AIIMS B.Sc Nursing Biology

Sample Paper – 6

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 organelle shown below has a smooth outer membrane and a folded inner membrane (cristae), carries its own DNA, and is bounded by a double membrane. This organelle is the:

double-membrane organelle

(A) mitochondrion

(B) lysosome

(C) ribosome

(D) Golgi apparatus

Q2. The jelly-like, semi-fluid material that fills the space between the nucleus and the cell membrane, and in which the cell organelles remain suspended, is the:

(A) cytoplasm

(B) nucleoplasm

(C) cell wall

(D) plasma membrane

Q3. The thread-like, gene-carrying structures shown inside the nucleus below, which become clearly visible only during cell division, are the:

nucleus

(A) centrioles

(B) chromosomes

(C) ribosomes

(D) lysosomes

Q4. The molecule that acts as the immediate energy currency of the cell, releasing energy when its terminal phosphate bond is broken, is:

(A) glucose

(B) DNA

(C) haemoglobin

(D) ATP

Q5. A biological catalyst that speeds up a biochemical reaction in the body without being used up, and which is mostly protein in nature, is an:

(A) enzyme

(B) hormone

(C) vitamin

(D) antibody

Q6. The two-word scientific naming system in which an organism is given a name made of its genus and its species (for example *Homo sapiens*) is called:

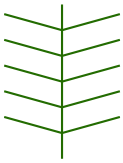
(A) taxonomy

(B) identification

(C) binomial nomenclature

(D) classification

Q7. The fern shown below is a pteridophyte. Unlike mosses (bryophytes), pteridophytes possess true roots, stems, and leaves because they have:



fern (pteridophyte)

(A) chlorophyll

(B) vascular (conducting) tissue

(C) a cell wall

(D) flowers

Q8. The three macronutrients required by plants in the largest amounts, and therefore the three elements supplied by most common fertilizers, are:

(A) carbon, hydrogen, and oxygen

(B) iron, zinc, and copper

(C) nitrogen, phosphorus, and potassium

(D) calcium, sulphur, and magnesium

Q9. The condition in which leaves turn yellow because of a lack of chlorophyll, often caused by a deficiency of nitrogen or magnesium, is called:

(A) necrosis

(B) etiolation

(C) wilting

(D) chlorosis

Q10. The process by which cells break down glucose to release the energy stored in it, mostly using oxygen and giving out carbon dioxide and water, is:

(A) cellular respiration

(B) photosynthesis

(C) transpiration

(D) digestion

Q11. The acidic digestive fluid secreted by the glands of the stomach wall, which contains hydrochloric acid and the enzyme pepsin, is called:

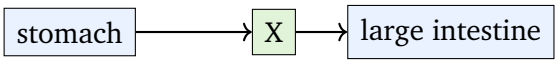
(A) bile

(B) gastric juice

(C) saliva

(D) pancreatic juice

Q12. In the human alimentary canal shown below, the long, coiled organ labelled X is where digestion is completed and where most of the absorption of digested food takes place. This organ is the:



(A) oesophagus

(B) rectum

(C) small intestine

(D) liver

Q13. The opening at the end of the alimentary canal through which undigested food (faeces) is finally egested out of the body is the:

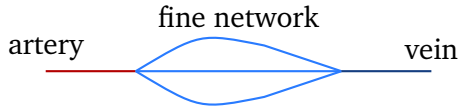
(A) mouth

(B) pharynx

(C) ureter

(D) anus

Q14. Between an artery and a vein lie the extremely thin-walled (one-cell-thick) blood vessels shown below, across which exchange of oxygen, nutrients, and wastes with the tissues takes place. These vessels are the:



(A) capillaries

(B) aorta

(C) venae cavae

(D) pulmonary arteries

Q15. In the schematic human heart shown below, the two upper chambers (shaded), which receive blood returning to the heart, are called the:

RA	LA
RV	LV

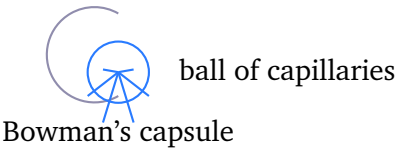
(A) ventricles

(B) atria (auricles)

(C) valves

(D) arteries

Q16. Within each nephron of the kidney, the tight ball of capillaries enclosed by the cup-shaped Bowman's capsule, where blood is filtered, is shown below. This ball of capillaries is the:



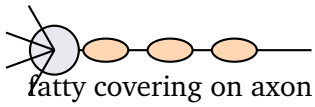
(A) ureter

(B) medulla

(C) glomerulus

(D) urethra

Q17. In the neuron shown below, the long axon is wrapped in a fatty, insulating covering (shaded segments) that speeds up the conduction of nerve impulses. This covering is the:



(A) dendrite

(B) synapse

(C) cell body

(D) myelin sheath

Q18. The longest and strongest bone in the human body, which forms the upper part of the leg (the thigh), is the:

(A) femur

(B) humerus

(C) stapes

(D) tibia

Q19. The enlargement of the thyroid gland in the neck, caused by a deficiency of the hormone thyroxine that results from a lack of iodine in the diet, is called:

(A) diabetes

(B) goitre

(C) anaemia

(D) rickets

Q20. The process in which a male gamete fuses with a female gamete to form a single cell called a zygote is known as:

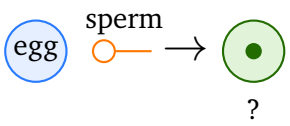
(A) pollination

(B) germination

(C) fertilization

(D) budding

Q21. In the diagram below, the single cell formed by the fusion of an egg and a sperm, which then divides repeatedly to develop into an embryo, is labelled. This cell is the:



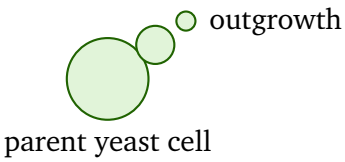
(A) ovum

(B) gamete

(C) spore

(D) zygote

Q22. The yeast cell shown below is reproducing asexually by producing a small outgrowth that enlarges and separates as a new cell. This method of asexual reproduction is called:



(A) budding

(B) binary fission

(C) fragmentation

(D) spore formation

Q23. A human body cell has 23 pairs of chromosomes. Of these, one pair is the sex chromosomes. The number of pairs of autosomes (non-sex chromosomes) is therefore:

(A) 46

(B) 23

(C) 22

(D) 44

Q24. A genetic disorder in which a person has three copies (instead of two) of chromosome number 21, leading to characteristic features and intellectual disability, is:

(A) haemophilia

(B) Down syndrome

(C) colour blindness

(D) sickle-cell anaemia

Q25. Mendel's law which states that, during the formation of gametes, the alleles of two different pairs of traits separate and combine independently of one another, is the law of:

(A) dominance

(B) segregation

(C) purity of gametes

(D) independent assortment

Q26. The preserved remains or impressions of organisms that lived in the past, found in rocks and regarded as direct evidence for organic evolution, are:

(A) fossils

(B) vestigial organs

(C) homologous organs

(D) analogous organs

Q27. AIDS (acquired immunodeficiency syndrome), a disease that weakens the body's immune system, is caused by the pathogen abbreviated as:

(A) TB bacterium

(B) *Plasmodium*

(C) HIV

(D) *Salmonella*

Q28. A disease that can spread from an infected person to a healthy person through air, water, food, or contact is called a:

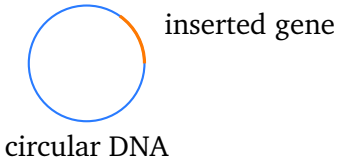
(A) deficiency disease

(B) communicable (infectious) disease

(C) hereditary disease

(D) degenerative disease

Q29. In genetic engineering, the small, circular DNA molecule found in bacteria (shown below) that is used as a vector to carry a desired gene into a host cell is called a:



(A) chromosome

(B) ribosome

(C) nucleus

(D) plasmid

Q30. In an ecosystem, the components shown in the shaded boxes below are the non-living physical parts that influence all the organisms. These non-living parts are called the:

air water soil light

(A) producers

(B) biotic components

(C) abiotic components

(D) decomposers

Detailed Solutions

Q1.

Solution

Concept — Mitochondria, the double-membrane organelle: The mitochondrion is bounded by two membranes. The smooth outer membrane encloses the organelle, while the inner membrane is thrown into folds called cristae, which carry the electron transport chain. Mitochondria also possess their own circular DNA and ribosomes, so they can make some of their own proteins, which is why they are described as semi-autonomous.

Step 1 — Read the figure: the oval body with an outer boundary, a separate inner folded membrane, and the label "double-membrane organelle" is the mitochondrion.

Step 2 — Match the clues: "own DNA", "double membrane", and "cristae" together point only to the mitochondrion.

Why each other option is wrong:

- (B) The lysosome is bounded by a single membrane and contains digestive enzymes.
- (C) The ribosome is a tiny non-membranous granule, not a double-membrane body.
- (D) The Golgi apparatus is a stack of single-membrane sacs that packages proteins.

Key point: Besides the nucleus, the mitochondrion is the organelle with its own DNA and a double membrane (the chloroplast in plants is the other).

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

Answer: (A) Go Back to Q1

Q2.

Solution

Concept — The cytoplasm: The cytoplasm is the thick, jelly-like, semi-fluid substance that fills the cell between the nucleus and the plasma membrane. All the cell organelles, such as mitochondria, ribosomes, and the endoplasmic reticulum, lie suspended in it, and many chemical reactions of the cell take place here.

Step 1 — Identify the location asked: the fluid between the nucleus and the cell

membrane that holds the organelles.

Step 2 — Name it: this region is the cytoplasm.

Why each other option is wrong:

- (B) Nucleoplasm is the fluid found *inside* the nucleus, not in the rest of the cell.
- (C) The cell wall is a rigid non-living outer layer (in plant cells), not a fluid.
- (D) The plasma membrane is the thin outer boundary of the cell, not the filling.

Key point: Cytoplasm = everything inside the cell membrane except the nucleus; the fluid inside the nucleus is the nucleoplasm.

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

Answer: (A) Go Back to Q2

Q3.

Solution

Concept — Chromosomes: Chromosomes are thread-like structures present in the nucleus. They are made of DNA and protein and carry the genes, which are the units of heredity. During most of the cell's life they are loosely spread out, but during cell division they coil up and condense, becoming thick enough to be seen under a microscope.

Step 1 — Read the figure: the coiled, thread-like bodies drawn inside the labelled nucleus represent chromosomes.

Step 2 — Match the description: "gene-carrying" and "visible during cell division" both fit chromosomes.

Why each other option is wrong:

- (A) Centrioles are paired cylindrical structures that help form the spindle, not gene carriers.
- (C) Ribosomes are protein-making granules, not thread-like nuclear structures.
- (D) Lysosomes are membrane sacs of digestive enzymes in the cytoplasm.

Key point: Genes are arranged along chromosomes; humans have 23 pairs of chromosomes in each body cell.

Final Answer: Chromosomes $\Rightarrow$ B

Answer: (B) Go Back to Q3

Q4.

Solution

Concept — ATP, the energy currency: ATP (adenosine triphosphate) is the molecule that stores and supplies energy for almost all cellular activities. It carries three phosphate groups, and the bond holding the last phosphate is a high-energy bond. When this bond is broken (ATP $\rightarrow$ ADP $+$ phosphate), energy is released for use by the cell.

Step 1 — Identify the role asked: the immediate, ready-to-use energy source whose terminal phosphate bond releases energy.

Step 2 — Name it: this is ATP.

Why each other option is wrong:

- (A) Glucose is a fuel store, but its energy must first be released and packaged into ATP before the cell can use it.
- (B) DNA stores genetic information, not usable energy.
- (C) Haemoglobin carries oxygen in the blood; it is not an energy molecule.

Key point: Glucose is the fuel, but ATP is the spendable "cash"; respiration converts the energy of glucose into ATP.

Final Answer: ATP $\Rightarrow$ D

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Enzymes as biological catalysts: Enzymes are biological catalysts that greatly speed up the chemical reactions in living cells without themselves being used up. They are mostly proteins, are highly specific for their substrates, and work best at a particular temperature and pH. Examples include amylase, pepsin, and lipase.

Step 1 — Identify the description: a substance that speeds up a reaction, is not consumed, and is protein in nature.

Step 2 — Name it: this is an enzyme.

Why each other option is wrong:

- (B) A hormone is a chemical messenger that regulates body functions; it is not a catalyst.
- (C) A vitamin is a micronutrient needed in tiny amounts; some help enzymes but are not themselves the catalyst.
- (D) An antibody is a defence protein that fights pathogens, not a metabolic catalyst.

Key point: Enzyme = biological catalyst, mostly protein, specific and reusable; it lowers the activation energy of a reaction.

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

Answer: (A) Go Back to Q5

Q6.

Solution

Concept — Binomial nomenclature: Binomial nomenclature, introduced by Carolus Linnaeus, is the system of giving every organism a scientific name made of two parts: the genus name (written first, with a capital letter) and the species name (written second, in small letters). For example, humans are *Homo sapiens*. The name is usually italicised or underlined.

Step 1 — Identify the system: a two-word name made of genus + species.

Step 2 — Name it: this is binomial nomenclature.

Why each other option is wrong:

- (A) Taxonomy is the whole science of naming, describing, and classifying organisms, not the two-word naming rule itself.
- (B) Identification is recognising and assigning an organism to a known group.
- (D) Classification is arranging organisms into groups; the two-name rule is one tool used within it.

Key point: Binomial = "two names"; the first word is the genus, the second is the species. Both together form the scientific name.

Final Answer: Binomial nomenclature $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q6

Q7.

Solution

Concept — Pteridophytes versus bryophytes: Pteridophytes (such as ferns) are the first land plants to have a proper vascular system, that is, conducting tissues called xylem and phloem. Xylem carries water and minerals while phloem carries food. Mosses (bryophytes) lack this vascular tissue, so they stay small and must live in moist places; ferns, having vascular tissue, can grow larger and develop true roots, stems, and leaves.

Step 1 — Read the figure: the plant with a stem and divided fronds is a fern, a pteridophyte.

Step 2 — State the key difference: ferns possess vascular (conducting) tissue, which mosses lack.

Why each other option is wrong:

- (A) Chlorophyll is present in mosses too, so it is not the distinguishing feature.
- (C) A cell wall is found in all plant cells, including mosses.
- (D) Ferns do not bear flowers; flowers appear only in angiosperms.

Key point: Bryophytes are non-vascular; pteridophytes are the first vascular plants, which lets them have true roots, stems, and leaves.

Final Answer: Vascular tissue $\Rightarrow$ B

Answer: (B) Go Back to Q7

Q8.

Solution

Concept — The N–P–K macronutrients: Plants need certain mineral elements in large amounts; these are the macronutrients. The three needed in the greatest quantity, and the three that soils most often run short of, are nitrogen (N), phosphorus (P), and potassium (K). Nitrogen builds proteins and chlorophyll, phosphorus is needed for energy transfer and roots, and potassium helps regulate water and enzyme activity. Most fertilizer bags are labelled with their N–P–K values.

Step 1 — Identify the demand: the three elements required in the largest

amounts.

Step 2 — Name them: nitrogen, phosphorus, and potassium.

Why each other option is wrong:

- (A) Carbon, hydrogen, and oxygen are obtained from air and water (CO_2 and H_2O), not from soil fertilizers.
- (B) Iron, zinc, and copper are micronutrients, needed only in trace amounts.
- (D) Calcium, sulphur, and magnesium are secondary or micro nutrients, needed in smaller amounts than N, P, and K.

Key point: The big three soil macronutrients are N, P, and K; remember them as the numbers printed on every fertilizer bag.

Final Answer: Nitrogen, phosphorus, potassium $\Rightarrow$ C

Answer: (C) Go Back to Q8

Q9.

Solution

Concept — Chlorosis: Chlorosis is the yellowing of leaves that occurs when a plant cannot make enough chlorophyll, the green pigment. Because nitrogen and magnesium are both needed to build chlorophyll, a shortage of either one is a common cause. Without chlorophyll the leaf loses its green colour and turns pale yellow, and photosynthesis falls.

Step 1 — Identify the symptom: leaves turning yellow due to a lack of chlorophyll.

Step 2 — Name the condition: this is chlorosis.

Why each other option is wrong:

- (A) Necrosis is the death and browning of tissue, not yellowing from low chlorophyll.
- (B) Etiolation is the pale, spindly growth of a plant kept in darkness.
- (C) Wilting is the drooping of a plant due to water loss, not a colour change from low chlorophyll.

Key point: Chlorosis = yellow leaves from too little chlorophyll, usually traced to nitrogen or magnesium deficiency.

Final Answer: Chlorosis $\Rightarrow$ D

Answer: (D) Go Back to Q9

Q10.

Solution

Concept — Cellular respiration: Cellular respiration is the process by which cells break down glucose to release the chemical energy locked inside it. In aerobic respiration, glucose is broken down with oxygen, producing carbon dioxide, water, and a large amount of energy that is captured as ATP. Much of this happens in the mitochondria.

Step 1 — Identify the process: the breakdown of glucose to release energy, using oxygen and giving out CO_2 and water.

Step 2 — Name it: this is cellular respiration.

Why each other option is wrong:

- (B) Photosynthesis is the opposite process; it *builds* glucose using light, not breaks it down.
- (C) Transpiration is the loss of water vapour from leaves, not glucose breakdown.
- (D) Digestion breaks large food molecules into smaller ones in the gut; it is not the energy-releasing oxidation of glucose inside cells.

Key point: Respiration releases energy from glucose (glucose $+ O_2 \rightarrow CO_2 + H_2O$ + energy); photosynthesis is the reverse.

Final Answer: Cellular respiration $\Rightarrow$ A

Answer: (A) Go Back to Q10

Q11.

Solution

Concept — Gastric juice: Gastric juice is the digestive fluid secreted by the gastric glands in the wall of the stomach. It contains hydrochloric acid (which makes it acidic, kills germs, and activates enzymes), the enzyme pepsin (which begins protein digestion), and mucus (which protects the stomach lining). The acidic medium is essential for pepsin to work.

Step 1 — Identify the fluid: an acidic stomach secretion containing HCl and pepsin.

Step 2 — Name it: this is gastric juice.

Why each other option is wrong:

- (A) Bile is made by the liver, is alkaline, and contains no digestive enzymes; it emulsifies fats.
- (C) Saliva is produced in the mouth and is mildly alkaline; it contains amylase, not pepsin.
- (D) Pancreatic juice is secreted by the pancreas into the small intestine and is alkaline, not acidic.

Key point: Gastric juice = HCl + pepsin + mucus; it is the only acidic digestive juice, and the acid activates pepsin from pepsinogen.

Final Answer: Gastric juice $\Rightarrow$ B

Answer: (B) Go Back to Q11

Q12.

Solution

Concept — The small intestine: The small intestine is the long, coiled part of the alimentary canal between the stomach and the large intestine. Here digestion is completed by bile, pancreatic juice, and intestinal juice, and the digested food is absorbed into the blood through millions of finger-like projections called villi, which give it a huge surface area.

Step 1 — Read the figure: organ X lies between the stomach and the large intestine.

Step 2 — Match the function: the place where digestion is completed and most absorption occurs is the small intestine.

Why each other option is wrong:

- (A) The oesophagus is the food pipe before the stomach; it only carries food, with no digestion.
- (B) The rectum is the last part of the large intestine; it stores faeces, not absorbs food.
- (D) The liver is a gland that secretes bile; it is not part of the food canal where absorption occurs.

Key point: The small intestine is the main site of digestion's completion and of nutrient absorption, helped by its villi.

Final Answer: Small intestine $\Rightarrow$ C

Answer: (C) Go Back to Q12

Q13.

Solution

Concept — The anus: The anus is the opening at the end of the alimentary canal. After water is absorbed in the large intestine, the undigested and unabsorbed material forms faeces, which is stored in the rectum and finally expelled (egested) from the body through the anus. This removal of faeces is called egestion or defecation.

Step 1 — Identify the function: the final opening through which faeces leave the body.

Step 2 — Name it: this is the anus.

Why each other option is wrong:

- (A) The mouth is the opening where food *enters*, the start of the canal.
- (B) The pharynx is the throat region behind the mouth that leads to the food pipe.
- (C) The ureter carries urine (not faeces) from the kidney to the bladder; it is part of the urinary system.

Key point: Food enters at the mouth and undigested waste leaves at the anus; egestion (faeces, via anus) is different from excretion (urine, via the urinary system).

Final Answer: Anus $\Rightarrow$ D

Answer: (D) Go Back to Q13

Q14.

Solution

Concept — Capillaries: Capillaries are the smallest and thinnest blood vessels, with walls only one cell thick. They form a fine network connecting the small arteries (arterioles) to the small veins (venules). Because their walls are so thin, oxygen, nutrients, carbon dioxide, and wastes are exchanged between the blood and the surrounding tissue cells across them.

Step 1 — Read the figure: the fine network of tiny vessels lying between the

artery and the vein represents the capillaries.

Step 2 — Match the function: exchange of materials with the tissues occurs across these thin-walled vessels.

Why each other option is wrong:

- (B) The aorta is the largest artery, with thick walls; no exchange happens there.
- (C) The venae cavae are the largest veins returning blood to the heart, not exchange vessels.
- (D) Pulmonary arteries are large vessels carrying blood to the lungs, not the exchange network.

Key point: Capillaries are one-cell-thick vessels where all exchange between blood and tissues takes place; arteries and veins only carry blood to and from them.

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

Answer: (A) Go Back to Q14

Q15.

Solution

Concept — The atria: The human heart has four chambers. The two upper chambers are the atria (singular: atrium), also called auricles. They are the receiving chambers: the right atrium receives deoxygenated blood from the body, and the left atrium receives oxygenated blood from the lungs. They then pass the blood down to the ventricles below.

Step 1 — Read the figure: the two shaded upper boxes (RA and LA) are the upper chambers.

Step 2 — Name them: the upper, receiving chambers are the atria.

Why each other option is wrong:

- (A) The ventricles are the two *lower* chambers, which pump blood out of the heart.
- (C) Valves are flaps between chambers that prevent the backflow of blood; they are not chambers.
- (D) Arteries are blood vessels that carry blood away from the heart, not chambers within it.

Key point: Atria (upper) receive blood; ventricles (lower) pump it out. Atria have

thinner walls than the muscular ventricles.

Final Answer: Atria $\Rightarrow$ B

Answer: (B) Go Back to Q15

Q16.

Solution

Concept — The glomerulus: Each nephron of the kidney begins with a cup-shaped Bowman's capsule that encloses a tight knot of capillaries called the glomerulus. Blood under pressure enters the glomerulus, and water, salts, glucose, urea, and other small molecules are filtered out of the blood into the capsule. This first step of urine formation is called ultrafiltration.

Step 1 — Read the figure: the ball of capillaries sitting inside the cup-shaped Bowman's capsule is the glomerulus.

Step 2 — Match the function: blood is filtered in this capillary ball, so it is the glomerulus.

Why each other option is wrong:

- (A) The ureter is the tube that carries urine from the kidney to the bladder, not a filtering ball.
- (B) The medulla is the inner region of the kidney, a zone, not a capillary cluster.
- (D) The urethra is the tube through which urine leaves the body from the bladder.

Key point: Glomerulus + Bowman's capsule = the filtering unit (Malpighian body) of the nephron, where ultrafiltration of blood occurs.

Final Answer: Glomerulus $\Rightarrow$ C

Answer: (C) Go Back to Q16

Q17.

Solution

Concept — The myelin sheath: In many neurons the axon is wrapped in a fatty, insulating covering called the myelin sheath. This sheath acts like the plastic insulation on an electric wire: it prevents the loss of the impulse and lets the nerve impulse jump quickly from gap to gap (the nodes of Ranvier), greatly speeding up conduction.

Step 1 — Read the figure: the shaded segments lying along the long axon are the fatty covering.

Step 2 — Match the description: the fatty, insulating, speed-boosting cover on the axon is the myelin sheath.

Why each other option is wrong:

- (A) Dendrites are the short branched fibres that *receive* impulses, not a covering on the axon.
- (B) A synapse is the junction between two neurons, not a sheath.
- (C) The cell body is the main part of the neuron containing the nucleus, not the axon's covering.

Key point: The myelin sheath insulates the axon and speeds up impulse conduction; gaps in it are the nodes of Ranvier.

Final Answer: Myelin sheath $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q17

Q18.

Solution

Concept — The femur: The femur, or thigh bone, is the longest, strongest, and heaviest bone in the human body. It runs from the hip to the knee and bears the weight of the body when standing and moving. Its strength comes from its thick shaft of compact bone.

Step 1 — Identify the clue: the longest and strongest bone, located in the thigh.

Step 2 — Name it: this is the femur.

Why each other option is wrong:

- (B) The humerus is the bone of the upper arm; it is long but shorter than the femur.

- (C) The stapes, in the middle ear, is the *smallest* bone in the body, the opposite of the femur.
- (D) The tibia is the larger bone of the lower leg (shin), but it is shorter than the femur.

Key point: Longest bone = femur (thigh); smallest bone = stapes (ear). Do not confuse the two extremes.

Final Answer: Femur $\Rightarrow$ A

Answer: (A) Go Back to Q18

Q19.

Solution

Concept — Goitre: The thyroid gland in the neck makes the hormone thyroxine, which needs iodine to be produced. If the diet lacks iodine, the gland cannot make enough thyroxine, so it enlarges and swells in an effort to trap more iodine. This visible swelling of the thyroid gland is called goitre.

Step 1 — Trace the cause: lack of iodine $\rightarrow$ too little thyroxine $\rightarrow$ enlarged thyroid.

Step 2 — Name the condition: the resulting neck swelling is goitre.

Why each other option is wrong:

- (A) Diabetes is caused by a lack of insulin from the pancreas, not by thyroxine or iodine.
- (C) Anaemia is a shortage of haemoglobin or red blood cells, often from iron deficiency.
- (D) Rickets is the softening of bones in children due to a deficiency of vitamin D.

Key point: Iodine deficiency $\rightarrow$ low thyroxine $\rightarrow$ goitre. Iodised salt is used to prevent it.

Final Answer: Goitre $\Rightarrow$ B

Answer: (B) Go Back to Q19

Q20.

Solution

Concept — Fertilization: Fertilization is the fusion of a male gamete (sperm) with a female gamete (egg or ovum) to form a single cell called a zygote. The zygote carries chromosomes from both parents and is the first cell of the new individual. In humans this fusion normally happens in the fallopian tube.

Step 1 — Identify the event: the fusion of a male and a female gamete to form a zygote.

Step 2 — Name it: this is fertilization.

Why each other option is wrong:

- (A) Pollination is the transfer of pollen from anther to stigma in plants; it comes *before* fertilization, not the fusion itself.
- (B) Germination is the sprouting of a seed or spore into a new plant.
- (D) Budding is a type of asexual reproduction (as in yeast), with no fusion of gametes.

Key point: Fertilization $=$ sperm $+$ egg $\rightarrow$ zygote; it is the key event of sexual reproduction.

Final Answer: Fertilization $\Rightarrow$ C

Answer: (C) Go Back to Q20

Q21.

Solution

Concept — The zygote: The zygote is the single diploid cell formed when an egg and a sperm fuse during fertilization. It contains one set of chromosomes from each parent. The zygote then divides repeatedly by mitosis to form a ball of cells, and over time develops into an embryo and finally a complete new organism.

Step 1 — Read the figure: the new single cell formed after the egg and sperm combine is shown on the right.

Step 2 — Name it: this fertilised cell is the zygote.

Why each other option is wrong:

- (A) The ovum (egg) is the female gamete *before* fertilization, not the fused cell.

- (B) A gamete is a sex cell (sperm or egg); the zygote is formed *from* two gametes.
- (C) A spore is a reproductive cell in some plants, fungi, and bacteria, formed without fusion of gametes.

Key point: Egg + sperm → zygote → embryo; the zygote is the very first cell of the new individual.

Final Answer: Zygote ⇒ D

Answer: (D) Go Back to Q21

Q22.

Solution

Concept — Budding in yeast: Yeast reproduces asexually by budding. A small bulge, or bud, grows out from the parent cell. The nucleus divides, and one copy passes into the bud, which enlarges and then either separates to become a new yeast cell or stays attached to form a short chain. No gametes and no fusion are involved.

Step 1 — Read the figure: a parent cell with a small outgrowth that is enlarging into a new cell.

Step 2 — Name the method: this outgrowth-based asexual reproduction is budding.

Why each other option is wrong:

- (B) In binary fission the parent splits into two equal cells (as in *Amoeba*), not a small bud from one side.
- (C) Fragmentation is the breaking of the body into pieces that each grow into a new individual (as in *Spirogyra*).
- (D) Spore formation produces many tiny spores inside a structure (as in *Rhizopus*), not a single side bud.

Key point: Yeast and *Hydra* reproduce by budding, where a new individual grows out as a bud from the parent.

Final Answer: Budding ⇒ A

Answer: (A) Go Back to Q22

Q23.

Solution

Concept — Autosomes: A human body cell contains 23 pairs of chromosomes, that is, 46 in total. Of these, one pair (the 23rd pair) is the sex chromosomes (XX in females, XY in males), which decide the sex of the individual. The remaining 22 pairs are called autosomes; they carry the genes for all the other body characters.

Step 1 — Start from the total: there are 23 pairs of chromosomes in all.

Step 2 — Subtract the sex pair: $23 - 1 = 22$ pairs of autosomes.

Why each other option is wrong:

- (A) 46 is the total *number* of chromosomes, not the number of autosome pairs.
- (B) 23 is the total number of chromosome *pairs*, which still includes the sex pair.
- (D) 44 is the total number of autosomes (as single chromosomes), not the number of *pairs*.

Key point: 23 pairs total $=$ 22 pairs of autosomes $+$ 1 pair of sex chromosomes.

Final Answer: 22 pairs $\Rightarrow$ C

Answer: (C) Go Back to Q23

Q24.

Solution

Concept — Down syndrome: Down syndrome is a genetic disorder caused by the presence of an extra copy of chromosome number 21, so the person has three copies of it instead of the usual two (a condition called trisomy 21). This extra chromosome leads to characteristic facial features, slower growth, and some degree of intellectual disability.

Step 1 — Identify the cause: an extra (third) copy of chromosome 21.

Step 2 — Name the disorder: this is Down syndrome.

Why each other option is wrong:

- (A) Haemophilia is a sex-linked disorder of blood clotting caused by a faulty gene, not an extra chromosome.
- (C) Colour blindness is a sex-linked gene defect affecting colour vision, not a chromosome-number disorder.

- (D) Sickle-cell anaemia is caused by a point mutation in the haemoglobin gene, not by an extra chromosome.

Key point: Down syndrome = trisomy 21 (an extra chromosome 21); the others listed are gene-level disorders, not extra-chromosome ones.

Final Answer: Down syndrome $\Rightarrow$ B

Answer: (B) Go Back to Q24

Q25.

Solution

Concept — Law of independent assortment: Mendel's law of independent assortment states that when two pairs of contrasting traits are inherited together (a dihybrid cross), the alleles of one pair separate and pass into the gametes independently of the alleles of the other pair. In other words, the inheritance of one trait does not affect the inheritance of the other, which is why a dihybrid cross gives the 9:3:3:1 ratio.

Step 1 — Identify the situation: the law deals with two pairs of traits inherited together.

Step 2 — Name the law: the alleles of the two pairs assort independently, so this is the law of independent assortment.

Why each other option is wrong:

- (A) The law of dominance explains why only the dominant trait shows in a heterozygote, dealing with a single pair.
- (B) The law of segregation says the two alleles of *one* pair separate during gamete formation, again a single pair.
- (C) "Purity of gametes" is another name for segregation (each gamete carries only one allele), not the two-pair law.

Key point: Segregation = one pair of alleles separates; independent assortment = two (or more) pairs separate independently of each other.

Final Answer: Independent assortment $\Rightarrow$ D

Answer: (D) Go Back to Q25

Q26.

Solution

Concept — Fossils as evidence of evolution: Fossils are the preserved remains, impressions, or traces of organisms that lived long ago, usually found buried in rocks. By studying fossils of different ages, scientists can trace how organisms changed gradually over millions of years. Because they show actual past forms and the links between groups, fossils are regarded as direct evidence for organic evolution.

Step 1 — Identify the description: preserved remains in rocks that are direct evidence for evolution.

Step 2 — Name them: these are fossils.

Why each other option is wrong:

- (B) Vestigial organs are reduced, functionless body parts (like the appendix); they are evidence, but not the preserved remains of past organisms.
- (C) Homologous organs have the same basic structure but different functions; they are anatomical evidence, not fossils.
- (D) Analogous organs have different structures but the same function; again anatomical evidence, not fossils.

Key point: Fossils give *direct* (palaeontological) evidence of evolution; homologous, analogous, and vestigial organs give anatomical evidence.

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

Answer: (A) Go Back to Q26

Q27.

Solution

Concept — HIV and AIDS: AIDS is caused by a virus called HIV (human immunodeficiency virus). HIV attacks and destroys the helper T-cells (a type of white blood cell), gradually weakening the body's immune system so that the person can no longer fight off other infections. It spreads mainly through unprotected sexual contact, infected blood, shared needles, and from mother to child.

Step 1 — Identify the pathogen type: AIDS is a viral disease.

Step 2 — Name the virus: the virus is HIV.

Why each other option is wrong:

- (A) The TB bacterium (*Mycobacterium tuberculosis*) causes tuberculosis, a bacterial lung disease, not AIDS.
- (B) *Plasmodium* is a protozoan that causes malaria, not AIDS.
- (D) *Salmonella* is a bacterium that causes typhoid, not AIDS.

Key point: AIDS = disease; HIV = the virus that causes it. HIV attacks the immune system's T-cells.

Final Answer: HIV $\Rightarrow$ C

Answer: (C) Go Back to Q27

Q28.

Solution

Concept — Communicable diseases: A communicable (or infectious) disease is one caused by a pathogen, such as a bacterium, virus, fungus, or protozoan, that can be passed from an infected person to a healthy person. It may spread through the air, water, food, insect vectors, or direct contact. Examples include the common cold, tuberculosis, cholera, and AIDS.

Step 1 — Identify the property: a disease that spreads from person to person.

Step 2 — Name the type: this is a communicable (infectious) disease.

Why each other option is wrong:

- (A) A deficiency disease results from a lack of a nutrient (like scurvy from vitamin C); it cannot spread.
- (C) A hereditary disease is passed through genes from parent to child, not from person to person by contact.
- (D) A degenerative disease develops from the wearing out of tissues with age; it is not infectious.

Key point: Communicable = caused by pathogens and spreads between people; non-communicable diseases (deficiency, hereditary, degenerative) do not spread by contact.

Final Answer: Communicable disease $\Rightarrow$ B

Answer: (B) Go Back to Q28

Q29.

Solution

Concept — Plasmids as vectors: A plasmid is a small, circular piece of DNA found in bacteria, separate from the main bacterial chromosome. Plasmids can replicate on their own and can be cut open so that a desired gene is inserted into them. The recombinant plasmid is then put into a host cell, where it carries and multiplies the new gene. This is why plasmids are widely used as vectors in genetic engineering.

Step 1 — Read the figure: the small circular DNA carrying an inserted gene is a plasmid.

Step 2 — Match the role: a circular DNA vector used to carry a gene into a host cell is the plasmid.

Why each other option is wrong:

- (A) A chromosome is the large, main DNA molecule of the cell, not the small circular vector.
- (B) A ribosome is a protein-making granule, not made of carrier DNA.
- (C) The nucleus is the organelle that holds the chromosomes; it is not a gene-carrying vector.

Key point: Plasmid = small circular bacterial DNA used as a vector to ferry genes into a host cell in genetic engineering.

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

Answer: (D) Go Back to Q29

Q30.

Solution

Concept — Abiotic components: An ecosystem is made of two kinds of components. The biotic components are the living things (plants, animals, microbes), while the abiotic components are the non-living physical and chemical parts, such as air, water, soil, sunlight, temperature, and minerals. The abiotic factors set the conditions in which the living organisms grow and interact.

Step 1 — Read the figure: air, water, soil, and light are all non-living physical factors.

Step 2 — Name the group: these non-living parts are the abiotic components.

Why each other option is wrong:

- (A) Producers are living green plants that make food; they are biotic, not non-living.
- (B) Biotic components are the *living* parts of the ecosystem, the opposite of what is shown.
- (D) Decomposers are living microbes (bacteria and fungi) that break down dead matter; they too are biotic.

Key point: Abiotic = non-living (air, water, soil, light); biotic = living (producers, consumers, decomposers).

Final Answer: Abiotic components $\Rightarrow$ C

Answer: (C) Go Back to Q30

Answer Key

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