

PGIMER BSc Nursing Biology

Sample Paper – 3

Duration: 23 Minutes

Maximum Marks: 25

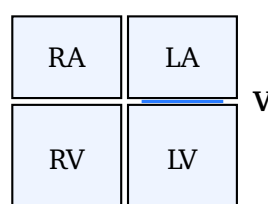
Instructions

- 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 juice, secreted by the liver and stored in the gall bladder, aids the digestion of fats in the small intestine mainly by:

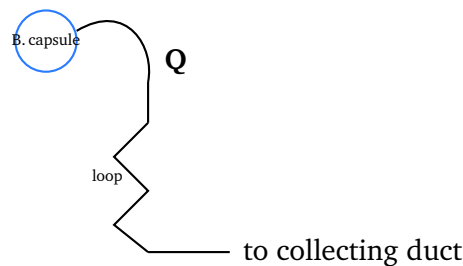
- (A) Chemically splitting fats into fatty acids and glycerol
- (B) Emulsifying large fat globules into tiny droplets
- (C) Directly absorbing the digested fat molecules
- (D) Supplying the enzyme lipase that digests fat

Q2. The diagram shows a schematic of the human heart. The valve labelled **V**, which lies between the left atrium and the left ventricle, is the:



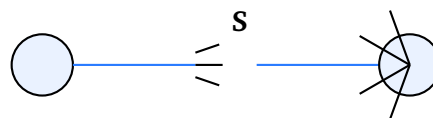
- (A) Bicuspid (mitral) valve
- (B) Tricuspid valve
- (C) Pulmonary semilunar valve
- (D) Aortic semilunar valve

Q3. The diagram shows a nephron. The coiled segment labelled **Q**, which lies just after Bowman's capsule and reabsorbs all of the glucose and most of the ions and water, is the:



- (A) Loop of Henle
- (B) Glomerulus
- (C) Collecting duct
- (D) Proximal convoluted tubule (PCT)

Q4. The diagram shows the junction between two neurons. The narrow gap labelled **S**, across which the impulse is carried by chemical neurotransmitters, is the:



- (A) Node of Ranvier
- (B) Axon terminal
- (C) Synapse
- (D) Dendrite

Q5. During inhalation (inspiration) in humans, the diaphragm:



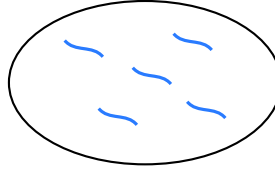
- (A) Contracts and flattens, increasing the volume of the thoracic cavity
- (B) Relaxes and becomes dome-shaped, decreasing the thoracic volume
- (C) Stays completely still while only the ribs move down
- (D) Contracts and arches further upward into the chest
- Q6.** The hormone secreted by the adrenal medulla that prepares the body for an emergency (the “fight or flight” response) by raising the heart rate and blood sugar is:
- (A) Insulin
- (B) Thyroxine
- (C) Cortisol
- (D) Adrenaline
- Q7.** When a pure tall pea plant (TT) is crossed with a pure dwarf plant (tt), every plant of the F₁ generation is tall, because the tall allele masks the effect of the dwarf allele. This is explained by Mendel’s:
- (A) Law of segregation
- (B) Law of independent assortment
- (C) Law of dominance
- (D) Law of incomplete dominance
- Q8.** The ABO blood group system in humans is controlled by three different alleles (I^A , I^B and i) of a single gene, although any one person carries only two of them. This is a clear example of:
- (A) Multiple alleles
- (B) Incomplete dominance
- (C) Polygenic inheritance
- (D) Sex-linked inheritance



- Q9.** The pentose (five-carbon) sugar that forms part of the backbone of a DNA molecule is:
- (A) Ribose
 - (B) Deoxyribose
 - (C) Glucose
 - (D) Sucrose
- Q10.** The vermiform appendix and the reduced ear muscles in humans are structures that have lost their original function during the course of evolution. Such organs are called:
- (A) Homologous organs
 - (B) Analogous organs
 - (C) Connecting links
 - (D) Vestigial organs
- Q11.** The green, double-membraned organelle found only in plant cells, which contains the pigment chlorophyll and is the site of photosynthesis, is the:
- (A) Mitochondrion
 - (B) Ribosome
 - (C) Chloroplast
 - (D) Vacuole
- Q12.** The net movement of the molecules of a substance from a region of its higher concentration to a region of its lower concentration, without the use of energy, is called:
- (A) Active transport
 - (B) Simple diffusion
 - (C) Osmosis
 - (D) Endocytosis



Q13. The figure shows a dividing cell in which the chromosomes have condensed and become clearly visible and the spindle fibres are beginning to form, but the chromosomes have *not* yet lined up at the equator. This stage of mitosis is:



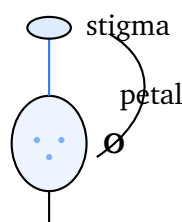
chromosomes condensed, scattered

- (A) Prophase
- (B) Metaphase
- (C) Anaphase
- (D) Telophase

Q14. The part of interphase during which DNA replication (synthesis) takes place, so that the DNA content of the cell is doubled before division, is the:

- (A) G₁ phase
- (B) G₂ phase
- (C) M phase
- (D) S phase

Q15. The figure shows a longitudinal section of a flower. The swollen basal part labelled **O**, which encloses the ovules, is the:



- (A) Stigma
- (B) Style



- (C) Ovary
- (D) Anther

- Q16.** A human sperm is divided into a head, a middle piece and a tail. The middle piece is packed with numerous mitochondria because it:
- (A) Stores the genetic material (DNA) of the sperm
 - (B) Provides the energy needed for the movement of the tail
 - (C) Contains the enzymes that help the sperm penetrate the egg
 - (D) Keeps the sperm afloat in the seminal fluid
- Q17.** After ovulation, the ruptured follicle in the ovary changes into the corpus luteum, which secretes a hormone that maintains the thickened uterine lining (endometrium) in readiness for pregnancy. This hormone is:
- (A) Estrogen
 - (B) Luteinising hormone (LH)
 - (C) Follicle-stimulating hormone (FSH)
 - (D) Progesterone
- Q18.** The green pigment present in the chloroplasts of leaves, which absorbs light energy and makes photosynthesis possible, is:
- (A) Chlorophyll
 - (B) Haemoglobin
 - (C) Anthocyanin
 - (D) Melanin
- Q19.** In a flowering plant, the vascular tissue that transports the food (sugars) prepared in the leaves to all the other parts of the plant is the:
- (A) Xylem
 - (B) Cambium



- (C) Phloem
- (D) Epidermis

Q20. Members of the kingdom Fungi are heterotrophic eukaryotes whose cell walls are made mainly of:

- (A) Chitin
- (B) Cellulose
- (C) Peptidoglycan (murein)
- (D) Lignin

Q21. Plants such as pine and cycas are placed in the group Gymnosperms because their seeds are:

- (A) Enclosed within a ripened fruit
- (B) Absent, as they reproduce only by spores
- (C) Enclosed within a brightly coloured flower
- (D) Naked, not enclosed within a fruit

Q22. The figure shows a simple food chain. The organism at position **P**, which makes its own food by photosynthesis and starts the chain, is the:

P → Grasshopper → Frog → Snake

- (A) Frog
- (B) Grass (a green plant)
- (C) Snake
- (D) Grasshopper

Q23. The bacterium *Rhizobium*, which lives in the root nodules of leguminous plants such as pea and gram, takes part in the nitrogen cycle by:

- (A) Fixing atmospheric nitrogen into nitrogen compounds usable by the plant



- (B) Converting nitrates in the soil back into atmospheric nitrogen
- (C) Oxidising ammonia into nitrites and then nitrates
- (D) Breaking down dead proteins into ammonia

Q24. Malaria is caused by the protozoan parasite *Plasmodium*, which is transmitted from one person to another by the bite of:

- (A) The female *Aedes* mosquito
- (B) The female *Anopheles* mosquito
- (C) The common housefly
- (D) The male *Culex* mosquito

Q25. In recombinant DNA technology, the small, circular, self-replicating DNA molecule found in bacteria that is widely used to carry a foreign gene into a host cell is the:

- (A) Ribosome
- (B) Bacterial chromosome
- (C) Plasmid
- (D) Restriction enzyme



Detailed Solutions

Q1.

Solution

Concept — Role of bile in fat digestion: Bile is a greenish fluid made by the liver and stored in the gall bladder. Although it contains no digestive enzymes, it plays a vital physical role in fat digestion.

Step 1 — Understand the problem with fats: Fats are insoluble in water and tend to collect into large globules, which offer a very small surface area for fat-digesting enzymes to act upon.

Step 2 — Identify the action of bile: The bile salts break these large fat globules into many tiny droplets, a process called emulsification. This greatly increases the surface area available for the enzyme lipase.

Why other options are wrong:

- Option A (Splits fats chemically): the chemical breakdown into fatty acids and glycerol is done by the enzyme lipase, not by bile.
- Option C (Absorbs fats): absorption occurs later through the villi of the small intestine, not by bile.
- Option D (Supplies lipase): bile contains no enzymes; lipase comes from the pancreas.

Final Answer: Bile aids fat digestion by emulsifying fats into tiny droplets ⇒

[Go Back to Q1](#)

Q2.

Solution

Concept — Valves of the human heart: Valves prevent the backflow of blood and are placed between the atria and ventricles (atrioventricular valves) and at the bases of the great arteries (semilunar valves).

Step 1 — Locate the valve V: The valve labelled V lies between the left atrium (LA) and the left ventricle (LV) on the left side of the heart.

Step 2 — Name the atrioventricular valve on the left: The left atrioventricular valve has two cusps (flaps), so it is called the bicuspid valve, also known as the mitral valve. It stops oxygenated blood from flowing back into the left atrium when the ventricle contracts.



Why other options are wrong:

- Option B (Tricuspid valve): lies on the right side, between the right atrium and right ventricle.
- Option C (Pulmonary semilunar valve): guards the opening of the pulmonary artery from the right ventricle.
- Option D (Aortic semilunar valve): guards the opening of the aorta, not the LA–LV junction.

Final Answer: The valve between the left atrium and left ventricle is the bicuspid (mitral) valve ⇒

[Go Back to Q2](#)

Q3.

Solution

Concept — Regions of a nephron: The nephron is the functional unit of the kidney. After filtration in Bowman's capsule, the filtrate passes through the proximal convoluted tubule, the loop of Henle, and the distal convoluted tubule before reaching the collecting duct.

Step 1 — Locate the labelled part Q: The part Q is the coiled tubule lying just after Bowman's capsule, before the U-shaped loop.

Step 2 — Recall its function: This is the proximal convoluted tubule (PCT). It reabsorbs all of the filtered glucose and amino acids, along with most of the ions and water, returning them to the blood in the surrounding capillaries.

Why other options are wrong:

- Option A (Loop of Henle): the U-shaped part that concentrates urine; it lies after the PCT.
- Option B (Glomerulus): the ball of capillaries inside Bowman's capsule where filtration occurs, not a tubule.
- Option C (Collecting duct): receives urine from many nephrons at the end of the pathway.

Final Answer: The tubule after Bowman's capsule that reabsorbs glucose and ions is the PCT ⇒

[Go Back to Q3](#)



Q4.

Solution

Concept — The synapse: A nerve impulse travelling along one neuron must be passed on to the next neuron. The neurons do not physically touch; there is a tiny gap between them.

Step 1 — Identify the gap S: The gap S lies between the axon terminal of one neuron and the dendrite of the next neuron.

Step 2 — Explain how the impulse crosses: This junction is called the synapse. When the impulse reaches the axon terminal, chemicals called neurotransmitters are released, diffuse across the gap, and start a new impulse in the next neuron.

Why other options are wrong:

- Option A (Node of Ranvier): a gap in the myelin sheath along a single axon, not a junction between two neurons.
- Option B (Axon terminal): the end of the axon that releases the neurotransmitter, not the gap itself.
- Option D (Dendrite): the branched part that receives the impulse, not the gap.

Final Answer: The gap between two neurons crossed by neurotransmitters is the synapse ⇒

Answer: (C) [Go Back to Q4](#)

Q5.

Solution

Concept — Mechanism of breathing: Breathing depends on changes in the volume of the thoracic (chest) cavity, brought about by the diaphragm and the rib muscles.

Step 1 — Recall the resting shape of the diaphragm: At rest, the diaphragm is a dome-shaped muscle arching upward into the chest.

Step 2 — Describe inhalation: During inhalation, the diaphragm contracts and flattens, moving downward. At the same time the ribs move up and out. Together these increase the volume of the thoracic cavity, lowering the pressure so that air rushes into the lungs.

Why other options are wrong:



- Option B (Relaxes and domes up): this describes exhalation, when the thoracic volume decreases.
- Option C (Stays still): the diaphragm is the chief muscle of breathing and does move.
- Option D (Contracts and arches upward): contraction flattens the diaphragm; it does not arch it further up.

Final Answer: During inhalation the diaphragm contracts and flattens, increasing thoracic volume ⇒

Answer: (A) [Go Back to Q5](#)

Q6.

Solution

Concept — Hormones of the adrenal gland: Each adrenal gland has an outer cortex and an inner medulla, and each part secretes different hormones.

Step 1 — Identify the medullary hormone: The adrenal medulla secretes adrenaline (epinephrine), often called the emergency hormone.

Step 2 — Recall its effects: In a stressful “fight or flight” situation, adrenaline speeds up the heartbeat, raises blood pressure, widens the airways, and increases blood glucose to supply quick energy.

Why other options are wrong:

- Option A (Insulin): from the pancreas; it lowers blood glucose, the opposite effect.
- Option B (Thyroxine): from the thyroid; it controls the general metabolic rate.
- Option C (Cortisol): from the adrenal cortex, not the medulla, and it manages long-term stress.

Final Answer: The emergency hormone from the adrenal medulla is adrenaline ⇒

Answer: (D) [Go Back to Q6](#)



Q7.

Solution

Concept — Mendel's law of dominance: When two contrasting factors (alleles) are present together in an organism, only one of them expresses its effect.

Step 1 — Analyse the cross: A pure tall plant (TT) crossed with a pure dwarf plant (tt) gives F_1 plants that are all Tt.

Step 2 — Interpret the result: Although each F_1 plant carries both T and t, all of them are tall. The tall allele (T) is dominant and masks the recessive dwarf allele (t). This is Mendel's law of dominance.

Why other options are wrong:

- Option A (Law of segregation): explains how the paired alleles separate during gamete formation, seen in the F_2 generation.
- Option B (Law of independent assortment): applies to two or more gene pairs in a dihybrid cross.
- Option D (Incomplete dominance): would give an F_1 of intermediate height, which does not happen here.

Final Answer: One allele masking the other in the F_1 illustrates the law of dominance \Rightarrow

Answer: (C) [Go Back to Q7](#)

Q8.

Solution

Concept — Multiple alleles: Usually a gene has two alleles, but sometimes a single gene exists in more than two allelic forms in a population. These are called multiple alleles.

Step 1 — Examine the ABO system: Human blood groups A, B, AB and O are governed by a single gene that has three alleles: I^A , I^B and i .

Step 2 — Apply the definition: Because three alleles of one gene exist in the population (though any individual has only two), the ABO system is a classic example of multiple alleles.

Why other options are wrong:

- Option B (Incomplete dominance): gives a blended intermediate phenotype, whereas I^A and I^B are fully expressed together.



- Option C (Polygenic inheritance): involves many genes controlling one trait, such as human skin colour.
- Option D (Sex-linked inheritance): involves genes on the sex chromosomes, but the ABO gene is autosomal.

Final Answer: Three alleles of one gene make ABO an example of multiple alleles
⇒

Answer: (A) [Go Back to Q8](#)

Q9.

Solution

Concept — Chemical make-up of nucleic acids: A nucleotide, the building block of a nucleic acid, is made of a nitrogenous base, a phosphate group and a pentose sugar. The type of sugar distinguishes DNA from RNA.

Step 1 — Recall the two nucleic acids: DNA (deoxyribonucleic acid) and RNA (ribonucleic acid) differ mainly in their sugar.

Step 2 — Identify the sugar in DNA: DNA contains the sugar deoxyribose, which has one less oxygen atom than the ribose sugar found in RNA.

Why other options are wrong:

- Option A (Ribose): is the sugar present in RNA, not DNA.
- Option C (Glucose): a six-carbon energy sugar; it is not part of nucleic acids.
- Option D (Sucrose): a disaccharide (table sugar) with no role in DNA structure.

Final Answer: The sugar in DNA is deoxyribose ⇒

Answer: (B) [Go Back to Q9](#)

Q10.

Solution

Concept — Vestigial organs: During evolution some organs that were once useful in an ancestor become reduced and lose their function in the descendants.

Step 1 — Examine the examples: The vermiform appendix and the reduced ear muscles in humans no longer perform any important function.

Step 2 — Apply the definition: Such reduced, functionless remnants of once-



useful organs are called vestigial organs, and they serve as evidence of evolution from ancestors in which those organs were well developed.

Why other options are wrong:

- Option A (Homologous organs): have the same basic structure but different functions, such as the forelimbs of a whale and a bat.
- Option B (Analogous organs): have different structures but the same function, such as the wings of a bird and an insect.
- Option C (Connecting links): are organisms (like *Archaeopteryx*) that share features of two groups, not reduced organs.

Final Answer: Reduced, functionless organs like the appendix are vestigial organs ⇒ D

Answer: (D) [Go Back to Q10](#)

Q11.

Solution

Concept — Plastids and photosynthesis: Plant cells contain plastids, and the green plastids are specialised for trapping light energy.

Step 1 — Identify the organelle: The green, double-membraned organelle containing chlorophyll is the chloroplast.

Step 2 — Explain its role: Chlorophyll in the chloroplast absorbs sunlight, and inside the chloroplast the light and dark reactions convert carbon dioxide and water into glucose. It is therefore the site of photosynthesis.

Why other options are wrong:

- Option A (Mitochondrion): the site of aerobic respiration and ATP release, not photosynthesis.
- Option B (Ribosome): the site of protein synthesis; it has no chlorophyll.
- Option D (Vacuole): a fluid-filled sac that stores cell sap and maintains turgidity.

Final Answer: The green organelle where photosynthesis occurs is the chloroplast ⇒ C

Answer: (C) [Go Back to Q11](#)



Q12.

Solution

Concept — Diffusion: Substances can move across membranes passively (down a gradient, no energy) or actively (against a gradient, using energy).

Step 1 — Read the description: The movement described is from a region of higher concentration to a region of lower concentration, and it uses no energy.

Step 2 — Name the process: This passive, downhill spreading of particles is called simple diffusion. It continues until the particles are evenly distributed.

Why other options are wrong:

- Option A (Active transport): moves substances against the gradient and needs ATP energy.
- Option C (Osmosis): is a special case of diffusion that applies only to water across a selectively permeable membrane, not to a substance in general.
- Option D (Endocytosis): the bulk intake of material by folding of the cell membrane, which does require energy.

Final Answer: Energy-free downhill movement of molecules is simple diffusion ⇒

[Go Back to Q12](#)

Q13.

Solution

Concept — Stages of mitosis: Mitosis passes through prophase, metaphase, anaphase and telophase, each marked by a distinct behaviour of the chromosomes.

Step 1 — Read the figure: The chromosomes have condensed and are clearly visible but are still scattered in the cell, and the spindle is only beginning to form.

Step 2 — Match the stage: Condensation of chromosomes and the start of spindle formation, before any alignment at the equator, is the defining feature of prophase, the first stage of mitosis.

Why other options are wrong:

- Option B (Metaphase): the chromosomes line up in a single row at the equator, which has not happened yet.
- Option C (Anaphase): the sister chromatids separate and move to opposite poles.



- Option D (Telophase): two new nuclear envelopes form around the chromosomes at the poles.

Final Answer: Condensed, scattered chromosomes with a forming spindle indicate prophase \Rightarrow

Answer: (A) [Go Back to Q13](#)

Q14.

Solution

Concept — Phases of the cell cycle: Interphase, the growth period before division, is divided into the G_1 , S and G_2 phases.

Step 1 — Recall what each phase does: G_1 is a growth phase, S is the synthesis phase, and G_2 is a second growth phase preparing for division.

Step 2 — Identify the DNA replication phase: DNA replication (synthesis), which doubles the DNA content so that each chromosome becomes two sister chromatids, takes place in the S phase.

Why other options are wrong:

- Option A (G_1 phase): the cell grows and makes proteins, but DNA is not yet copied.
- Option B (G_2 phase): the cell prepares for mitosis after the DNA has already been copied.
- Option C (M phase): the actual mitotic division of the nucleus and cell, not DNA synthesis.

Final Answer: DNA replication occurs during the S phase of interphase \Rightarrow

Answer: (D) [Go Back to Q14](#)

Q15.

Solution

Concept — The gynoecium of a flower: The female reproductive whorl of a flower, the gynoecium (pistil), is made of the stigma at the top, the style in the middle, and the ovary at the base.

Step 1 — Locate the labelled part O: The part O is the swollen structure at the base of the pistil that contains small bodies (the ovules).



Step 2 — Name it: The basal part that encloses and protects the ovules is the ovary. After fertilisation, the ovary grows into the fruit and the ovules become the seeds.

Why other options are wrong:

- Option A (Stigma): the sticky tip of the pistil that receives pollen, shown at the top.
- Option B (Style): the slender stalk connecting the stigma to the ovary, not the swollen base.
- Option D (Anther): the pollen-bearing part of the male stamen, not part of the female ovary.

Final Answer: The swollen basal part enclosing the ovules is the ovary ⇒

Answer: (C) [Go Back to Q15](#)

Q16.

Solution

Concept — Structure of a sperm: A mature sperm has three regions: a head carrying the nucleus, a middle piece, and a long whip-like tail (flagellum) used for swimming.

Step 1 — Note what the middle piece contains: The middle piece is densely packed with mitochondria.

Step 2 — Link structure to function: Mitochondria carry out respiration and release ATP energy. This energy powers the lashing movements of the tail, which propel the sperm towards the egg.

Why other options are wrong:

- Option A (Stores DNA): the genetic material is in the head (nucleus), not the middle piece.
- Option C (Contains penetrating enzymes): those enzymes are held in the acrosome at the tip of the head.
- Option D (Keeps sperm afloat): the sperm swims actively; it does not simply float.

Final Answer: The mitochondria of the middle piece supply energy for the tail's movement ⇒

Answer: (B) [Go Back to Q16](#)



Q17.

Solution

Concept — The corpus luteum and pregnancy: After an egg is released at ovulation, the empty follicle transforms into a yellow body called the corpus luteum, which acts as a temporary endocrine gland.

Step 1 — Recall what the corpus luteum secretes: The corpus luteum secretes large amounts of the hormone progesterone.

Step 2 — Explain its role: Progesterone maintains the thickened, blood-rich lining of the uterus (endometrium), preparing it to receive and nourish the embryo if fertilisation occurs.

Why other options are wrong:

- Option A (Estrogen): is secreted mainly by the growing follicle before ovulation and repairs the uterine lining.
- Option B (LH): from the pituitary, triggers ovulation and forms the corpus luteum but does not maintain the endometrium.
- Option C (FSH): from the pituitary, stimulates follicle growth in the ovary.

Final Answer: The corpus luteum secretes progesterone, which maintains the endometrium ⇒

Answer: (D) [Go Back to Q17](#)

Q18.

Solution

Concept — Pigment of photosynthesis: Photosynthesis begins when a coloured pigment in the leaf captures light energy from the Sun.

Step 1 — Identify the pigment: The green pigment found in the chloroplasts of leaves is chlorophyll.

Step 2 — Explain its function: Chlorophyll absorbs mainly the red and blue parts of sunlight (reflecting green, which is why leaves look green) and passes this energy into the photosynthetic reactions that make glucose.

Why other options are wrong:

- Option B (Haemoglobin): the red oxygen-carrying pigment of blood, found in animals, not plants.
- Option C (Anthocyanin): a red, purple or blue pigment in some flowers and



fruits; it does not drive photosynthesis.

- Option D (Melanin): the brown-black pigment of animal skin and hair, unrelated to photosynthesis.

Final Answer: The green light-absorbing pigment of photosynthesis is chlorophyll

⇒

[Go Back to Q18](#)

Q19.

Solution

Concept — Vascular tissues of plants: Flowering plants have two conducting tissues: xylem, which carries water, and phloem, which carries food.

Step 1 — Recall the job of phloem: The phloem transports the food (mainly sugars such as sucrose) prepared in the leaves during photosynthesis.

Step 2 — Note the direction: This movement of food, called translocation, can go both upward and downward, delivering sugars to growing and storage parts of the plant.

Why other options are wrong:

- Option A (Xylem): conducts water and dissolved minerals upward from the roots, not food.
- Option B (Cambium): a layer of dividing cells that adds new xylem and phloem, but does not itself transport food.
- Option D (Epidermis): the protective outer layer of the plant, not a conducting tissue.

Final Answer: The tissue that translocates food (sugars) is the phloem ⇒

[Go Back to Q19](#)



Q20.

Solution

Concept — Kingdom Fungi: Fungi are eukaryotic, mostly multicellular organisms that feed heterotrophically by absorbing nutrients from dead or living matter.

Step 1 — Recall the cell wall material: Unlike plants, whose walls are made of cellulose, the cell wall of fungi is made mainly of chitin, a tough nitrogen-containing carbohydrate.

Step 2 — Confirm the choice: Chitin is the same substance found in the exoskeleton of insects, and it gives the fungal wall its strength.

Why other options are wrong:

- Option B (Cellulose): forms the cell walls of plants and some protists, not of fungi.
- Option C (Peptidoglycan): forms the cell walls of bacteria (kingdom Monera).
- Option D (Lignin): a hardening material deposited in the walls of woody plant tissues, not the main wall material of fungi.

Final Answer: The fungal cell wall is made mainly of chitin ⇒

[Go Back to Q20](#)

Q21.

Solution

Concept — Gymnosperms: The seed plants are divided into gymnosperms and angiosperms based on how their seeds are borne.

Step 1 — Recall the meaning of the name: The word gymnosperm means “naked seed” (gymnos = naked, sperma = seed).

Step 2 — Apply it to pine and cycas: In gymnosperms such as pine and cycas, the seeds lie exposed on the scales of cones and are not enclosed within a fruit. This naked-seed condition is their defining feature.

Why other options are wrong:

- Option A (Enclosed in a fruit): describes angiosperms, whose seeds develop inside fruits.
- Option B (Absent, reproduce by spores): describes non-seed plants such as ferns (pteridophytes).



- Option C (Enclosed in a flower): gymnosperms do not bear true flowers; they bear cones.

Final Answer: Gymnosperms are so named because their seeds are naked, not enclosed in a fruit \Rightarrow **D**

Answer: (D) [Go Back to Q21](#)

Q22.

Solution

Concept — Producers in a food chain: Every food chain begins with a producer, an organism that makes its own food from simple substances using sunlight.

Step 1 — Read the food chain: The chain is P \rightarrow Grasshopper \rightarrow Frog \rightarrow Snake. Position P is at the very start and is eaten by the grasshopper.

Step 2 — Identify the producer: The starting organism must be a green plant that photosynthesises. Grass, a green plant, is the producer at position P, while the grasshopper feeds on it as the primary consumer.

Why other options are wrong:

- Option A (Frog): a secondary consumer that eats the grasshopper.
- Option C (Snake): the top carnivore at the end of the chain.
- Option D (Grasshopper): the primary consumer, already shown as the second link.

Final Answer: The photosynthetic producer that starts the chain is grass \Rightarrow **B**

Answer: (B) [Go Back to Q22](#)

Q23.

Solution

Concept — Nitrogen fixation: Although the air is about 78% nitrogen gas, plants cannot use nitrogen in this form. It must first be “fixed” into usable compounds.

Step 1 — Recall the role of *Rhizobium*: *Rhizobium* is a nitrogen-fixing bacterium that lives in the root nodules of leguminous plants.

Step 2 — Describe what it does: It converts atmospheric nitrogen (N_2) into nitrogen compounds such as ammonia, which the plant can absorb and use to build proteins. This step of the nitrogen cycle is nitrogen fixation.



Why other options are wrong:

- Option B (Nitrates to N_2): this is denitrification, carried out by denitrifying bacteria.
- Option C (Ammonia to nitrates): this is nitrification, done by nitrifying bacteria.
- Option D (Proteins to ammonia): this is ammonification (decay), performed by decomposers.

Final Answer: *Rhizobium* fixes atmospheric nitrogen into usable compounds \Rightarrow

A

Answer: (A) [Go Back to Q23](#)

Q24.

Solution

Concept — Malaria and its vector: Malaria is a serious disease caused by a protozoan parasite that is spread by a specific mosquito.

Step 1 — Identify the causative agent: Malaria is caused by the protozoan parasite *Plasmodium*, which multiplies in human red blood cells and the liver.

Step 2 — Identify the vector: The parasite is carried from an infected person to a healthy person by the bite of the female *Anopheles* mosquito, which acts as the vector.

Why other options are wrong:

- Option A (Female *Aedes*): spreads dengue and chikungunya, not malaria.
- Option C (Housefly): spreads diseases such as typhoid and cholera by contaminating food, not malaria.
- Option D (Male *Culex*): only female mosquitoes bite and suck blood; *Culex* spreads filariasis, not malaria.

Final Answer: Malarial *Plasmodium* is transmitted by the female *Anopheles* mosquito \Rightarrow B

Answer: (B) [Go Back to Q24](#)



Q25.

Solution

Concept — Cloning vectors: In genetic engineering, a foreign gene must be carried into a host cell using a vehicle called a vector.

Step 1 — Identify the vector: The small, circular, self-replicating DNA molecule found naturally in bacteria (separate from the main chromosome) is the plasmid.

Step 2 — Explain its use: The desired gene is inserted into the plasmid, and the recombinant plasmid is then put into a host cell, where it replicates and expresses the gene. So the plasmid acts as a cloning vector.

Why other options are wrong:

- Option A (Ribosome): the site of protein synthesis, not a DNA-carrying vector.
- Option B (Bacterial chromosome): the large main DNA of the cell; it is not used as a portable cloning vector.
- Option D (Restriction enzyme): a tool that cuts DNA, not a vehicle that carries a gene into a cell.

Final Answer: The circular bacterial DNA used to carry a foreign gene is the plasmid ⇒

Answer: (C) [Go Back to Q25](#)



Answer Key

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

