PGIMER BSc Nursing Biology

Sample Paper – 13

Duration: 23 Minutes **Maximum Marks: 25**

Instructions

- This paper contains **25** Multiple Choice Questions (Single Correct Answer), modelled on the Biology portion of the **PGIMER BSc Nursing** entrance exam.
- Each correct answer carries **+1 mark**. **0.25 mark** is deducted for every incorrect answer. Unattempted questions carry **0 marks**.
- Only **one** option is correct. Choose carefully.
- Syllabus level: **Class 11 and 12 (NCERT) Biology**.
- The exam is conducted as a computer-based test. Personal calculators, mobile phones, and other electronic gadgets are strictly prohibited.

Q1. Bile made by the liver is not always released at once. The organ that stores bile between meals and concentrates it by removing water is the:

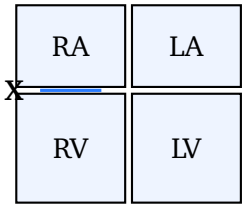
(A) Pancreas

(B) Spleen

(C) Gall bladder

(D) Appendix

Q2. The diagram shows a schematic of the human heart. The valve labelled **X**, which lies between the right atrium and the right ventricle and stops blood from flowing back, is the:



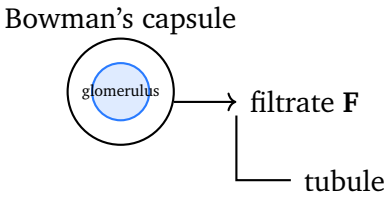
(A) Bicuspid (mitral) valve

(B) Tricuspid valve

(C) Semilunar valve

(D) Pulmonary valve

Q3. The diagram shows blood being filtered in the Bowman's capsule of a nephron. The fluid **F** formed here is almost the same as blood plasma, except that it normally lacks:



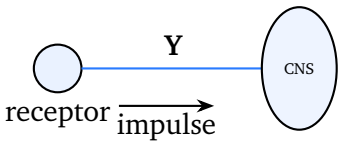
(A) Blood cells and large plasma proteins

(B) Glucose and amino acids

(C) Water and mineral salts

(D) Urea and uric acid

Q4. The diagram shows the pathway of a nerve impulse. The neuron labelled **Y**, which carries the impulse from a receptor in the sense organ towards the central nervous system, is the:



(A) Motor neuron

(B) Relay (interneuron)

(C) Efferent neuron

(D) Sensory (afferent) neuron

Q5. The maximum volume of air that a person can breathe out after taking the deepest possible breath in is called the:

(A) Tidal volume

(B) Vital capacity

(C) Residual volume

(D) Inspiratory reserve volume

Q6. Over-secretion of growth hormone in an adult, after the long bones have stopped growing, causes abnormal thickening of the hands, feet and jaw. This condition is called:

(A) Dwarfism

(B) Cretinism

(C) Acromegaly

(D) Goitre

Q7. In a person with the AB blood group, both antigen A and antigen B appear fully on the red blood cells. This pattern, in which both alleles express themselves equally, is called:

(A) Incomplete dominance

(B) Complete dominance

(C) Pleiotropy

(D) Co-dominance

Q8. In humans, whether a child is a boy or a girl is decided by the type of sex chromosome carried by the:

(A) Ovum of the mother

(B) Sperm of the father

(C) Body cells of the mother

(D) First polar body

Q9. On an mRNA molecule the codon AUG has a special role: it is read first and sets the reading frame while also coding for methionine. Because of this, AUG is known as the:

(A) Start (initiator) codon

(B) Stop (terminator) codon

(C) Nonsense codon

(D) Anticodon

Q10. The early embryos of a fish, a tortoise, a bird and a human look remarkably alike and all show pharyngeal (gill) slits. This similarity is used as proof of evolution and is called:

(A) Anatomical evidence

(B) Palaeontological evidence

(C) Embryological evidence

(D) Molecular evidence

Q11. The colourless plastids present in the underground storage parts of plants, such as potato tubers, which store starch, are the:

(A) Chloroplasts

(B) Chromoplasts

(C) Mitochondria

(D) Leucoplasts

Q12. The process by which a cell takes in large particles or fluid droplets by folding its plasma membrane inward to form a vesicle is called:

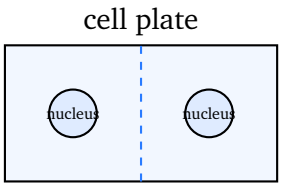
(A) Exocytosis

(B) Endocytosis

(C) Osmosis

(D) Diffusion

Q13. The figure shows the division of the cytoplasm in a plant cell, where a new cell plate forms at the centre and grows outward. In an animal cell the same result is instead achieved by a:



(A) Cleavage furrow that pinches the cell inward

(B) Cell plate that grows outward

(C) Spindle fibre laid down in the centre

(D) New cell wall built from outside inward

Q14. The natural, genetically programmed death of cells, such as the removal of the webbing between the fingers of a developing human embryo, is called:

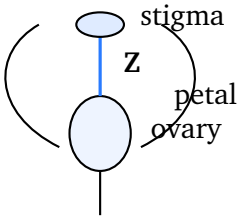
(A) Necrosis

(B) Mitosis

(C) Apoptosis

(D) Metastasis

Q15. The figure shows the female part of a flower. The slender stalk labelled **Z**, which connects the stigma at the top to the ovary at the base, is the:



(A) Filament

(B) Style

(C) Pedicel

(D) Funicle

Q16. Unlike the female, in whom a fixed number of eggs is set aside before birth, the human male produces sperms:

(A) Only once in a lifetime

(B) Only during a fixed breeding season

(C) Before birth in a fixed number

(D) Continuously from puberty onwards

Q17. In the human female, the paired organ that both produces the ova and secretes the female sex hormones oestrogen and progesterone is the:

(A) Ovary

(B) Uterus

(C) Fallopian tube

(D) Cervix

Q18. The light-dependent reactions of photosynthesis supply the Calvin cycle (dark reaction) with the two energy-rich molecules:

(A) Glucose and oxygen

(B) ATP and NADPH

(C) Carbon dioxide and water

(D) ADP and $NADP^{+}$

Q19. The only plant hormone that is a gas at ordinary temperature, and which promotes the ripening of fruits, is:

(A) Auxin

(B) Gibberellin

(C) Ethylene

(D) Cytokinin

Q20. The smallest known living cells, which completely lack a cell wall and can therefore change their shape, are the:

(A) Amoeba

(B) Bacteriophages

(C) Cyanobacteria

(D) Mycoplasma

Q21. The starfish belongs to a phylum of exclusively marine animals with a spiny skin and a unique water-vascular system of tube feet used for locomotion. This phylum is:

(A) Echinodermata

(B) Mollusca

(C) Arthropoda

(D) Coelenterata

Q22. The figure shows the energy available at each trophic level of a food chain. The steady fall in energy from one level to the next happens because:

(A) Energy is created at each higher level

(B) Energy stays constant at every level

(C) Most of the energy is lost as heat at each level

(D) Energy increases towards the top consumer

Q23. Unlike the carbon and nitrogen cycles, the phosphorus cycle has almost no gaseous phase. This is because the main reservoir of phosphorus is:

(A) The atmosphere

(B) Rocks and sediments

(C) The oceans in the form of a gas

(D) Living plants only

Q24. The exaggerated response of the immune system to harmless substances such as pollen or dust, involving the release of histamine, is called:

(A) Auto-immunity

(B) Active immunity

(C) Inflammation

(D) Allergy

Q25. The hepatitis-B vaccine is made by inserting the gene for the viral surface antigen into yeast cells, which then produce the pure antigen. Such a vaccine, made using genetic engineering, is called a:

(A) Recombinant vaccine

(B) Attenuated live vaccine

(C) Killed whole-organism vaccine

(D) Toxoid vaccine

Detailed Solutions

Q1.

Solution

Concept — Storage of bile: Bile is a greenish digestive juice made continuously by the liver, but it is needed only when fatty food reaches the intestine.

Step 1 — Where bile is stored: Between meals the bile is diverted into a small sac attached to the under-surface of the liver, called the gall bladder.

Step 2 — What the gall bladder does: The gall bladder stores the bile and concentrates it by absorbing water from it; when fatty food enters the duodenum, it releases this bile through the bile duct.

Why other options are wrong:

- Option A (Pancreas): makes pancreatic juice and the hormone insulin, but does not store bile.
- Option B (Spleen): breaks down old red blood cells and stores blood; it has no role in bile.
- Option D (Appendix): a small vestigial part of the large intestine, not involved in bile at all.

Final Answer: The organ that stores and concentrates bile is the gall bladder $\Rightarrow$ C

Answer: (C) Go Back to Q1

Q2.

Solution

Concept — Heart valves: The valves between the atria and the ventricles (the atrioventricular valves) make sure blood flows in one direction only.

Step 1 — Locate valve X: In the diagram, valve **X** lies on the right side, between the right atrium (RA) and the right ventricle (RV).

Step 2 — Name it: The right atrioventricular valve has three flaps or cusps, so it is called the tricuspid valve. It closes when the right ventricle contracts, stopping blood from flowing back into the right atrium.

Why other options are wrong:

- Option A (Bicuspid/mitral valve): has two cusps and lies on the left side,

between the left atrium and the left ventricle.
- Option C (Semilunar valve): guards the exit of a ventricle into an artery, not the opening between an atrium and a ventricle.
- Option D (Pulmonary valve): a semilunar valve at the base of the pulmonary artery, again an exit valve.

Final Answer: The valve between the right atrium and right ventricle is the tricuspid valve $\Rightarrow$ B

Answer: (B) Go Back to Q2

Q3.

Solution

Concept — Glomerular filtration: Blood entering the glomerulus is filtered under high pressure into the Bowman's capsule, and the fluid formed is called the glomerular filtrate.

Step 1 — What passes through the filter: The filtration barrier lets water, glucose, amino acids, mineral salts, urea and other small molecules pass out of the blood into the capsule.

Step 2 — What is held back: The pores of the barrier are too small for blood cells and large plasma proteins such as albumin, so these stay behind in the blood. The filtrate **F** is therefore just like plasma but without blood cells and large proteins.

Why other options are wrong:

- Option B (Glucose and amino acids): these small molecules do enter the filtrate and are only reabsorbed later in the tubule.
- Option C (Water and mineral salts): these are freely filtered into the capsule.
- Option D (Urea and uric acid): small waste molecules that readily pass into the filtrate.

Final Answer: The glomerular filtrate normally lacks blood cells and large plasma proteins $\Rightarrow$ A

Answer: (A) Go Back to Q3

Q4.

Solution

Concept — Types of neurons: Neurons are named by the direction in which they carry impulses in relation to the central nervous system (CNS).

Step 1 — Read the diagram: Neuron **Y** starts at a receptor in the sense organ and runs towards the CNS, and the impulse arrow points in the same direction.

Step 2 — Name it: A neuron that carries an impulse from a receptor towards the CNS is a sensory neuron, also called an afferent neuron (afferent means "carrying towards").

Why other options are wrong:

- Option A (Motor neuron): carries impulses away from the CNS to muscles or glands, the opposite direction.
- Option B (Relay/interneuron): lies entirely within the CNS and connects other neurons.
- Option C (Efferent neuron): another name for a motor neuron, again carrying impulses outward from the CNS.

Final Answer: The neuron carrying the impulse from the receptor to the CNS is the sensory (afferent) neuron $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Respiratory volumes and capacities: The air moved in and out of the lungs is measured as several volumes, and some of these add up to form capacities.

Step 1 — Define the quantity: Vital capacity is the maximum volume of air a person can breathe out after taking the deepest possible breath in.

Step 2 — Express it: It is the sum of the tidal volume, the inspiratory reserve volume and the expiratory reserve volume, and it shows how much usable air the lungs can handle.

Why other options are wrong:

- Option A (Tidal volume): only the small amount of air exchanged during a normal, quiet breath.
- Option C (Residual volume): the air that always stays in the lungs and can

never be breathed out.
- Option D (Inspiratory reserve volume): only the extra air taken in by a forced breath, which is just one part of the vital capacity.

Final Answer: The maximum air exhaled after the deepest inspiration is the vital capacity $\Rightarrow$ B

Answer: (B) Go Back to Q5

Q6.

Solution

Concept — Disorders of growth hormone: Growth hormone (GH) from the anterior pituitary controls body growth, and its over- or under-secretion causes distinct disorders.

Step 1 — Timing matters: When GH is over-secreted in an adult, the long bones have already fused at their ends and can no longer grow in length.

Step 2 — The result: So instead of increasing height, the excess GH thickens and enlarges the small bones of the hands, feet and jaw. This condition is called acromegaly.

Why other options are wrong:

- Option A (Dwarfism): caused by a deficiency of GH in childhood, giving very short stature.
- Option B (Cretinism): caused by a deficiency of thyroid hormone in children, with stunted growth and mental effects.
- Option D (Goitre): an enlargement of the thyroid gland, usually due to lack of iodine.

Final Answer: Excess growth hormone in an adult causes acromegaly $\Rightarrow$ C

Answer: (C) Go Back to Q6

Q7.

Solution

Concept — Ways in which alleles interact: When two different alleles are present together, they may interact in several ways to decide the character shown.

Step 1 — Look at the AB blood group: A person of blood group AB has the genotype I^AI^B and makes both antigen A and antigen B on the red blood cells.

Step 2 — Name the pattern: Because both alleles are expressed fully and equally in the same individual, with neither masking the other, this pattern is called co-dominance.

Why other options are wrong:

- Option A (Incomplete dominance): the heterozygote shows a blended, intermediate character, such as pink flowers from red and white; here neither antigen is blended.
- Option B (Complete dominance): only the dominant allele is expressed and the recessive one is hidden, which is not the case here.
- Option C (Pleiotropy): a single gene affecting many different traits, which is a different idea altogether.

Final Answer: Both alleles expressed fully in the AB group is co-dominance $\Rightarrow$ D

Answer: (D) Go Back to Q7

Q8.

Solution

Concept — Sex determination in humans: Humans have 22 pairs of autosomes and one pair of sex chromosomes, which are XX in the female and XY in the male.

Step 1 — The gametes of each parent: The mother (XX) produces eggs that all carry an X chromosome. The father (XY) produces two kinds of sperm, half carrying an X and half carrying a Y.

Step 2 — Decide the sex: If an X-bearing sperm fertilises the egg, the child is XX, a girl; if a Y-bearing sperm does, the child is XY, a boy. So the sex is decided by the sperm of the father.

Why other options are wrong:

- Option A (Ovum of the mother): the egg always carries an X, so it cannot decide the sex either way.

- Option C (Body cells of the mother): ordinary body cells take no part in fertilisation.
- Option D (First polar body): a discarded product of egg formation that plays no role in fertilisation.

Final Answer: The child's sex is decided by the X- or Y-bearing sperm of the father $\Rightarrow$ B

Answer: (B) Go Back to Q8

Q9.

Solution

Concept — The genetic code: The bases on mRNA are read in groups of three, called codons; each codon stands for an amino acid or for a signal.

Step 1 — Role of AUG: The codon AUG is the first codon read during translation. It sets the reading frame and also codes for the amino acid methionine.

Step 2 — Name it: Because it marks the point where protein synthesis begins, AUG is called the start or initiator codon.

Why other options are wrong:

- Option B (Stop codon): the codons UAA, UAG and UGA end translation; AUG does not.
- Option C (Nonsense codon): another name for a stop codon, which codes for no amino acid.
- Option D (Anticodon): the triplet of bases found on tRNA, not on mRNA.

Final Answer: The AUG codon that begins protein synthesis is the start (initiator) codon $\Rightarrow$ A

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Evidences of evolution: Evolution is supported by several independent lines of proof, one of which comes from the study of embryos.

Step 1 — Compare the embryos: The early embryos of a fish, a tortoise, a bird and a human look very much alike, and all of them show pharyngeal (gill) slits at an early stage.

Step 2 — Interpret the finding: These shared embryonic features point to descent from a common ancestor, and this line of proof is called embryological evidence.

Why other options are wrong:

- Option A (Anatomical evidence): compares the adult body structures, such as homologous limbs, not embryos.
- Option B (Palaeontological evidence): is based on fossils preserved in rocks.
- Option D (Molecular evidence): is based on similarities in DNA and proteins between species.

Final Answer: Similar early embryos give embryological evidence for evolution $\Rightarrow$ C

Answer: (C) Go Back to Q10

Q11.

Solution

Concept — Types of plastids: Plant cells contain three kinds of plastids: green chloroplasts, coloured chromoplasts, and colourless leucoplasts.

Step 1 — Locate the colourless plastids: Leucoplasts are found in cells that are not exposed to light, such as the storage cells of roots and underground stems.

Step 2 — State their function: Leucoplasts store food materials; those that store starch, as in potato tubers, are specifically called amyloplasts.

Why other options are wrong:

- Option A (Chloroplasts): green plastids that carry out photosynthesis in the light.
- Option B (Chromoplasts): coloured plastids that give flowers and fruits their red, orange and yellow colours.
- Option C (Mitochondria): energy-releasing organelles, not plastids at all.

Final Answer: The colourless, starch-storing plastids are leucoplasts $\Rightarrow$ D

Answer: (D) Go Back to Q11

Q12.

Solution

Concept — Bulk transport across the membrane: Very large materials cannot cross the plasma membrane by simple diffusion, so the membrane itself moves to carry them.

Step 1 — Define the process: In endocytosis, the flexible plasma membrane folds inward around the material and then pinches off to form a vesicle inside the cell.

Step 2 — Note its forms: When solid particles are taken in it is called phagocytosis (cell eating); when fluid droplets are taken in it is called pinocytosis (cell drinking). Both are types of endocytosis.

Why other options are wrong:

- Option A (Exocytosis): the reverse process, in which materials are thrown out of the cell.
- Option C (Osmosis): only the movement of water across a membrane, not the bulk intake of material.
- Option D (Diffusion): the movement of individual molecules down a concentration gradient, without any folding of the membrane.

Final Answer: Bulk intake of material by inward folding of the membrane is endocytosis $\Rightarrow$ B

Answer: (B) Go Back to Q12

Q13.

Solution

Concept — Cytokinesis: After the nucleus divides, the cytoplasm itself divides to give two cells, and the way this happens differs between plant and animal cells.

Step 1 — In the plant cell: A plant cell has a rigid cell wall, so a new cell plate forms across the middle and grows outward until it reaches the existing wall, exactly as the figure shows.

Step 2 — In the animal cell: An animal cell has only a flexible membrane and no wall, so its surface pinches inward, forming a cleavage furrow that deepens until

the cell is divided into two.

Why other options are wrong:

- Option B (Cell plate growing outward): this is the plant method shown in the figure, not the animal one.
- Option C (Spindle fibre in the centre): the spindle separates the chromosomes; it does not divide the cytoplasm.
- Option D (New cell wall from outside inward): animal cells have no cell wall, and even the plant plate forms from the centre outward, so this is doubly wrong.

Final Answer: In an animal cell, cytokinesis occurs by an inward cleavage furrow $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q13

Q14.

Solution

Concept — Programmed cell death: Some cells are meant to die at fixed times as a normal, controlled part of the body's development.

Step 1 — Define the event: Apoptosis is the genetically programmed, orderly death of cells that the body no longer needs, without harming the neighbouring cells.

Step 2 — Give the example: The webbing between the fingers of a human embryo is removed by apoptosis, and this carving away frees the individual fingers.

Why other options are wrong:

- Option A (Necrosis): uncontrolled, accidental death of cells caused by injury or lack of blood supply, not a programmed process.
- Option B (Mitosis): the division of one cell into two, which is the opposite of cell death.
- Option D (Metastasis): the spread of cancer cells from one part of the body to another.

Final Answer: The programmed, orderly death of cells is apoptosis $\Rightarrow \boxed{C}$

Answer: (C) Go Back to Q14

Q15.

Solution

Concept — Parts of the gynoecium: The female part of a flower, the pistil, has three regions arranged from top to bottom: stigma, style and ovary.

Step 1 — Read the figure: The part labelled **Z** is the slender stalk lying between the stigma at the top and the ovary at the base.

Step 2 — Name it: This connecting stalk is the style. It holds the stigma up in the air and provides the path down which the pollen tube grows to reach the ovary.

Why other options are wrong:

- Option A (Filament): the stalk of the male stamen that bears the anther, not a part of the pistil.
- Option C (Pedicel): the stalk that attaches the whole flower to the stem.
- Option D (Funicle): the tiny stalk that attaches an ovule to the ovary wall, found inside the ovary.

Final Answer: The stalk joining the stigma to the ovary is the style $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q15

Q16.

Solution

Concept — Timing of gamete formation: Sperm and egg production follow very different schedules in the two sexes.

Step 1 — In the female: All the future eggs are set aside as immature cells before birth, and their number does not increase later in life.

Step 2 — In the male: Sperms are not made before birth. The testes begin to produce them only at puberty and then keep making them throughout adult life. So the male produces sperms continuously from puberty onwards.

Why other options are wrong:

- Option A (Only once in a lifetime): sperms are produced constantly, not just once.
- Option B (Only during a fixed breeding season): this is true of some seasonal animals, but not of humans.
- Option C (Before birth in a fixed number): this describes egg formation in the female, not sperm formation.

Final Answer: The human male makes sperms continuously from puberty onwards $\Rightarrow$ D

Answer: (D) Go Back to Q16

Q17.

Solution

Concept — The female gonad: The gonads produce the gametes and also secrete the sex hormones; in the female this organ is the ovary.

Step 1 — Its gamete-making role: The paired ovaries contain follicles inside which the ova (eggs) develop, and one ovum is released at ovulation in each cycle.

Step 2 — Its hormone role: The ovaries also secrete the female sex hormones oestrogen and progesterone, which control the menstrual cycle and the secondary sexual characters.

Why other options are wrong:

- Option B (Uterus): the muscular organ in which the embryo develops; it does not make eggs.
- Option C (Fallopian tube): carries the egg towards the uterus and is the usual site of fertilisation, but does not produce eggs.
- Option D (Cervix): the narrow neck of the uterus, with no gamete- or hormone-producing role.

Final Answer: The organ that makes ova and female hormones is the ovary $\Rightarrow$ A

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Two stages of photosynthesis: The light reaction traps energy, and the Calvin cycle (dark reaction) then uses that energy to build sugar.

Step 1 — Products of the light reaction: Using light energy, the light reaction splits water, releases oxygen, and stores energy in two molecules: ATP and NADPH.

Step 2 — Link to the Calvin cycle: The ATP and NADPH are passed on to the Calvin cycle, where their energy and hydrogen are used to fix carbon dioxide into

glucose.

Why other options are wrong:

- Option A (Glucose and oxygen): glucose is the final product of the dark reaction and oxygen is a by-product, so these are not the energy carriers handed over.
- Option C (Carbon dioxide and water): these are the raw materials of photosynthesis, not the products of the light reaction.
- Option D (ADP and $NADP^+$): these are the spent, low-energy forms that are returned to the light reaction, not what powers the Calvin cycle.

Final Answer: The light reaction supplies the Calvin cycle with ATP and NADPH $\Rightarrow$ B

Answer: (B) Go Back to Q18

Q19.

Solution

Concept — Plant hormones: Plant growth and responses are controlled by five main groups of hormones, each with typical effects.

Step 1 — The gaseous hormone: Ethylene is unique among plant hormones because it is a gas at ordinary temperatures.

Step 2 — Its main action: Ethylene promotes the ripening of fruits and the ageing and fall of leaves. This is why keeping one ripe fruit with unripe ones hastens their ripening.

Why other options are wrong:

- Option A (Auxin): promotes cell elongation and the bending of shoots towards light.
- Option B (Gibberellin): promotes stem elongation and the germination of seeds.
- Option D (Cytokinin): promotes cell division and delays the ageing of leaves.

Final Answer: The gaseous, fruit-ripening hormone is ethylene $\Rightarrow$ C

Answer: (C) Go Back to Q19

Q20.

Solution

Concept — The smallest cells: Among all living cells, one group stands out for being extremely small and simple in structure.

Step 1 — Identify them: Mycoplasmas are the smallest known living cells.

Step 2 — Their special feature: They completely lack a cell wall, so they have no fixed shape and can take up many forms. Unlike viruses, they can live and reproduce on their own.

Why other options are wrong:

- Option A (Amoeba): a much larger single-celled protist with a true nucleus and many organelles.
- Option B (Bacteriophages): these are viruses, which are not cells and cannot live independently.
- Option C (Cyanobacteria): photosynthetic bacteria that do possess a cell wall and are much larger.

Final Answer: The smallest cells, lacking a cell wall, are mycoplasma $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q20

Q21.

Solution

Concept — The phylum of the starfish: Animals are grouped into phyla by their body plan, and the starfish has a very distinctive one.

Step 1 — The key features: The starfish lives only in the sea and has a spiny skin; in fact the name Echinodermata means "spiny-skinned".

Step 2 — The unique system: It moves using a water-vascular system, a network of fluid-filled canals ending in tube feet, a feature found in no other phylum.

Why other options are wrong:

- Option B (Mollusca): soft-bodied animals with a muscular foot and often a shell, such as snails, and no water-vascular system.
- Option C (Arthropoda): animals with a jointed exoskeleton and jointed legs, such as insects and prawns.
- Option D (Coelenterata): simple aquatic animals with stinging cells, such as Hydra and jellyfish.

Final Answer: The spiny-skinned starfish with a water-vascular system belongs to Echinodermata ⇒ A

Answer: (A) Go Back to Q21

Q22.

Solution

Concept — Energy flow through trophic levels: Energy enters a food chain through the producers and passes up to each higher level, but never completely.

Step 1 — Read the figure: The energy values fall from 10000 kJ in the grass to 1000 kJ in the deer to 100 kJ in the tiger as we move up the chain.

Step 2 — Explain the fall: At every level most of the energy is used up in life processes and lost as heat during respiration, so only about a tenth is stored and passed on. This is why the energy steadily decreases at each higher level.

Why other options are wrong:

- Option A (Energy is created at each level): energy can never be created, it only transfers from one form or level to another.
- Option B (Energy stays constant): the figure clearly shows the energy falling, so this is wrong.
- Option D (Energy increases towards the top): the opposite is true; less energy is available at higher levels.

Final Answer: Energy falls at each level because most of it is lost as heat ⇒ C

Answer: (C) Go Back to Q22

Q23.

Solution

Concept — The phosphorus cycle: Nutrients cycle between the living and the non-living world, and phosphorus follows a mainly sedimentary path.

Step 1 — The main reservoir: The largest store of phosphorus is locked up in rocks and natural sediments in the form of phosphate.

Step 2 — Why there is no gaseous phase: Phosphorus does not form any common gas, so, unlike carbon and nitrogen, it has almost no atmospheric phase. It is released slowly by the weathering of rocks and eventually returns to the sediments.

Why other options are wrong:

- Option A (The atmosphere): holds carbon as carbon dioxide and nitrogen as N_2, but essentially no phosphorus.
- Option C (The oceans in the form of a gas): phosphorus in the sea is dissolved phosphate, not a gas.
- Option D (Living plants only): plants hold only a small, temporary fraction of the total phosphorus.

Final Answer: The phosphorus cycle lacks a gaseous phase because its reservoir is rocks and sediments $\Rightarrow$ B

Answer: (B) Go Back to Q23

Q24.

Solution

Concept — Hypersensitivity of the immune system: Sometimes the immune system over-reacts to substances that are actually harmless.

Step 1 — Define the response: An allergy is an exaggerated, hypersensitive immune reaction to harmless environmental substances such as pollen, dust or certain foods, which are called allergens.

Step 2 — The mechanism: On exposure to the allergen, certain cells release chemicals such as histamine, which cause sneezing, watering of the eyes, itching and other allergic symptoms.

Why other options are wrong:

- Option A (Auto-immunity): the immune system attacking the body's own cells, not a harmless outside substance.
- Option B (Active immunity): the useful production of antibodies after an infection or a vaccination.
- Option C (Inflammation): the general redness, heat and swelling seen after any injury or infection, not specifically an allergen reaction.

Final Answer: An over-reaction to harmless allergens with histamine release is an allergy $\Rightarrow$ D

Answer: (D) Go Back to Q24

Q25.

Solution

Concept — Modern vaccines: Genetic engineering allows vaccines to be made without using the whole disease-causing microbe.

Step 1 — How it is made: The gene for the hepatitis-B surface antigen is inserted into yeast cells, which then multiply and produce large amounts of the pure antigen.

Step 2 — Name the vaccine: A vaccine made in this way, using recombinant DNA technology, is called a recombinant vaccine. It is very safe because no live or whole virus is used.

Why other options are wrong:

- Option B (Attenuated live vaccine): uses a living but weakened microbe, as in the oral polio vaccine.
- Option C (Killed whole-organism vaccine): uses the whole microbe after it has been killed.
- Option D (Toxoid vaccine): uses an inactivated bacterial toxin, as in the tetanus vaccine, not an engineered antigen.

Final Answer: A vaccine made by inserting the antigen gene into yeast is a recombinant vaccine $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q25

Answer Key

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