AIIMS B.Sc Nursing Biology

Sample Paper – 3

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

Instructions

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

Q1. The cell theory, which states that all living organisms are made up of cells, was jointly proposed by two scientists. They were:

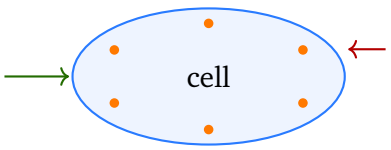
(A) Watson and Crick

(B) Darwin and Wallace

(C) Schleiden and Schwann

(D) Mendel and Morgan

Q2. The thin boundary shown below, which surrounds the cell and allows only certain substances to pass while keeping others out, is described as:



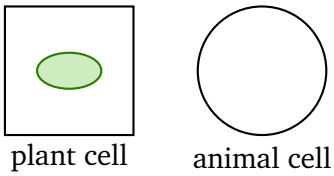
(A) completely impermeable

(B) selectively permeable

(C) freely permeable to everything

(D) permeable only to gases

Q3. The two plant-and-animal cells shown below differ in one organelle. The green disc-shaped organelle present only in the plant cell (left) and absent from the animal cell (right) is the:



(A) chloroplast

(B) mitochondrion

(C) ribosome

(D) nucleus

Q4. A molecule of fat (lipid) is built up when fatty acids combine with one other small molecule. That molecule is:

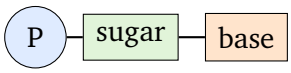
(A) glucose

(B) an amino acid

(C) a nucleotide

(D) glycerol

Q5. The repeating unit of the nucleic acids DNA and RNA, shown below as a sugar joined to a phosphate and a nitrogen base, is called a:



(A) nucleotide

(B) amino acid

(C) monosaccharide

(D) fatty acid

Q6. Moulds, yeasts, and mushrooms have cell walls made of chitin and feed by absorbing nutrients. In the five-kingdom system they are placed in the kingdom:

(A) Monera

(B) Plantae

(C) Fungi

(D) Protista

Q7. Viruses are considered to lie on the borderline between living and non-living things, mainly because they:

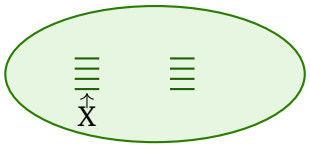
(A) are made of many cells

(B) can reproduce only inside a living host cell

(C) carry out photosynthesis

(D) have a true nucleus

Q8. Inside the chloroplast shown, the light reaction of photosynthesis, which traps sunlight and splits water, takes place in the stacked green discs labelled X. These discs (a stack of thylakoids) are the:



(A) stroma

(B) cristae

(C) matrix

(D) grana

Q9. The dark reaction (Calvin cycle) of photosynthesis, in which carbon dioxide is fixed into sugar, takes place in the colourless fluid that fills the chloroplast around the grana. This fluid is the:

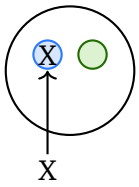
(A) stroma

(B) thylakoid

(C) granum

(D) cell sap

Q10. In the stem section shown, water and dissolved minerals absorbed by the roots are carried upward to the leaves through the conducting tissue marked X. This tissue is the:



(A) phloem

(B) cambium

(C) xylem

(D) epidermis

Q11. The hydrochloric acid secreted by the gastric glands of the stomach has two main roles: it kills germs in the food and it also:

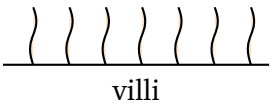
(A) digests fats directly

(B) activates the enzyme pepsin

(C) absorbs glucose

(D) makes the medium alkaline

Q12. The finger-like projections shown lining the inner wall of the small intestine greatly increase the surface area for absorbing digested food. Most absorption of the products of digestion therefore occurs in the:



(A) mouth

(B) stomach

(C) large intestine

(D) small intestine

Q13. The wave-like muscular contraction and relaxation of the wall of the alimentary canal that pushes food forward along the gut is called:

(A) peristalsis

(B) digestion

(C) assimilation

(D) egestion

Q14. Among the cells of human blood, the white blood cells (leucocytes) chiefly serve to:

(A) carry oxygen to tissues

(B) help blood to clot

(C) defend the body against germs (immunity)

(D) transport carbon dioxide

Q15. When a small blood vessel is cut, the tiny cell fragments in blood that gather at the wound and help the blood to clot are the:

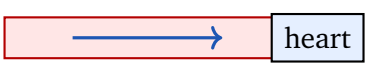
(A) red blood cells

(B) platelets

(C) white blood cells

(D) plasma proteins

Q16. The blood vessel shown carrying blood in the direction of the arrow, back towards the heart, is a:



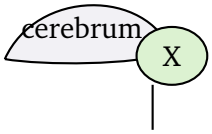
(A) artery

(B) aorta

(C) capillary

(D) vein

Q17. In the brain shown, the part marked X at the back, which controls balance and coordinates muscular activity so that movements are smooth, is the:



(A) cerebellum

(B) cerebrum

(C) medulla oblongata

(D) hypothalamus

Q18. The part of the brain that lies at its base, joins the brain to the spinal cord, and controls involuntary actions such as heartbeat, breathing, and blood pressure is the:

(A) cerebrum

(B) cerebellum

(C) medulla oblongata

(D) pituitary gland

Q19. A pea-sized gland attached to the base of the brain secretes hormones that control several other endocrine glands of the body. Because of this it is called the master gland. It is the:

(A) thyroid gland

(B) pituitary gland

(C) adrenal gland

(D) pancreas

Q20. In the human female, the organ that produces the ova (eggs) and also secretes the hormone oestrogen is the:

(A) uterus

(B) oviduct

(C) vagina

(D) ovary

Q21. In a normal human female, one complete menstrual cycle lasts on average about:

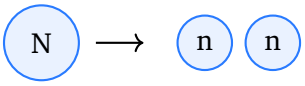
(A) 28 days

(B) 7 days

(C) 90 days

(D) 365 days

Q22. The single-celled organism shown is dividing into two daughter cells of equal size, as in the diagram. This type of asexual reproduction in Amoeba is called:



(A) budding

(B) spore formation

(C) binary fission

(D) regeneration

Q23. The number of chromosomes present in a normal human body (somatic) cell is:

(A) 23

(B) 46

(C) 48

(D) 92

Q24. With respect to the sex chromosomes, a normal human female and male respectively are:

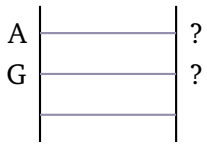
(A) XY and XX

(B) XY and XY

(C) XX and XX

(D) XX and XY

Q25. In a DNA molecule the two strands are held together by base pairs. In the rungs shown, adenine (A) always pairs with one particular base, and guanine (G) pairs with another. The correct pairing is:



(A) A with T and G with C

(B) A with G and T with C

(C) A with C and G with T

(D) A with A and G with G

Q26. One of the two or more alternative forms of a gene, which occupy the same position on a chromosome and control the same trait, is called an:

(A) gene

(B) chromosome

(C) allele

(D) nucleotide

Q27. Typhoid fever in humans is caused by the bacterium Salmonella typhi. Typhoid is therefore an example of a disease caused by:

(A) a virus

(B) a protozoan

(C) a fungus

(D) a bacterium

Q28. Medicines such as penicillin and streptomycin are used to treat infections. These antibiotics are effective mainly against:

(A) viruses

(B) bacteria

(C) allergies

(D) vitamin deficiencies

Q29. The laboratory technique used to make a large number of copies of a particular segment of DNA in a short time is:

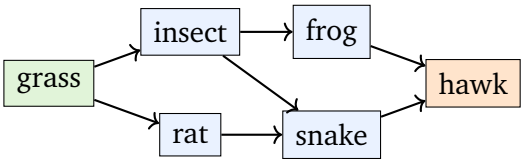
(A) PCR (polymerase chain reaction)

(B) electrophoresis

(C) vaccination

(D) pasteurisation

Q30. The diagram below shows several food chains of an ecosystem linked together, with many organisms feeding on more than one kind of food. Such a network of interconnected food chains is called a:



(A) food chain

(B) trophic level

(C) food web

(D) ecological pyramid

Detailed Solutions

Q1.

Solution

Concept — The cell theory: The cell theory is one of the foundations of biology. It states that all living organisms are made of one or more cells, that the cell is the basic structural and functional unit of life, and that all cells arise from pre-existing cells. The first two parts were put forward jointly in 1838–39 by the botanist Matthias Schleiden (for plants) and the zoologist Theodor Schwann (for animals).

Step 1 — Identify the ask: the question wants the two scientists who proposed the cell theory.

Step 2 — Recall the names: Schleiden studied plant cells and Schwann studied animal cells; together they framed the cell theory.

Why each other option is wrong:

- (A) Watson and Crick worked out the double-helix structure of DNA, not the cell theory.
- (B) Darwin and Wallace proposed evolution by natural selection.
- (D) Mendel founded genetics and Morgan worked on fruit-fly chromosomes; neither framed the cell theory.

Key point: Cell theory = Schleiden + Schwann; Rudolf Virchow later added that all cells come from pre-existing cells.

Final Answer: Schleiden and Schwann $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q1

Q2.

Solution

Concept — The plasma membrane: Every cell is bounded by a thin plasma (cell) membrane made of a lipid bilayer with proteins. It is described as selectively permeable (or semi-permeable) because it lets some substances pass freely (such as water, oxygen, and carbon dioxide) while controlling or blocking the movement of others (such as ions and large molecules). This control keeps the internal composition of the cell stable.

Step 1 — Read the figure: the boundary lets one arrow in but blocks another, showing that only certain substances pass.

Step 2 — Name the property: a membrane that admits some substances and not others is selectively permeable.

Why each other option is wrong:

- (A) If it were completely impermeable, nothing could enter or leave and the cell would die.
- (C) It is not freely permeable to everything; it controls what passes.
- (D) It allows more than just gases, for example water and certain nutrients.

Key point: Selectively permeable = "some in, some out". This selective transport is what makes the membrane a living, controlling boundary.

Final Answer: Selectively permeable $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q2

Q3.

Solution

Concept — Chloroplasts in plant cells: Chloroplasts are green, disc-shaped organelles that contain the pigment chlorophyll and carry out photosynthesis. They are found in the cells of green plants and algae but are completely absent from animal cells, because animals do not make their own food. This is one of the key differences between a plant cell and an animal cell.

Step 1 — Read the figure: the plant cell (left) has a green oval organelle that the animal cell (right) lacks.

Step 2 — Identify it: the green photosynthetic organelle unique to plant cells is the chloroplast.

Why each other option is wrong:

- (B) Mitochondria are present in both plant and animal cells, so they cannot be the difference.
- (C) Ribosomes occur in both kinds of cell.
- (D) The nucleus is present in both plant and animal cells.

Key point: Chloroplast, cell wall, and large central vacuole are typical of plant cells; chloroplasts in particular are absent from animal cells.

Final Answer: Chloroplast $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q3

Q4.

Solution

Concept — Structure of fats: Fats (and oils) belong to the group of biomolecules called lipids. A single fat molecule is formed when three fatty acid molecules join with one molecule of glycerol. Glycerol is a three-carbon alcohol, and the fatty acids are long hydrocarbon chains ending in an acid group. Such a fat is also called a triglyceride.

Step 1 — Identify the building blocks of fat: fatty acids plus one more small molecule.

Step 2 — Name the partner molecule: the molecule that combines with fatty acids to form a fat is glycerol.

Why each other option is wrong:

- (A) Glucose is a sugar; it builds carbohydrates, not fats.
- (B) Amino acids are the building blocks of proteins.
- (C) Nucleotides are the building blocks of nucleic acids (DNA and RNA).

Key point: Fat = glycerol + fatty acids (a triglyceride). Match each biomolecule to its monomer to avoid mix-ups.

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

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — The nucleotide: Nucleic acids (DNA and RNA) are large polymers. Their repeating monomer unit is the nucleotide. Each nucleotide is made of three parts joined together: a pentose sugar, a phosphate group, and a nitrogenous base (adenine, guanine, cytosine, and thymine or uracil). Thousands of nucleotides link in a chain to form a strand of DNA or RNA.

Step 1 — Read the figure: a phosphate joined to a sugar joined to a base is exactly one nucleotide.

Step 2 — Name the unit: this sugar–phosphate–base unit is the nucleotide, the monomer of nucleic acids.

Why each other option is wrong:

- (B) Amino acids are the monomers of proteins.

- (C) Monosaccharides (simple sugars) are the monomers of carbohydrates.
- (D) Fatty acids, with glycerol, build up fats.

Key point: Nucleic acid monomer = nucleotide = sugar + phosphate + base. This is the unit that carries the genetic code.

Final Answer: Nucleotide $\Rightarrow$ A

Answer: (A) Go Back to Q5

Q6.

Solution

Concept — The kingdom Fungi: In Whittaker's five-kingdom classification, fungi form their own kingdom, Fungi. They are eukaryotic, mostly multicellular, and have cell walls made of chitin (not cellulose). They are heterotrophic and feed by absorbing dissolved nutrients (saprophytic or parasitic). Moulds, yeasts, and mushrooms are all members of this kingdom.

Step 1 — Match the features: chitin cell wall + absorptive nutrition points clearly to fungi.

Step 2 — Name the kingdom: these organisms belong to the kingdom Fungi.

Why each other option is wrong:

- (A) Monera holds prokaryotes such as bacteria, which have no true nucleus.
- (B) Plantae holds green, photosynthetic plants with cellulose walls.
- (D) Protista holds mostly unicellular eukaryotes such as Amoeba and Paramecium.

Key point: Fungi = chitin walls, absorptive feeders, decomposers. Yeast is a unicellular fungus; mushrooms and moulds are multicellular fungi.

Final Answer: Fungi $\Rightarrow$ C

Answer: (C) Go Back to Q6

Q7.

Solution

Concept — The nature of viruses: Viruses are acellular particles made of a nucleic acid (DNA or RNA) enclosed in a protein coat. They are placed on the borderline between living and non-living things because they show living characters (they have genetic material and can reproduce and mutate) only when inside a living host cell. Outside a host they are inert and can even be crystallised like non-living chemicals.

Step 1 — Identify the borderline character: the question asks why viruses are between living and non-living.

Step 2 — Reason it out: a virus cannot multiply on its own; it reproduces only inside a living host cell, which is why it shows life only there.

Why each other option is wrong:

- (A) Viruses are acellular (not even one cell), let alone many cells.
- (C) Viruses do not photosynthesise; they have no chloroplasts.
- (D) Viruses have no nucleus or any cell organelle at all.

Key point: Inside a host = living-like (reproduces); outside a host = non-living (inert, crystallisable). Obligate parasitism is the key.

Final Answer: Reproduce only inside a living host cell $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q7

Q8.

Solution

Concept — The grana and the light reaction: A chloroplast has two main regions. The grana are stacks of flattened membrane discs called thylakoids; they contain chlorophyll. The colourless fluid around them is the stroma. The light reaction of photosynthesis, which traps sunlight, splits water, and makes ATP and NADPH, takes place in the thylakoid membranes of the grana.

Step 1 — Read the figure: the stacked green discs labelled X are the grana.

Step 2 — Link to the light reaction: chlorophyll in these discs captures light, so the light reaction happens in the grana.

Why each other option is wrong:

- (A) The stroma is the fluid where the dark reaction (Calvin cycle) occurs,

not the light reaction.

- (B) Cristae are the inner folds of the mitochondrion, not the chloroplast.
- (C) The matrix is the fluid inside the mitochondrion.

Key point: Light reaction → grana (thylakoids); dark reaction → stroma. Keep the two regions of the chloroplast separate.

Final Answer: Grana ⇒ D

Answer: (D) Go Back to Q8

Q9.

Solution

Concept — The stroma and the Calvin cycle: The dark reaction, also called the Calvin cycle, is the second stage of photosynthesis. It does not need light directly; it uses the ATP and NADPH made in the light reaction to fix carbon dioxide into glucose. This series of enzyme-controlled reactions takes place in the stroma, the colourless ground fluid that fills the chloroplast around the grana.

Step 1 — Identify the process: the dark reaction (Calvin cycle) that fixes carbon dioxide into sugar.

Step 2 — Locate it: this happens in the stroma of the chloroplast.

Why each other option is wrong:

- (B) The thylakoid membranes carry out the light reaction, not the dark reaction.
- (C) A granum is a single stack of thylakoids, the site of the light reaction.
- (D) Cell sap is the fluid in a plant cell's vacuole, unrelated to photosynthesis.

Key point: Dark reaction (Calvin cycle) → stroma; light reaction → grana. The stroma holds the enzymes that fix CO_2.

Final Answer: Stroma ⇒ A

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Conduction by xylem: Plants have two conducting (vascular) tissues. The xylem carries water and dissolved minerals upward from the roots to the stem and leaves. The phloem carries food (sugars) made in the leaves to the rest of the plant. Xylem conduction is one-directional (upward) and is driven mainly by the transpiration pull from the leaves.

Step 1 — Read the figure: the tissue marked X conducts water upward from the roots.

Step 2 — Name it: the upward-conducting tissue for water and minerals is the xylem.

Why each other option is wrong:

- (A) Phloem conducts food (sugars), not water and minerals.
- (B) Cambium is a layer of dividing cells that adds new xylem and phloem; it does not conduct.
- (D) The epidermis is the protective outer layer, not a conducting tissue.

Key point: Xylem = water and minerals upward; phloem = food in both directions. Remember "xylem carries water".

Final Answer: Xylem $\Rightarrow$ C

Answer: (C) Go Back to Q10

Q11.

Solution

Concept — Hydrochloric acid in the stomach: The gastric glands of the stomach secrete hydrochloric acid (HCl) along with the inactive enzyme pepsinogen. The HCl makes the stomach contents strongly acidic. This acidic medium has two main roles: it kills most germs (bacteria) that enter with the food, and it converts the inactive pepsinogen into the active enzyme pepsin, which then digests proteins.

Step 1 — Recall the two roles of HCl: kills germs and provides an acidic medium.

Step 2 — Pick the second role: the acid activates pepsin from pepsinogen.

Why each other option is wrong:

- (A) Fats are digested by lipase (helped by bile), not directly by HCl.

- (C) Glucose is absorbed in the small intestine, not handled by stomach acid.
- (D) HCl makes the medium acidic, not alkaline.

Key point: HCl = germ-killing + activating pepsin (pepsinogen → pepsin) in an acidic medium needed for protein digestion.

Final Answer: Activates the enzyme pepsin ⇒ B

Answer: (B) Go Back to Q11

Q12.

Solution

Concept — Absorption in the small intestine: Digestion is completed in the small intestine, and it is also the main site of absorption of digested food. Its inner wall is folded and covered with millions of tiny finger-like projections called villi. The villi greatly increase the surface area and are richly supplied with blood and lymph, so the simple sugars, amino acids, and fatty acids pass into the blood here.

Step 1 — Read the figure: the finger-like villi belong to the lining of the small intestine.

Step 2 — Locate absorption: because the villi maximise surface area, most absorption of digested food occurs in the small intestine.

Why each other option is wrong:

- (A) The mouth only begins digestion (of starch); little is absorbed there.
- (B) The stomach digests proteins but absorbs very little food.
- (C) The large intestine mainly absorbs water and some salts, not digested food.

Key point: Villi → large surface area → small intestine is the chief site of absorption of digested nutrients.

Final Answer: Small intestine ⇒ D

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Peristalsis: The wall of the alimentary canal has layers of smooth muscle. As food enters, these muscles contract just behind the food and relax just ahead of it, producing rhythmic wave-like movements. These waves, called peristalsis, push the food forward all along the gut, from the food-pipe (oesophagus) right through to the rectum.

Step 1 — Identify the movement: a wave-like muscular movement that moves food along the gut.

Step 2 — Name it: this movement is peristalsis.

Why each other option is wrong:

- (B) Digestion is the chemical breakdown of food, not a movement.
- (C) Assimilation is the use of absorbed food by body cells.
- (D) Egestion is the removal of undigested waste (defaecation).

Key point: Peristalsis = the rhythmic muscular wave that propels food through the digestive tract; it works even against gravity.

Final Answer: Peristalsis $\Rightarrow$ A

Answer: (A) Go Back to Q13

Q14.

Solution

Concept — White blood cells and immunity: White blood cells (leucocytes) are the colourless cells of the blood that have a nucleus but no haemoglobin. Their main job is defence: they protect the body against germs. Some types (such as phagocytes) engulf and destroy bacteria, while others (lymphocytes) produce antibodies. Thus WBCs form the body's main immune defence.

Step 1 — Recall the role of WBCs: they are the body's defence cells.

Step 2 — Match it: WBCs defend the body against germs and provide immunity.

Why each other option is wrong:

- (A) Carrying oxygen is the job of red blood cells (using haemoglobin).
- (B) Clotting of blood is helped by platelets, not WBCs.
- (D) Transport of carbon dioxide is mainly done by red blood cells and plasma.

Key point: RBCs carry oxygen, platelets help clotting, and WBCs defend the body (immunity). Each blood cell has its own role.

Final Answer: Defend the body against germs $\Rightarrow$ C

Answer: (C) Go Back to Q14

Q15.

Solution

Concept — Platelets and clotting: Blood platelets (thrombocytes) are tiny, colourless cell fragments without a nucleus. When a blood vessel is injured, the platelets collect at the wound and release chemicals that start the clotting process. The clot seals the cut, stops bleeding, and prevents the entry of germs. A low platelet count leads to delayed clotting and excessive bleeding.

Step 1 — Identify the function: the blood cells that help blood to clot at a wound.

Step 2 — Name them: these are the platelets.

Why each other option is wrong:

- (A) Red blood cells carry oxygen; they do not start clotting.
- (C) White blood cells fight germs (immunity), not clotting.
- (D) Plasma proteins like fibrinogen help form the clot, but the cell fragments asked for are the platelets.

Key point: Platelets = clotting of blood. They trigger the clot that seals an injured vessel.

Final Answer: Platelets $\Rightarrow$ B

Answer: (B) Go Back to Q15

Q16.

Solution

Concept — Veins: Blood vessels are of three kinds. Arteries carry blood away from the heart, veins carry blood towards the heart, and capillaries connect the two. Veins have thinner walls and wider lumens than arteries and contain valves that stop the blood from flowing backward, so the blood keeps moving towards the heart.

Step 1 — Read the figure: the arrow shows blood moving towards the heart.

Step 2 — Name the vessel: a vessel that carries blood towards the heart is a vein.

Why each other option is wrong:

- (A) An artery carries blood away from the heart, the opposite direction.
- (B) The aorta is the largest artery and carries blood away from the heart.
- (C) A capillary is a tiny vessel that links arteries to veins for exchange.

Key point: Arteries carry blood *away from* the heart; veins carry blood *towards* the heart. Veins also have valves to prevent backflow.

Final Answer: Vein $\Rightarrow$ D

Answer: (D) Go Back to Q16

Q17.

Solution

Concept — The cerebellum: The human brain has three main parts: the cerebrum, the cerebellum, and the medulla oblongata. The cerebellum lies below and behind the cerebrum. Its job is to maintain balance and posture and to coordinate muscular activity so that movements such as walking, writing, and cycling are smooth and accurate.

Step 1 — Read the figure: the part marked X at the back, below the cerebrum, is the cerebellum.

Step 2 — Match the function: balance and coordination of muscular activity are controlled by the cerebellum.

Why each other option is wrong:

- (B) The cerebrum controls thinking, memory, and voluntary actions.
- (C) The medulla oblongata controls involuntary actions such as heartbeat and breathing.
- (D) The hypothalamus controls body temperature, hunger, and thirst.

Key point: Cerebellum = balance and coordination. Damage to it causes loss of balance and jerky, uncoordinated movements.

Final Answer: Cerebellum $\Rightarrow$ A

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — The medulla oblongata: The medulla oblongata is the lowest part of the brain, lying at its base where it joins the spinal cord. It controls many involuntary (automatic) activities of the body, such as the heartbeat, breathing, blood pressure, swallowing, coughing, sneezing, and vomiting. Because these vital functions are essential for life, the medulla is sometimes called the vital centre.

Step 1 — Identify the location and role: the part at the base of the brain that controls involuntary vital actions.

Step 2 — Name it: this is the medulla oblongata.

Why each other option is wrong:

- (A) The cerebrum controls thinking, memory, and voluntary movements.
- (B) The cerebellum controls balance and coordination.
- (D) The pituitary gland is an endocrine gland, not a region that controls heartbeat and breathing.

Key point: Medulla oblongata = involuntary vital functions (heartbeat, breathing). It keeps these going even during sleep.

Final Answer: Medulla oblongata $\Rightarrow$ C

Answer: (C) Go Back to Q18

Q19.

Solution

Concept — The pituitary, the master gland: The pituitary gland is a small, pea-sized endocrine gland attached to the base of the brain, just below the hypothalamus. It secretes several hormones, many of which control the activity of other endocrine glands (such as the thyroid, adrenal cortex, and gonads). Because it directs these other glands, it is called the master gland of the body.

Step 1 — Read the clue: a pea-sized gland at the base of the brain that controls other glands.

Step 2 — Name it: this master gland is the pituitary gland.

Why each other option is wrong:

- (A) The thyroid secretes thyroxine, which controls metabolism, but is itself controlled by the pituitary.

- (C) The adrenal gland secretes adrenaline and is also regulated by the pituitary.
- (D) The pancreas secretes insulin and is not the master gland.

Key point: Pituitary = master gland; it controls many other endocrine glands. It is itself guided by the hypothalamus.

Final Answer: Pituitary gland $\Rightarrow$ B

Answer: (B) Go Back to Q19

Q20.

Solution

Concept — The ovary: The ovaries are a pair of female reproductive organs (gonads). They have two functions. First, they produce the female gametes, the ova (eggs), one of which is usually released each month at ovulation. Second, they act as endocrine glands and secrete the female sex hormones, mainly oestrogen (and progesterone), which control the secondary sexual characters and the menstrual cycle.

Step 1 — Identify the dual role: produce ova and secrete oestrogen.

Step 2 — Name the organ: both functions belong to the ovary.

Why each other option is wrong:

- (A) The uterus is where the embryo implants and develops; it does not make ova.
- (B) The oviduct (fallopian tube) carries the egg and is the site of fertilization.
- (C) The vagina is the birth canal and receives sperm; it does not make eggs or hormones.

Key point: Ovary = ova (eggs) + oestrogen. It is both a gamete-producing organ and an endocrine gland.

Final Answer: Ovary $\Rightarrow$ D

Answer: (D) Go Back to Q20

Q21.

Solution

Concept — The menstrual cycle: In a mature human female, the reproductive system undergoes a regular monthly cycle called the menstrual cycle. On average it lasts about 28 days. It includes the release of an egg (ovulation) around the middle of the cycle and, if the egg is not fertilised, the shedding of the uterine lining as menstruation. The cycle is controlled by hormones from the pituitary and the ovaries.

Step 1 — Recall the average length: the typical menstrual cycle is about 28 days.

Step 2 — Pick the matching option: 28 days.

Why each other option is wrong:

- (B) 7 days is roughly the length of the bleeding phase only, not the whole cycle.
- (C) 90 days is far longer than a normal cycle.
- (D) 365 days is one year, not a menstrual cycle.

Key point: An average menstrual cycle $\approx$ 28 days, with ovulation around day 14. The exact length varies slightly from person to person.

Final Answer: 28 days $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q21

Q22.

Solution

Concept — Binary fission in Amoeba: Amoeba is a single-celled organism that reproduces asexually by binary fission. In this process the nucleus divides first by mitosis, and then the cytoplasm divides, so the parent cell splits into two daughter cells of roughly equal size. Each daughter then grows into a full Amoeba. No gametes are involved, and one parent gives rise to two.

Step 1 — Read the figure: one parent cell divides into two equal daughter cells.

Step 2 — Name the process: division of one cell into two equal cells is binary fission.

Why each other option is wrong:

- (A) In budding a small outgrowth (bud) forms and detaches, as in yeast and Hydra; the products are unequal.

- (B) Spore formation produces many spores inside a structure, as in Rhizopus.
- (D) Regeneration is the regrowth of lost parts, as in Planaria.

Key point: Amoeba $\rightarrow$ binary fission (one into two equal cells). Budding gives unequal products; binary fission gives equal ones.

Final Answer: Binary fission $\Rightarrow$ C

Answer: (C) Go Back to Q22

Q23.

Solution

Concept — Human chromosome number: A normal human body (somatic) cell contains 46 chromosomes, arranged as 23 pairs. Of these, 22 pairs are autosomes and one pair is the sex chromosomes. This full set ($2n = 46$) is the diploid number. The gametes (egg and sperm) carry only half this number, 23 chromosomes each (the haploid number), so that fertilisation restores 46.

Step 1 — Recall the diploid number: a human body cell has 23 pairs of chromosomes.

Step 2 — Count them: $23 \times 2 = 46$ chromosomes.

Why each other option is wrong:

- (A) 23 is the haploid number found in a gamete (egg or sperm), not a body cell.
- (C) 48 is the chromosome number of the chimpanzee, not the human.
- (D) 92 would be twice the normal number and is not normal.

Key point: Body cell $= 46$ (23 pairs, diploid); gamete $= 23$ (haploid). Fertilisation $23 + 23 = 46$ restores the full set.

Final Answer: $46 \Rightarrow$ B

Answer: (B) Go Back to Q23

Q24.

Solution

Concept — Human sex chromosomes: One of the 23 pairs of human chromosomes is the sex chromosomes, which decide the sex of a person. A normal female has two X chromosomes (XX), so she is homogametic. A normal male has one X and one Y chromosome (XY), so he is heterogametic. The father's sperm (carrying either X or Y) therefore determines the sex of the child.

Step 1 — Recall the female set: a female is XX.

Step 2 — Recall the male set: a male is XY. So female and male are XX and XY respectively.

Why each other option is wrong:

- (A) XY and XX reverses the two; the female is XX, not XY.
- (B) XY and XY would make both sexes male.
- (C) XX and XX would make both sexes female.

Key point: Female = XX, male = XY. The sperm decides the sex of the baby, since the egg always carries an X.

Final Answer: XX and XY $\Rightarrow$ D

Answer: (D) Go Back to Q24

Q25.

Solution

Concept — Complementary base pairing: In a DNA double helix the two strands are joined by hydrogen bonds between their nitrogenous bases. The pairing is fixed and complementary: adenine (A) always pairs with thymine (T), and guanine (G) always pairs with cytosine (C). A pairs with T by two hydrogen bonds and G pairs with C by three. This A–T and G–C rule lets DNA copy itself accurately.

Step 1 — Read the figure: the rungs A–? and G–? need their complementary partners.

Step 2 — Apply the rule: A pairs with T and G pairs with C.

Why each other option is wrong:

- (B) A with G and T with C is wrong; a purine never pairs with another purine here.

- (C) A with C and G with T breaks the complementary rule.
- (D) A with A and G with G has like bases pairing, which does not happen.

Key point: Base-pairing rule: A–T and G–C. A purine (A or G) always pairs with a pyrimidine (T or C).

Final Answer: A with T and G with C $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q25

Q26.

Solution

Concept — The allele: A gene controls a particular character, and a gene can exist in two or more slightly different forms. Each such alternative form of a gene is called an allele. The different alleles occupy the same position (locus) on the homologous chromosomes and control the same trait, but they may produce different versions of it (for example, the alleles for tall and short, T and t).

Step 1 — Identify the term: the alternative form of a gene.

Step 2 — Name it: this is an allele.

Why each other option is wrong:

- (A) A gene is the unit of heredity itself; an allele is one of its alternative forms.
- (B) A chromosome is a long thread of DNA carrying many genes.
- (D) A nucleotide is the chemical building block of DNA, not a form of a gene.

Key point: Gene = unit of heredity; allele = an alternative form of that gene (e.g. T and t for height).

Final Answer: Allele $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q26

Q27.

Solution

Concept — Typhoid, a bacterial disease: Typhoid (enteric fever) is caused by the bacterium *Salmonella typhi*. It spreads through food and water contaminated with the bacterium, usually by poor sanitation. Its symptoms include sustained high fever, headache, and weakness. Because the pathogen is a bacterium, typhoid is classed as a bacterial disease and can be treated with antibiotics.

Step 1 — Identify the pathogen: *Salmonella typhi* is a bacterium.

Step 2 — Classify the disease: a disease caused by a bacterium is a bacterial disease.

Why each other option is wrong:

- (A) Viral diseases include AIDS, influenza, and dengue, not typhoid.
- (B) Protozoan diseases include malaria and amoebic dysentery.
- (C) Fungal diseases include ringworm and athlete's foot.

Key point: Typhoid = bacterial (*Salmonella typhi*), spread by contaminated food and water; it is treatable with antibiotics.

Final Answer: A bacterium $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q27

Q28.

Solution

Concept — Antibiotics: Antibiotics are medicines (originally obtained from microbes such as fungi and bacteria) that kill bacteria or stop their growth. Penicillin, streptomycin, and tetracycline are common examples. They work by blocking processes that are special to bacteria, such as cell-wall formation. Importantly, antibiotics do not work against viruses, because viruses lack those bacterial structures.

Step 1 — Recall what antibiotics target: they act against bacteria.

Step 2 — Pick the option: antibiotics are effective mainly against bacteria.

Why each other option is wrong:

- (A) Viral infections (such as the common cold and AIDS) are not cured by antibiotics; antiviral drugs are used instead.
- (C) Allergies are treated with antihistamines, not antibiotics.

- (D) Vitamin deficiencies are corrected by supplying the missing vitamin, not by antibiotics.

Key point: Antibiotics act against bacteria, not viruses. Overuse leads to antibiotic resistance, so they must be used only as prescribed.

Final Answer: Bacteria $\Rightarrow$ B

Answer: (B) Go Back to Q28

Q29.

Solution

Concept — PCR (polymerase chain reaction): PCR is a laboratory technique that makes millions of copies of a chosen segment of DNA in a few hours. It works by repeated cycles of heating and cooling: the DNA is denatured (strands separated), primers bind, and the enzyme DNA polymerase builds new strands. Each cycle doubles the amount of DNA, so the segment is amplified rapidly. PCR is widely used in DNA fingerprinting, diagnosis, and research.

Step 1 — Identify the need: a technique to make many copies of a DNA segment.

Step 2 — Name it: this amplification technique is PCR (polymerase chain reaction).

Why each other option is wrong:

- (B) Electrophoresis separates DNA fragments by size; it does not copy DNA.
- (C) Vaccination gives immunity against a disease; it is unrelated to copying DNA.
- (D) Pasteurisation is a heat treatment to kill microbes in milk.

Key point: PCR = rapid copying (amplification) of a DNA segment using DNA polymerase and repeated heating–cooling cycles.

Final Answer: PCR (polymerase chain reaction) $\Rightarrow$ A

Answer: (A) Go Back to Q29

Q30.

Solution

Concept — The food web: A food chain is a single straight-line path of energy flow (for example grass → insect → frog → snake). In nature, however, most organisms eat more than one kind of food and are eaten by more than one predator, so many food chains cross and link with one another. This network of interconnected food chains is called a food web, and it gives an ecosystem stability.

Step 1 — Read the figure: several food chains share organisms and are joined into a branching network.

Step 2 — Name it: a network of many interconnected food chains is a food web.

Why each other option is wrong:

- (A) A food chain is only a single linear sequence, not a network.
- (B) A trophic level is one feeding step (such as all the herbivores), not the whole network.
- (D) An ecological pyramid is a graph of numbers, biomass, or energy at each level.

Key point: Food chain = one straight path; food web = many chains linked together. A food web makes the ecosystem more stable.

Final Answer: Food web ⇒ C

Answer: (C) Go Back to Q30

Answer Key

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