# PGIMER BSc Nursing Biology

## Sample Paper – 2

**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.** In the human stomach, the inactive enzyme pepsinogen is converted into the active enzyme pepsin, which begins the digestion of proteins. The gastric secretion that activates pepsinogen and provides the required acidic medium is:

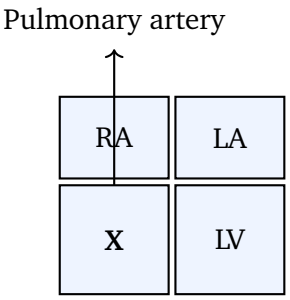
(A) Bile

(B) Hydrochloric acid

(C) Sodium bicarbonate

(D) Mucus

**Q2.** The diagram shows a schematic of the human heart. The chamber labelled **X** pumps deoxygenated blood to the lungs through the pulmonary artery. Chamber **X** is the:



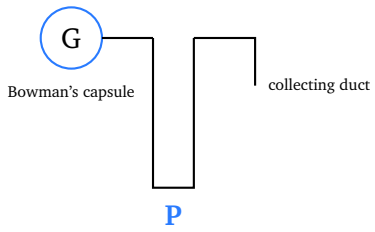

(A) Right ventricle

(B) Left ventricle

(C) Right atrium

(D) Left atrium

**Q3.** The diagram shows a nephron. The long U-shaped segment labelled **P**, which concentrates the urine by setting up a salt gradient in the medulla, is the:



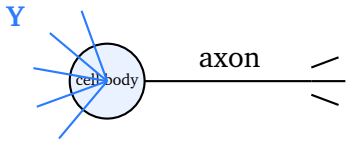

(A) Glomerulus

(B) Bowman's capsule

(C) Loop of Henle

(D) Collecting duct

**Q4.** The diagram shows a neuron. The short, branched projections labelled **Y**, which receive nerve impulses and carry them towards the cell body, are the:



(A) Dendrites

(B) Axon

(C) Myelin sheath

(D) Synaptic knob

**Q5.** In the human respiratory system, the actual exchange of oxygen and carbon dioxide between the inhaled air and the blood takes place across the thin walls of the:

(A) Trachea

(B) Bronchi

(C) Larynx

(D) Alveoli

**Q6.** A prolonged deficiency of iodine in the diet lowers the production of a hormone and leads to an enlargement of the thyroid gland known as goitre. The hormone whose synthesis is reduced is:

(A) Insulin

(B) Thyroxine

(C) Adrenaline

(D) Parathormone

**Q7.** A test cross is performed by crossing an organism showing a dominant trait with a homozygous recessive individual. When the dominant parent is heterozygous, the phenotypic ratio obtained among the offspring is:

(A) $3:1$

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

(C) $1:1$

(D) $1:2:1$

**Q8.** In a dihybrid cross, the alleles of one gene segregate into the gametes independently of the alleles of another gene. This principle is Mendel's:

(A) Law of dominance

(B) Law of segregation

(C) Law of purity of gametes

(D) Law of independent assortment

**Q9.** In a DNA double helix, the base pair that is held together by three hydrogen bonds, making that region of the molecule more stable, is:

(A) Guanine–Cytosine

(B) Adenine–Thymine

(C) Adenine–Uracil

(D) Guanine–Thymine

**Q10.** The wings of a bird and the wings of an insect perform the same function of flight but differ completely in their internal structure and evolutionary origin. Such organs are called:

(A) Homologous organs

(B) Analogous organs

(C) Vestigial organs

(D) Fossil organs

**Q11.** The cell organelle that acts as the site of protein synthesis by joining amino acids together in the order specified by the messenger RNA is the:

(A) Mitochondrion

(B) Golgi apparatus

(C) Lysosome

(D) Ribosome

**Q12.** The movement of ions or molecules across a cell membrane from a region of their lower concentration to a region of their higher concentration, using energy supplied by ATP, is called:

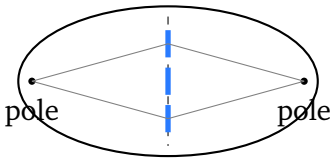
(A) Osmosis

(B) Simple diffusion

(C) Active transport

(D) Facilitated diffusion

**Q13.** The figure shows a stage of mitosis in which the chromosomes are arranged in a single row along the equator of the cell (the metaphase plate), with spindle fibres attached to them. This stage is:




(A) Prophase

(B) Metaphase

(C) Anaphase

(D) Telophase

**Q14.** Mitosis is described as an equational division because a single parent cell divides to produce:

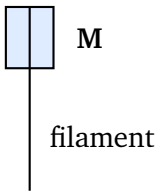
(A) Two daughter cells genetically identical to the parent cell

(B) Four haploid daughter cells

(C) Two cells each with half the chromosome number

(D) Four genetically different daughter cells

**Q15.** The figure shows a stamen, the male part of a flower. The swollen top structure labelled **M**, which produces and stores pollen grains, is the:




(A) Stigma

(B) Style

(C) Ovary

(D) Anther

**Q16.** In the human testis, the interstitial cells (cells of Leydig) lying between the seminiferous tubules secrete the principal male sex hormone, which is:

(A) Estrogen

(B) Progesterone

(C) Testosterone

(D) Oxytocin

**Q17.** During the first half of the human menstrual cycle, the growing ovarian (Graafian) follicle secretes a hormone that repairs and thickens the lining of the uterus. This hormone is:

(A) Estrogen

(B) Progesterone

(C) Testosterone

(D) Prolactin

**Q18.** In photosynthesis, the light reaction takes place in one region of the chloroplast and the dark reaction (Calvin cycle) in another. The correct pair of sites (light reaction; dark reaction) is:

(A) Stroma; grana

(B) Grana (thylakoids); stroma

(C) Stroma; cytoplasm

(D) Cytoplasm; grana

**Q19.** In a vascular plant, the tissue responsible for conducting water and dissolved minerals upward from the roots to the leaves is the:

(A) Phloem

(B) Cambium

(C) Cortex

(D) Xylem

**Q20.** Amoeba and Paramecium are single-celled organisms that possess a true, membrane-bound nucleus. In the five-kingdom classification they are placed in the kingdom:

(A) Protista

(B) Monera

(C) Fungi

(D) Animalia

**Q21.** Mosses and liverworts are called the "amphibians of the plant kingdom" because they live on land but still need water for reproduction. They are placed in the group:

(A) Thallophyta

(B) Pteridophyta

(C) Bryophyta

(D) Gymnosperms

**Q22.** The figure shows a grassland food chain. The organism that occupies the trophic level of the **secondary consumer** (the animal that feeds on the primary consumer) is the:

Grass ➤ Grasshopper ⟶ Frog ⟶ Snake

(A) Grasshopper

(B) Frog

(C) Grass

(D) Snake

**Q23.** The biogeochemical cycle in which atmospheric carbon dioxide is fixed by green plants during photosynthesis and returned to the air through respiration, decomposition and combustion is the:

(A) Nitrogen cycle

(B) Water cycle

(C) Phosphorus cycle

(D) Carbon cycle

**Q24.** When a person is given a vaccine containing weakened or killed microbes, the body is stimulated to make its own antibodies against them. The immunity so developed is:

(A) Passive natural immunity

(B) Innate immunity

(C) Active artificial immunity

(D) Passive artificial immunity

**Q25.** In recombinant DNA technology, the enzyme that seals two DNA fragments together by forming phosphodiester bonds, and is therefore called "molecular glue", is:

(A) DNA ligase

(B) Restriction endonuclease

(C) DNA polymerase

(D) Helicase

## Detailed Solutions

**Q1.**

**Solution**

**Concept — Protein digestion in the stomach:** The gastric glands in the stomach wall secrete a mixture called gastric juice, which contains an enzyme precursor, an acid and mucus.

**Step 1 — Recall the secretions:** The chief (peptic) cells secrete pepsinogen, the inactive form of the enzyme, while the parietal (oxyntic) cells secrete hydrochloric acid.

**Step 2 — Identify the activator:** Hydrochloric acid provides the strongly acidic medium (about pH 1.5–2) and converts inactive pepsinogen into active pepsin.

**Step 3 — State the action:** The active pepsin then begins the digestion of proteins by breaking them into smaller peptones and proteoses.

**Why other options are wrong:**

- Option A (Bile): comes from the liver and works in the small intestine, where it emulsifies fats; it does not activate pepsin.
- Option C (Sodium bicarbonate): makes the medium alkaline in the intestine, the opposite of what pepsin needs.
- Option D (Mucus): only protects the stomach wall from the acid; it does not activate pepsinogen.

**Final Answer:** Hydrochloric acid activates pepsinogen and gives the acidic medium $\Rightarrow$ B

**Answer: (B)** Go Back to Q1

**Q2.**

**Solution**

**Concept — Chambers of the human heart:** The heart has four chambers: two atria above that receive blood, and two ventricles below that pump it out.

**Step 1 — Trace the deoxygenated blood:** Deoxygenated blood from the body enters the right atrium and then passes down into the right ventricle.

**Step 2 — Identify the chamber pumping to the lungs:** The right ventricle pumps this deoxygenated blood into the pulmonary artery, which carries it to the lungs for oxygenation. Chamber **X**, connected to the pulmonary artery in the diagram,

is therefore the right ventricle.

**Why other options are wrong:**

- Option B (Left ventricle): pumps oxygenated blood into the aorta to supply the whole body.
- Option C (Right atrium): only receives deoxygenated blood from the body and passes it to the right ventricle.
- Option D (Left atrium): receives oxygenated blood returning from the lungs.

**Final Answer:** The chamber pumping deoxygenated blood to the lungs is the right ventricle $\Rightarrow$ A

**Answer: (A)** Go Back to Q2

## Q3.

### Solution

**Concept — Regions of a nephron:** The nephron has a filtering unit (glomerulus in Bowman's capsule) followed by a long tubule with several parts that adjust the filtrate.

**Step 1 — Identify the U-shaped part:** After the proximal tubule, the filtrate passes through a long hairpin-shaped loop that dips into the medulla and returns. This is the loop of Henle.

**Step 2 — Explain its function:** The loop of Henle sets up a high salt concentration in the medulla. This gradient draws water out of the collecting duct, concentrating the urine. The labelled U-shaped part **P** is therefore the loop of Henle.

**Why other options are wrong:**

- Option A (Glomerulus): a ball of capillaries that filters blood; it is not U-shaped and does not concentrate urine.
- Option B (Bowman's capsule): the cup that encloses the glomerulus and collects the filtrate.
- Option D (Collecting duct): carries the final urine to the pelvis, but the concentrating gradient is created by the loop of Henle.

**Final Answer:** The U-shaped part that concentrates urine is the loop of Henle $\Rightarrow$ C

**Answer: (C)** Go Back to Q3

## Q4.

### Solution

**Concept — Structure of a neuron:** A neuron has branched dendrites that receive impulses, a cell body, and one long axon that carries impulses away.

**Step 1 — Note the direction of the impulse:** An impulse is first picked up by the dendrites, which carry it towards the cell body.

**Step 2 — Match the label:** The short, branched projections labelled **Y** that receive impulses and conduct them towards the cell body are the dendrites.

**Why other options are wrong:**

- Option B (Axon): the single long fibre that carries the impulse away from the cell body, the opposite direction.
- Option C (Myelin sheath): the fatty insulating cover around the axon, not a receiving branch.
- Option D (Synaptic knob): the swollen tip at the end of the axon that passes the impulse to the next cell.

**Final Answer:** The branches that receive impulses towards the cell body are the dendrites $\Rightarrow$ A

**Answer: (A)** Go Back to Q4

## Q5.

### Solution

**Concept — Gaseous exchange in the lungs:** The respiratory passage conducts air, but the exchange of gases with the blood happens only at the finest air sacs.

**Step 1 — Locate the exchange surface:** Each lung ends in millions of tiny, thin-walled, balloon-like sacs called alveoli, surrounded by a network of blood capillaries.

**Step 2 — Explain the exchange:** Across the thin alveolar wall, oxygen diffuses from the air into the blood and carbon dioxide diffuses from the blood into the air. This is the actual site of gaseous exchange.

**Why other options are wrong:**

- Option A (Trachea): the windpipe; it only conducts air and does not exchange gases.
- Option B (Bronchi): the branches of the trachea that carry air into the lungs,

without exchange.
- Option C (Larynx): the voice box, involved in sound production, not gas exchange.

**Final Answer:** Gaseous exchange takes place across the walls of the alveoli $\Rightarrow$ D

**Answer: (D)** Go Back to Q5

## Q6.

### Solution

**Concept — Thyroid gland and iodine:** The thyroid gland uses iodine as a raw material to make its hormone, so a lack of iodine directly affects that hormone.

**Step 1 — Identify the hormone:** The thyroid gland secretes thyroxine ($T_4$), which contains iodine and controls the body's overall metabolic rate.

**Step 2 — Link to goitre:** When iodine is scarce, thyroxine cannot be made in sufficient amounts. The gland enlarges as it works harder to trap iodine, producing the swelling called goitre.

**Why other options are wrong:**

- Option A (Insulin): secreted by the pancreas to lower blood glucose; it contains no iodine.
- Option C (Adrenaline): the emergency hormone from the adrenal medulla, unrelated to iodine.
- Option D (Parathormone): from the parathyroid glands; it regulates blood calcium, not iodine metabolism.

**Final Answer:** Iodine deficiency reduces thyroxine and causes goitre $\Rightarrow$ B

**Answer: (B)** Go Back to Q6

## Q7.

### Solution

**Concept — Test cross:** A test cross is used to find out whether an organism showing a dominant trait is homozygous or heterozygous, by crossing it with a homozygous recessive.

**Step 1 — Set up the cross:** Take a heterozygous dominant parent (Tt) and cross it with a homozygous recessive (tt). The gametes are T and t from one parent, and only t from the other.

**Step 2 — Work out the offspring:** The offspring are Tt and tt in equal numbers, that is one tall to one dwarf.

**Step 3 — State the ratio:** The phenotypic ratio of the test cross is therefore $1 : 1$.

**Why other options are wrong:**

- Option A $(3 : 1)$: is the monohybrid $F_2$ ratio from a Tt $\times$ Tt cross.
- Option B $(9 : 3 : 3 : 1)$: is the dihybrid $F_2$ ratio, involving two genes.
- Option D $(1 : 2 : 1)$: is the genotypic ratio of a monohybrid $F_2$, not a test-cross phenotype.

**Final Answer:** A test cross of a heterozygote gives a $1 : 1$ ratio $\Rightarrow$ C

**Answer: (C)** Go Back to Q7

## Q8.

### Solution

**Concept — Mendel's laws:** Mendel proposed three principles of inheritance: dominance, segregation, and independent assortment.

**Step 1 — Focus on two genes:** In a dihybrid cross, two different characters (each with its own gene) are followed together.

**Step 2 — State the principle:** The law of independent assortment says that during gamete formation the two alleles of one gene separate independently of the two alleles of another gene, so all combinations of gametes are formed.

**Why other options are wrong:**

- Option A (Law of dominance): explains why only the dominant trait appears in the $F_1$ hybrid.
- Option B (Law of segregation): explains that the two alleles of a single gene separate during gamete formation.
- Option C (Law of purity of gametes): another name for the law of segregation, still dealing with a single gene, not two.

**Final Answer:** Independent behaviour of two genes is the law of independent assortment $\Rightarrow$ D

**Answer: (D)** Go Back to Q8

## Q9.

### Solution

**Concept — Hydrogen bonding in DNA:** The two strands of DNA are held together by hydrogen bonds between complementary bases, and the number of bonds differs between the two pairs.

**Step 1 — Recall the pairing rule:** Adenine (A) pairs with thymine (T), and guanine (G) pairs with cytosine (C).

**Step 2 — Count the bonds:** The A–T pair is joined by two hydrogen bonds, while the G–C pair is joined by three hydrogen bonds, so the G–C pair is the stronger, more stable one.

**Why other options are wrong:**

- Option B (Adenine–Thymine): held by only two hydrogen bonds.
- Option C (Adenine–Uracil): uracil replaces thymine in RNA, not in the DNA double helix.
- Option D (Guanine–Thymine): not a valid complementary base pair in DNA.

**Final Answer:** The pair with three hydrogen bonds is guanine–cytosine $\Rightarrow \boxed{\text{A}}$

**Answer: (A)** Go Back to Q9

## Q10.

### Solution

**Concept — Analogous versus homologous organs:** Organs are compared by structure and by function to understand the direction of evolution.

**Step 1 — Examine the two wings:** A bird's wing is a modified forelimb with bones, feathers and muscles, while an insect's wing is a thin fold of the body wall with no bones. Their structures are entirely different.

**Step 2 — Apply the definition:** Organs that have different structures and origins but perform the same function are called analogous organs; they are the result of convergent evolution.

**Why other options are wrong:**

- Option A (Homologous organs): have the same basic structure but different functions, such as the forelimbs of a human and a whale.
- Option C (Vestigial organs): reduced, non-functional remnants like the human appendix.

- Option D (Fossil organs): not a recognised biological term.

**Final Answer:** Same function but different structure makes them analogous organs $\Rightarrow$ B

**Answer: (B)** Go Back to Q10

## Q11.

### Solution

**Concept — Site of protein synthesis:** Different organelles perform different jobs; the building of proteins from amino acids is carried out by one particular structure.

**Step 1 — Recall the role of ribosomes:** Ribosomes are tiny granular structures found free in the cytoplasm or attached to the endoplasmic reticulum.

**Step 2 — Describe the function:** Ribosomes read the sequence of codons on the messenger RNA and join amino acids in that order to form a protein chain. This process is translation.

**Why other options are wrong:**

- Option A (Mitochondrion): the powerhouse of the cell that releases ATP during respiration.
- Option B (Golgi apparatus): packages, modifies and secretes proteins after they are made.
- Option C (Lysosome): contains digestive enzymes that break down waste and worn-out parts.

**Final Answer:** Protein synthesis takes place on the ribosome $\Rightarrow$ D

**Answer: (D)** Go Back to Q11

## Q12.

### Solution

**Concept — Membrane transport:** Substances cross the cell membrane either passively (down a gradient, no energy) or actively (against a gradient, using energy).

**Step 1 — Read the direction:** The question describes movement from a region of lower concentration to a region of higher concentration, that is against the concentration gradient.

**Step 2 — Identify the process:** Moving a substance uphill against its gradient requires energy from ATP and carrier proteins. This is active transport.

**Why other options are wrong:**

- Option A (Osmosis): the passive movement of water across a membrane, down a water-potential gradient.
- Option B (Simple diffusion): passive movement of particles down their gradient, needing no energy.
- Option D (Facilitated diffusion): still passive; it uses carrier proteins but moves substances down the gradient without ATP.

**Final Answer:** Movement against the gradient using ATP is active transport $\Rightarrow$ C

**Answer: (C)** Go Back to Q12

## Q13.

### Solution

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

**Step 1 — Read the figure:** The chromosomes are lined up in a single row across the middle of the cell, along the equatorial (metaphase) plate, with spindle fibres attached to their centromeres.

**Step 2 — Match the stage:** Alignment of chromosomes at the equator is the defining feature of metaphase.

**Why other options are wrong:**

- Option A (Prophase): chromosomes condense and the spindle starts to form, but they are scattered, not aligned.
- Option C (Anaphase): the sister chromatids have already separated and are moving to the poles.
- Option D (Telophase): chromosomes have reached the poles and nuclear envelopes reform.

**Final Answer:** Chromosomes aligned at the equator indicate metaphase $\Rightarrow$ B

**Answer: (B)** Go Back to Q13

## Q14.

### Solution

**Concept — Nature of mitosis:** Mitosis is the division of body (somatic) cells for growth, repair and replacement.

**Step 1 — Recall the chromosome number:** During mitosis the DNA is first copied, and then the copies are shared equally, so each daughter cell receives the same number of chromosomes as the parent.

**Step 2 — State the outcome:** One parent cell divides to give two daughter cells that are genetically identical to it and to each other. This is why mitosis is called an equational division.

**Why other options are wrong:**

- Option B (Four haploid cells): describes meiosis, not mitosis.
- Option C (Half the chromosome number): the reduction seen in meiosis, not in mitosis.
- Option D (Four genetically different cells): again a feature of meiosis, which introduces variation.

**Final Answer:** Mitosis produces two genetically identical daughter cells $\Rightarrow$ A

**Answer: (A)** Go Back to Q14

## Q15.

### Solution

**Concept — Parts of a stamen:** The stamen is the male reproductive part of a flower and is made of two portions.

**Step 1 — Recall the two parts:** A stamen consists of a slender stalk called the filament and a swollen top called the anther.

**Step 2 — Match the label:** The anther contains pollen sacs in which pollen grains are produced and stored. The swollen top structure **M** that produces pollen is therefore the anther.

**Why other options are wrong:**

- Option A (Stigma): the tip of the female part (pistil) that receives pollen, not part of the stamen.
- Option B (Style): the stalk of the female pistil connecting stigma and ovary.
- Option C (Ovary): the female part that encloses the ovules; it does not make

pollen.

**Final Answer:** The pollen-producing top of the stamen is the anther $\Rightarrow$ D

**Answer: (D)** Go Back to Q15

## Q16.

### Solution

**Concept — Endocrine role of the testis:** Besides making sperm, the testis also works as an endocrine gland through special cells lying between its tubules.

**Step 1 — Identify the cells:** The interstitial cells, also called the cells of Leydig, are found in the spaces between the seminiferous tubules.

**Step 2 — Name the hormone:** These cells secrete testosterone, the principal male sex hormone, which controls the development of male secondary sexual characters and supports sperm production.

**Why other options are wrong:**

- Option A (Estrogen): the female sex hormone, secreted mainly by the ovary.
- Option B (Progesterone): a female hormone from the corpus luteum that maintains pregnancy.
- Option D (Oxytocin): released by the pituitary; it causes uterine contraction and milk ejection.

**Final Answer:** The Leydig cells of the testis secrete testosterone $\Rightarrow$ C

**Answer: (C)** Go Back to Q16

## Q17.

### Solution

**Concept — Ovarian hormones in the menstrual cycle:** The ovary releases different hormones at different phases of the cycle, controlled by the pituitary.

**Step 1 — Focus on the first half:** In the follicular phase (first half of the cycle), the follicle grows under the influence of FSH and begins to secrete a hormone.

**Step 2 — Identify the hormone and its action:** The growing Graafian follicle secretes estrogen, which repairs and thickens the endometrium (uterine lining) in preparation for a possible pregnancy.

**Why other options are wrong:**

- Option B (Progesterone): secreted mainly by the corpus luteum in the second half of the cycle, after ovulation.
- Option C (Testosterone): the male sex hormone, not the follicular hormone.
- Option D (Prolactin): stimulates milk production and is unrelated to thickening the endometrium here.

**Final Answer:** The growing follicle secretes estrogen $\Rightarrow$ A

**Answer: (A)** Go Back to Q17

## Q18.

### Solution

**Concept — Two phases of photosynthesis:** Photosynthesis has a light-dependent reaction and a light-independent (dark) reaction, each occurring in a different part of the chloroplast.

**Step 1 — Site of the light reaction:** The light reaction takes place on the thylakoid membranes stacked as grana, where chlorophyll traps light and water is split to release oxygen.

**Step 2 — Site of the dark reaction:** The dark reaction (Calvin cycle) takes place in the stroma, the fluid surrounding the grana, where carbon dioxide is fixed into sugar. So the correct pair is grana (thylakoids); stroma.

**Why other options are wrong:**

- Option A (Stroma; grana): reverses the two correct sites.
- Option C (Stroma; cytoplasm): the dark reaction is in the stroma, not the cytoplasm, and the light reaction is not in the stroma.
- Option D (Cytoplasm; grana): both sites are wrong; photosynthesis occurs inside the chloroplast, not the cytoplasm.

**Final Answer:** Light reaction in the grana, dark reaction in the stroma $\Rightarrow$ B

**Answer: (B)** Go Back to Q18

## Q19.

### Solution

**Concept — Conducting tissues of plants:** Vascular plants have two transport tissues, xylem and phloem, each carrying different materials in different directions.

**Step 1 — Recall the role of xylem:** Xylem is made of dead, tube-like cells (vessels and tracheids) with lignified walls.

**Step 2 — State the direction of flow:** Xylem conducts water and dissolved mineral salts upward, from the roots through the stem to the leaves. This one-way upward flow is driven mainly by transpiration pull.

**Why other options are wrong:**

- Option A (Phloem): carries food (sugars) made in the leaves to the rest of the plant, not water upward.
- Option B (Cambium): a layer of dividing cells for growth in thickness; it does not conduct water.
- Option C (Cortex): a packing and storage tissue, not a conducting tissue.

**Final Answer:** Water is carried upward by the xylem $\Rightarrow$ $\boxed{\text{D}}$

**Answer: (D)** Go Back to Q19

## Q20.

### Solution

**Concept — Five-kingdom classification:** Whittaker grouped organisms into Monera, Protista, Fungi, Plantae and Animalia, using cell structure and body organisation.

**Step 1 — Examine Amoeba and Paramecium:** Both are single-celled and possess a true, membrane-bound nucleus, which makes them unicellular eukaryotes.

**Step 2 — Place them in a kingdom:** Unicellular eukaryotes are placed in the kingdom Protista.

**Why other options are wrong:**

- Option B (Monera): contains prokaryotes such as bacteria, which lack a true nucleus.
- Option C (Fungi): eukaryotic but mostly multicellular decomposers with chitin cell walls.
- Option D (Animalia): multicellular heterotrophs, not single-celled organ-

isms.

**Final Answer:** Unicellular eukaryotes like Amoeba and Paramecium belong to Protista $\Rightarrow$ A

**Answer: (A)** Go Back to Q20

## Q21.

### Solution

**Concept — Groups of the plant kingdom:** Plants are arranged in groups of increasing complexity: Thallophyta, Bryophyta, Pteridophyta, Gymnosperms and Angiosperms.

**Step 1 — Recall the feature of bryophytes:** Mosses and liverworts are simple land plants that lack true vascular tissue and still depend on an external film of water to carry their male gametes for fertilisation.

**Step 2 — Apply the nickname:** Because they live on land but need water for reproduction, they are called the amphibians of the plant kingdom, and they belong to the group Bryophyta.

**Why other options are wrong:**

- Option A (Thallophyta): the simplest plants, mainly algae, with an undifferentiated thallus.
- Option B (Pteridophyta): ferns, the first plants with true vascular tissue.
- Option D (Gymnosperms): seed plants that bear naked seeds and do not need water for fertilisation.

**Final Answer:** The amphibians of the plant kingdom are the bryophytes $\Rightarrow$ C

**Answer: (C)** Go Back to Q21

## Q22.

### Solution

**Concept — Trophic levels in a food chain:** Energy flows from producers to a series of consumers, each named according to its position.

**Step 1 — Assign the trophic levels:** In the chain Grass $\rightarrow$ Grasshopper $\rightarrow$ Frog $\rightarrow$ Snake, grass is the producer, the grasshopper (herbivore) is the primary consumer, the frog is the secondary consumer, and the snake is the tertiary consumer.

**Step 2 — Identify the secondary consumer:** The secondary consumer is the animal that feeds on the primary consumer. Here the frog eats the grasshopper, so the frog is the secondary consumer.

**Why other options are wrong:**

- Option A (Grasshopper): the primary consumer, which eats the producer.
- Option C (Grass): the producer that begins the chain.
- Option D (Snake): the tertiary consumer, one level above the frog.

**Final Answer:** The secondary consumer that feeds on the grasshopper is the frog $\Rightarrow$ B

**Answer: (B)** Go Back to Q22

## Q23.

### Solution

**Concept — Biogeochemical cycles:** Elements move between the living world and the environment in cyclic pathways. Each cycle is named after the element it circulates.

**Step 1 — Trace the pathway of carbon:** Green plants take in atmospheric carbon dioxide and fix it into glucose during photosynthesis.

**Step 2 — Complete the cycle:** Carbon returns to the atmosphere as carbon dioxide through respiration by living things, decomposition of dead matter, and the combustion of fuels. This circulation is the carbon cycle.

**Why other options are wrong:**

- Option A (Nitrogen cycle): circulates nitrogen through fixation, nitrification and denitrification, not carbon dioxide.
- Option B (Water cycle): describes the movement of water by evaporation and precipitation.
- Option C (Phosphorus cycle): moves phosphorus mainly through rocks, soil and organisms, with no atmospheric gas step.

**Final Answer:** Fixation of $CO_2$ by photosynthesis and its return is the carbon cycle $\Rightarrow$ D

**Answer: (D)** Go Back to Q23

## Q24.

**Solution**

**Concept — Types of acquired immunity:** Acquired immunity is either active (the body makes its own antibodies) or passive (ready-made antibodies are received), and each can be natural or artificial.

**Step 1 — Analyse vaccination:** A vaccine introduces weakened or killed microbes (antigens) into the body without causing disease.

**Step 2 — Classify the response:** In response, the body produces its own antibodies and memory cells, so it is active immunity. Because the antigen was given deliberately as a vaccine, it is artificial. Hence vaccination gives active artificial immunity.

**Why other options are wrong:**

- Option A (Passive natural immunity): ready-made antibodies received naturally, as through mother's milk.
- Option B (Innate immunity): the inborn, non-specific defence such as skin and mucus barriers.
- Option D (Passive artificial immunity): ready-made antibodies injected as an antiserum, where the body does not make its own.

**Final Answer:** Vaccination stimulates the body's own antibodies, giving active artificial immunity $\Rightarrow$ C

**Answer: (C)** Go Back to Q24

## Q25.

**Solution**

**Concept — Enzymes of genetic engineering:** Recombinant DNA technology uses enzymes to cut DNA at chosen sites and then to join fragments together.

**Step 1 — Identify the joining enzyme:** DNA ligase seals the gap between two DNA fragments by forming phosphodiester bonds in the sugar-phosphate backbone.

**Step 2 — Explain the nickname:** Because it glues the fragments together, for example a piece of foreign DNA into a plasmid vector, DNA ligase is called molecular glue.

**Why other options are wrong:**

- Option B (Restriction endonuclease): cuts DNA at specific sequences, acting as molecular scissors, the opposite job.
- Option C (DNA polymerase): synthesises new DNA strands during replication.
- Option D (Helicase): unwinds the DNA double helix; it neither cuts nor joins fragments.

**Final Answer:** The enzyme that joins DNA fragments, the molecular glue, is DNA ligase $\Rightarrow \boxed{A}$

**Answer: (A)** **Go Back to Q25**

# Answer Key

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