rightarrow$ B

Answer: (B) Go Back to Q22

Q23.

Solution

Concept — Diploid cells: Chromosomes carry the genes. A cell with two complete sets of chromosomes, one set inherited from each parent, is said to be diploid (2n). Most body (somatic) cells of humans and other animals are diploid; in humans $2n = 46$.

Step 1 — Read the clue: two complete sets of chromosomes.

Step 2 — Name the condition: this is described as diploid.

Why each other option is wrong:

- (A) Haploid (n) means a *single* set of chromosomes, as in gametes.
- (B) Monoploid also means one basic set, again not two sets.
- (D) Polyploid means *more* than two sets (three, four, or more), not exactly two.

Key point: Haploid (n) = one set (gametes); diploid (2n) = two sets (body cells); polyploid = more than two sets.

Final Answer: Diploid $\Rightarrow$ C

Answer: (C) Go Back to Q23

Q24.

Solution

Concept — Chromosome number in human gametes: Human body cells are diploid with 46 chromosomes (23 pairs). Gametes (sperm and egg) are produced by meiosis, which halves the number, so each gamete is haploid and carries 23 chromosomes. At fertilization, $23 + 23 = 46$ restores the diploid number in the zygote.

Step 1 — Read the figure: sperm (n) + egg (n) $\rightarrow$ zygote (46).

Step 2 — Solve for n: if $n + n = 46$, then $n = 23$. So each gamete has 23 chromosomes.

Why each other option is wrong:

- (A) 46 is the diploid number of a body cell or the zygote, not a single gamete.
- (B) 92 would be twice the body-cell number, far too many for a gamete.
- (C) 24 is not correct; the human haploid number is exactly 23.

Key point: Human gametes are haploid with 23 chromosomes; fertilization restores the diploid number 46. Meiosis halves the chromosome number.

Final Answer: 23 $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q24

Q25.

Solution

Concept — Variation and evolution: Variation means the differences among individuals of a species. Sexual reproduction shuffles the genes of two parents (and mutation adds new changes), producing offspring that all differ from one another. These variations are the raw material on which natural selection acts, so sexual reproduction is the main source of variation that drives evolution.

Step 1 — Identify what creates differences: mixing of genes from two parents plus mutation.

Step 2 — Name the source: sexual reproduction (along with mutation).

Why each other option is wrong:

- (B) Binary fission is asexual and produces genetically identical offspring, giving little variation.

- (C) Budding is also asexual; the new individual is a clone of the parent.
- (D) Vegetative propagation produces plants identical to the parent, so it adds almost no variation.

Key point: Sexual reproduction (gene recombination) and mutation create variation; asexual methods (fission, budding, vegetative propagation) make near-identical copies.

Final Answer: Sexual reproduction $\Rightarrow$ A

Answer: (A) Go Back to Q25

Q26.

Solution

Concept — Homologous organs: Homologous organs have the same basic internal structure and developmental origin but may perform different functions. The human arm and the bat's wing share the same bone plan (humerus, radius, ulna, and digits), even though one is used for grasping and the other for flying. Such organs indicate descent from a common ancestor.

Step 1 — Read the figure: arm and wing show the same bone arrangement but do different jobs.

Step 2 — Name the organs: same structure, different function = homologous organs.

Why each other option is wrong:

- (A) Analogous organs have the same *function* but different basic structure (e.g. a bird's wing and an insect's wing).
- (C) Vestigial organs are reduced, non-functional remnants (e.g. the appendix).
- (D) "Vital organs" simply means organs essential for life; it is not an evolutionary term.

Key point: Homologous = same structure, different function, common ancestry; analogous = same function, different structure. The arm and bat wing are homologous.

Final Answer: Homologous organs $\Rightarrow$ B

Answer: (B) Go Back to Q26

Q27.

Solution

Concept — Antibodies and lymphocytes: Antibodies are protective proteins that recognise and neutralise germs (antigens). They are made by a special kind of white blood cell called the lymphocyte (B-lymphocytes). This response is part of the body's immune system, which defends against infection.

Step 1 — Identify the cell type: the white blood cell that makes antibodies.

Step 2 — Name it: the lymphocyte.

Why each other option is wrong:

- (A) Red blood cells carry oxygen with haemoglobin; they have no nucleus and make no antibodies.
- (B) Platelets help in blood clotting, not in producing antibodies.
- (D) Nerve cells carry impulses; they have nothing to do with making antibodies.

Key point: Antibodies are produced by lymphocytes (a type of white blood cell); they are central to immunity against disease.

Final Answer: Lymphocytes $\Rightarrow$ C

Answer: (C) Go Back to Q27

Q28.

Solution

Concept — Kwashiorkor: Kwashiorkor is a deficiency disease caused by a serious lack of *protein* in the diet, even when total calorie intake may be enough. It is seen mainly in young children and shows a swollen belly (due to fluid retention), stunted growth, thin limbs, and changes in skin and hair.

Step 1 — Identify the missing nutrient: the disease is linked to a protein-poor diet.

Step 2 — Name it: kwashiorkor is caused by protein deficiency.

Why each other option is wrong:

- (A) Lack of vitamin C causes scurvy (bleeding gums), not kwashiorkor.
- (B) Lack of iron causes anaemia, not the swollen belly of kwashiorkor.
- (C) Lack of iodine causes goitre (swelling of the thyroid in the neck).

Key point: Kwashiorkor = protein deficiency (swollen belly, stunted growth); marasmus is caused by a lack of both protein and total calories.

Final Answer: Protein $\Rightarrow$ D

Answer: (D) Go Back to Q28

Q29.

Solution

Concept — Vectors in genetic engineering: In recombinant DNA technology, a desired (foreign) gene must be carried into a host cell. The DNA molecule that picks up this gene and ferries it into the host is called a vector. The commonest vectors are plasmids, small circular DNA molecules found in bacteria, which can replicate inside the host.

Step 1 — Read the figure: the circular DNA carrying the inserted foreign gene, entering the host cell, is the vector.

Step 2 — Name it: a DNA molecule that carries a foreign gene into a host is a vector.

Why each other option is wrong:

- (B) An enzyme (such as a restriction enzyme or ligase) cuts or joins DNA but does not itself carry the gene into the host.
- (C) A ribosome is the cell's protein-synthesis machinery, not a gene carrier.
- (D) An antibody is a defence protein of the immune system, unrelated to gene transfer.

Key point: Vector = the carrier DNA (usually a plasmid) that inserts a foreign gene into a host cell; restriction enzymes cut the DNA and ligase joins it.

Final Answer: Vector $\Rightarrow$ A

Answer: (A) Go Back to Q29

Q30.

Solution

Concept — The ten per cent law: As energy flows along a food chain, most of it is lost at each step as heat, in respiration, and in undigested matter. Only about 10% of the energy at one trophic level is passed on to the next level. This is Lindeman's ten per cent law, and it is why food chains rarely have more than four or five links.

Step 1 — Read the figure: plants hold 1000 J and the deer receives 100 J.

Step 2 — Work out the fraction: $\frac{100}{1000} \times 100 = 10\%$, so about 10% is transferred.

Why each other option is wrong:

- (A) 1% is far too little; the figure clearly shows 100 out of 1000 joules.
- (B) 50% would mean the deer receives 500 J, which is not the case.
- (D) 90% is roughly the amount *lost* at each level, not the amount passed on.

Key point: Only about 10% of energy moves to the next trophic level; the other 90% is lost mainly as heat. This limits the length of food chains.

Final Answer: 10 percent $\Rightarrow$ C

Answer: (C) Go Back to Q30

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	B	3	C	4	D	5	A
6	B	7	C	8	D	9	A	10	B
11	C	12	D	13	C	14	B	15	C
16	D	17	C	18	D	19	C	20	D
21	A	22	B	23	C	24	D	25	A
26	B	27	C	28	D	29	A	30	C