AIIMS B.Sc Nursing Biology

Sample Paper – 2

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, bounded by a porous double membrane and holding the cell's thread-like DNA, is the one that controls all cell activities. It is the:

(A) nucleus

(B) ribosome

(C) lysosome

(D) vacuole

Q2. Proteins made on the rough endoplasmic reticulum are sent to a stack of flattened membrane sacs that modify, sort, and pack them into vesicles for dispatch. This packaging-and-dispatch organelle is the:

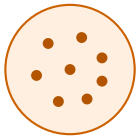
(A) mitochondrion

(B) nucleus

(C) Golgi apparatus

(D) ribosome

Q3. The membrane-bound sac shown below is full of powerful digestive enzymes and can burst to digest the cell's own worn-out parts, which is why it is called the "suicide bag" of the cell. It is the:



enzymes

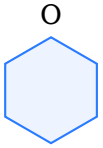
(A) chloroplast

(B) lysosome

(C) ribosome

(D) centriole

Q4. Carbohydrates such as starch are polymers built from a single repeating sugar unit, shown below as a six-membered ring. This monomer unit (a monosaccharide) is:



one sugar ring

(A) glucose

(B) glycerol

(C) an amino acid

(D) a nucleotide

Q5. A substance that speeds up a biochemical reaction in a living cell without being used up, and which is chemically a protein, is best described as a:

(A) vitamin

(B) hormone

(C) carbohydrate

(D) biological catalyst (enzyme)

Q6. The two-part system of scientific naming, in which every species is given a genus name and a species name (for example *Homo sapiens*), was introduced by:

(A) Charles Darwin

(B) Gregor Mendel

(C) Carolus Linnaeus

(D) R. H. Whittaker

Q7. The five-kingdom system of classification — Monera, Protista, Fungi, Plantae, and Animalia — was proposed by:

(A) Carolus Linnaeus

(B) R. H. Whittaker

(C) Charles Darwin

(D) Ernst Haeckel

Q8. Apart from sunlight and chlorophyll, the two raw materials a green leaf must take in to carry out photosynthesis are:

(A) carbon dioxide and water

(B) oxygen and water

(C) glucose and oxygen

(D) nitrogen and water

Q9. During photosynthesis the leaf converts its raw materials, using light energy, into two products. These products are:

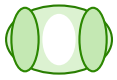
(A) carbon dioxide and water

(B) starch and nitrogen

(C) proteins and carbon dioxide

(D) glucose and oxygen

Q10. The tiny pore shown below, bounded by a pair of bean-shaped guard cells on the underside of a leaf, opens and closes to let gases move in and out. Its main job in the leaf is:



pore between guard cells

(A) making chlorophyll

(B) storing food

(C) gas exchange (and transpiration)

(D) absorbing water from soil

Q11. Bile, made by the liver and released into the small intestine, contains no digestive enzyme yet aids fat digestion. It does this by:

(A) digesting proteins into peptides

(B) breaking large fat droplets into tiny droplets (emulsifying fats)

(C) converting starch into sugar

(D) absorbing glucose into the blood

Q12. The enzyme trypsin, present in the pancreatic juice that empties into the small intestine, digests:

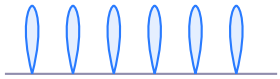
(A) proteins

(B) starch

(C) fats

(D) nucleic acids

Q13. The inner wall of the small intestine carries millions of the finger-like projections shown below. Their main role is to:



(A) secrete bile into the gut

(B) produce hydrochloric acid

(C) move food by churning

(D) increase the surface area for absorption of digested food

Q14. A person whose red blood cells carry neither the A nor the B antigen can give blood safely to people of all ABO groups. This "universal donor" blood group is:

(A) AB

(B) O

(C) A

(D) B

Q15. A striking feature of a mature red blood cell in humans, which leaves more room for haemoglobin, is that it:

(A) lacks a nucleus

(B) has many nuclei

(C) contains chlorophyll

(D) is the largest cell in the body

Q16. Among the blood vessels of the human body, the arteries are the ones that:

(A) carry blood away from the heart

(B) carry blood towards the heart

(C) have valves along their length to stop backflow

(D) are the smallest vessels, one cell thick

Q17. When you touch a hot object, your hand pulls back instantly, before the brain even registers the pain. This rapid, automatic reflex action is controlled mainly by the:

(A) cerebrum

(B) cerebellum

(C) spinal cord (through a reflex arc)

(D) pituitary gland

Q18. The thyroid gland in the neck secretes a hormone that controls the rate of metabolism, and it needs a particular mineral to make this hormone. The hormone and the required mineral are:

(A) insulin, needing zinc

(B) thyroxine, needing iodine

(C) adrenaline, needing calcium

(D) growth hormone, needing iron

Q19. When a person is suddenly frightened, the heartbeat quickens and the body is readied for "fight or flight". The hormone responsible, adrenaline, is secreted by the:

(A) thyroid gland

(B) pancreas

(C) pituitary gland

(D) adrenal gland

Q20. The two human reproductive cells (gametes) are shown below. The small, tadpole-shaped, motile cell on the left and the large, rounded cell on the right are, respectively, the:

(A) ovum and sperm

(B) zygote and ovum

(C) sperm (male gamete) and ovum/egg (female gamete)

(D) embryo and sperm

Q21. In a flowering plant, the transfer of pollen grains from the anther to the stigma is the essential step that comes before fertilization. This transfer is called:

(A) germination

(B) fertilization

(C) transpiration

(D) pollination

Q22. Inside the uterus of a pregnant woman, a special disc-shaped structure links the mother's blood supply to the developing foetus, passing oxygen and nutrients to it and taking wastes away. This structure is the:

(A) placenta

(B) ovary

(C) fallopian tube

(D) cervix

Q23. Working with pea plants, this monk worked out the basic laws of inheritance and is honoured as the "Father of Genetics". He was:

(A) Charles Darwin

(B) Gregor Mendel

(C) Hugo de Vries

(D) Carolus Linnaeus

Q24. In a heterozygous individual that carries two different alleles for the same trait, the allele whose effect is actually seen in the organism is called the:

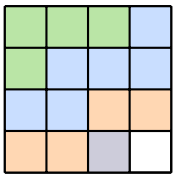
(A) recessive allele

(B) dominant allele

(C) hybrid allele

(D) mutant allele

Q25. When Mendel crossed pea plants differing in two traits (a dihybrid cross) and self-pollinated the F_1, the four kinds of offspring appeared in the F_2 generation, as suggested by the 16-box grid below. The F_2 phenotypic ratio is:



(A) $3:1$

(B) $1:2:1$

(C) $9:3:3:1$

(D) $1:1:1:1$

Q26. An organism that carries two identical alleles for a particular trait (for example TT or tt) is described as:

(A) heterozygous

(B) hybrid

(C) carrier

(D) homozygous

Q27. Tuberculosis, a disease that mainly affects the lungs and spreads through droplets in the air, is caused by:

(A) a virus

(B) a protozoan

(C) a fungus

(D) a bacterium (*Mycobacterium tuberculosis*)

Q28. The overall ability of the body to recognise and resist disease-causing germs, so that a person does not fall ill on exposure to them, is called:

(A) digestion

(B) respiration

(C) immunity

(D) excretion

Q29. The human insulin used to treat diabetics today is no longer taken from animals; it is now produced on a large scale by:

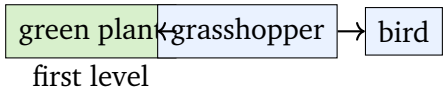
(A) recombinant DNA technology (genetically engineered bacteria)

(B) simple distillation of blood plasma

(C) grinding the human pancreas

(D) ordinary chemical synthesis in a test tube

Q30. In the food chain shown below, the green plants at the very start make their own food by photosynthesis and supply energy to all the organisms that follow. These first-trophic-level organisms are called:



(A) herbivores

(B) carnivores

(C) decomposers

(D) producers

Detailed Solutions

Q1.

Solution

Concept — The nucleus, control centre of the cell: The nucleus is a large organelle bounded by a double membrane (the nuclear envelope) that is dotted with nuclear pores. It stores the cell's hereditary material (DNA, organised as chromatin) and directs all cell activities — growth, metabolism, and reproduction — by controlling which proteins are made. It also contains a dense body, the nucleolus.

Step 1 — Read the figure: a large circle with a porous outline (nuclear pores) enclosing a smaller inner body (the nucleolus) is the nucleus.

Step 2 — Match clue to organelle: "stores DNA" and "controls the cell" both point only to the nucleus.

Why each other option is wrong:

- (B) The ribosome is a tiny granule that builds proteins; it does not store DNA.
- (C) The lysosome holds digestive enzymes for breaking down waste.
- (D) The vacuole is a storage sac for water, food, or waste.

Key point: The nucleus is the "brain" of the cell; it stores DNA and gives instructions, but the actual proteins are built later on the ribosomes.

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

Answer: (A) Go Back to Q1

Q2.

Solution

Concept — The Golgi apparatus: The Golgi apparatus (Golgi body) is a stack of flattened, membrane-bound sacs. It receives proteins and lipids made by the endoplasmic reticulum, then chemically modifies, sorts, and packs them into vesicles. These vesicles are dispatched to other parts of the cell or secreted out, so the Golgi is the cell's "packaging and dispatch" department.

Step 1 — Identify the function asked: the organelle that modifies, packs, and sends out cell products.

Step 2 — Match it: only the Golgi apparatus performs packaging and dispatch.

Why each other option is wrong:

- (A) The mitochondrion releases energy (ATP); it does not package products.
- (B) The nucleus stores DNA and controls the cell.
- (D) The ribosome only synthesises the proteins; it does not pack or dispatch them.

Key point: ER makes and the Golgi packs: think of the ER as the factory floor and the Golgi as the dispatch and post office of the cell.

Final Answer: Golgi apparatus $\Rightarrow$ C

Answer: (C) Go Back to Q2

Q3.

Solution

Concept — The lysosome, suicide bag of the cell: Lysosomes are small membrane-bound sacs filled with powerful hydrolytic (digestive) enzymes. They digest worn-out organelles, food particles taken in by the cell, and invading germs. If a cell is damaged or ageing, the lysosomes can burst and digest the cell itself, which is why the lysosome is nicknamed the "suicide bag".

Step 1 — Read the figure: a single membrane sac packed with enzyme granules represents a lysosome.

Step 2 — Match the clue: "digestive enzymes" plus "suicide bag" uniquely identify the lysosome.

Why each other option is wrong:

- (A) The chloroplast carries out photosynthesis and is found only in plant cells.
- (C) The ribosome builds proteins; it carries no digestive enzymes.
- (D) The centriole helps form the spindle during cell division.

Key point: Lysosome = digestion and "suicide bag". Its enzymes are kept safely inside a membrane so they do not digest the healthy cell.

Final Answer: Lysosome $\Rightarrow$ B

Answer: (B) Go Back to Q3

Q4.

Solution

Concept — Monomers of carbohydrates: Carbohydrates are energy-giving biomolecules built from small repeating sugar units. The simplest sugars, which cannot be broken into smaller carbohydrates, are the monosaccharides. Glucose is the most common monosaccharide and is the building block of starch, glycogen, and cellulose.

Step 1 — Read the figure: a single six-membered sugar ring (with an oxygen in the ring) is one monosaccharide unit.

Step 2 — Name the monomer: the monomer of carbohydrates is glucose (a monosaccharide).

Why each other option is wrong:

- (B) Glycerol, with fatty acids, builds fats, not carbohydrates.
- (C) An amino acid is the monomer of proteins.
- (D) A nucleotide is the monomer of nucleic acids (DNA and RNA).

Key point: Carbohydrate $\leftarrow$ monosaccharide (glucose); protein $\leftarrow$ amino acid; nucleic acid $\leftarrow$ nucleotide; fat $\leftarrow$ glycerol $+$ fatty acids.

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

Answer: (A) Go Back to Q4

Q5.

Solution

Concept — Enzymes as biological catalysts: An enzyme is a substance that speeds up a chemical reaction in a living organism without itself being used up or changed. Chemically, almost all enzymes are proteins. Each enzyme is highly specific, acting on one substrate (the "lock and key" idea), and works best at a particular temperature and pH.

Step 1 — Identify the description: "speeds up a reaction, not used up, chemically a protein".

Step 2 — Name it: this is a biological catalyst, i.e. an enzyme.

Why each other option is wrong:

- (A) A vitamin is a micronutrient needed in small amounts; it is not a catalyst protein (though some help enzymes work).

- (B) A hormone is a chemical messenger that regulates body processes, not a reaction catalyst.
- (C) A carbohydrate is an energy source, not a catalyst.

Key point: Enzyme = biological catalyst = protein. It lowers the energy needed for a reaction and is reused again and again.

Final Answer: Biological catalyst (enzyme) $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q5

Q6.

Solution

Concept — Binomial nomenclature: Binomial nomenclature is the system of giving every organism a two-part Latinised scientific name: the first part is the genus (written with a capital letter) and the second is the species (in small letters). This system was introduced by the Swedish naturalist Carolus Linnaeus and gives each species one universally accepted name.

Step 1 — Identify the system: two-part naming such as *Homo sapiens*.

Step 2 — Name its founder: Carolus Linnaeus.

Why each other option is wrong:

- (A) Charles Darwin proposed the theory of evolution by natural selection.
- (B) Gregor Mendel is the father of genetics.
- (D) R. H. Whittaker proposed the five-kingdom classification.

Key point: Linnaeus = binomial nomenclature and is also called the father of taxonomy. The genus name is capitalised; the species name is not.

Final Answer: Carolus Linnaeus $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q6

Q7.

Solution

Concept — The five-kingdom classification: In 1969 R. H. Whittaker divided all living organisms into five kingdoms — Monera (prokaryotes), Protista (unicellular eukaryotes), Fungi, Plantae, and Animalia. He based the grouping on cell structure, body organisation, mode of nutrition, and reproduction.

Step 1 — Identify the scheme: five kingdoms, Monera to Animalia.

Step 2 — Name its proposer: R. H. Whittaker.

Why each other option is wrong:

- (A) Linnaeus gave binomial nomenclature, not the five-kingdom system.
- (C) Darwin gave the theory of natural selection.
- (D) Haeckel proposed an earlier three-kingdom idea, not the five-kingdom one.

Key point: Whittaker = five kingdoms. The key novelty was placing fungi in a separate kingdom and separating prokaryotes (Monera) from eukaryotes.

Final Answer: R. H. Whittaker $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q7

Q8.

Solution

Concept — Raw materials of photosynthesis: Photosynthesis is the process by which green plants make their own food. Using light energy trapped by chlorophyll, the leaf combines two raw materials — carbon dioxide (taken in from the air through stomata) and water (drawn up from the soil by the roots). The overall reaction is: carbon dioxide + water $\xrightarrow{\text{light, chlorophyll}}$ glucose + oxygen.

Step 1 — Recall the inputs: the substances consumed are CO_2 and water.

Step 2 — Confirm: these are the raw materials; glucose and oxygen are the outputs.

Why each other option is wrong:

- (B) Oxygen is a *product*, not a raw material.
- (C) Glucose and oxygen are the *products* of photosynthesis.
- (D) Nitrogen is not used directly in photosynthesis; it is needed for proteins.

Key point: Inputs (raw materials) = CO_2 + water; outputs (products) = glucose + oxygen. Do not swap inputs and outputs.

Final Answer: Carbon dioxide and water $\Rightarrow$ A

Answer: (A) Go Back to Q8

Q9.

Solution

Concept — Products of photosynthesis: In photosynthesis the leaf uses light energy to turn carbon dioxide and water into food. The two products are glucose (a sugar that stores chemical energy, later changed to starch for storage) and oxygen (released into the air through the stomata as a by-product). The oxygen released is what most living things use for respiration.

Step 1 — Recall the equation: CO_2 + water $\rightarrow$ glucose + oxygen.

Step 2 — Identify the outputs: the products are glucose and oxygen.

Why each other option is wrong:

- (A) Carbon dioxide and water are the *raw materials*, not the products.
- (B) Nitrogen is not produced in photosynthesis.
- (C) Carbon dioxide is taken in, not given out, in photosynthesis.

Key point: Photosynthesis makes glucose (food) and releases oxygen; respiration does the reverse, using oxygen and releasing CO_2.

Final Answer: Glucose and oxygen $\Rightarrow$ D

Answer: (D) Go Back to Q9

Q10.

Solution

Concept — Stomata and gas exchange: Stomata are tiny pores, mostly on the lower surface of a leaf, each guarded by two bean-shaped guard cells. By swelling or shrinking, the guard cells open or close the pore. Through these pores the leaf takes in carbon dioxide for photosynthesis, lets out oxygen, and loses water vapour during transpiration.

Step 1 — Read the figure: a pore flanked by two curved guard cells is a stoma.

Step 2 — State the function: the stoma's main role is gas exchange (and water

loss as transpiration).

Why each other option is wrong:

- (A) Chlorophyll is made in chloroplasts inside the leaf cells, not by the stoma.
- (B) Food is stored in tissues, not produced by the pore.
- (D) Water is absorbed by the roots, not through leaf stomata.

Key point: Guard cells open and close the stoma; the stoma is the leaf's gateway for gases (CO_2 in, O_2 out) and for transpiration.

Final Answer: Gas exchange $\Rightarrow$ C

Answer: (C) Go Back to Q10

Q11.

Solution

Concept — Bile and fat digestion: Bile is a greenish-yellow fluid made by the liver and stored in the gall bladder. It contains no digestive enzyme. Its bile salts break large fat globules into many tiny droplets — a process called emulsification. This greatly increases the surface area on which the fat-digesting enzyme lipase can act, speeding up fat digestion.

Step 1 — Recall what bile does: bile has no enzyme but acts physically on fats.

Step 2 — Name the action: it emulsifies fats (breaks big droplets into small ones).

Why each other option is wrong:

- (A) Proteins are digested by enzymes such as pepsin and trypsin, not by bile.
- (C) Starch is digested by amylase, not by bile.
- (D) Absorption of glucose is done by the villi of the small intestine.

Key point: Bile does not digest fat by itself; it emulsifies fat so that lipase can finish the chemical digestion. Bile is also alkaline and neutralises stomach acid.

Final Answer: Emulsifies fats $\Rightarrow$ B

Answer: (B) Go Back to Q11

Q12.

Solution

Concept — Trypsin: Trypsin is a protein-digesting enzyme (a protease) present in the pancreatic juice. It is secreted in an inactive form (trypsinogen) and activated in the small intestine, where it breaks proteins and peptides into smaller peptides and amino acids in an alkaline medium.

Step 1 — Identify the enzyme type: trypsin is a protease.

Step 2 — State the substrate: it therefore acts on proteins.

Why each other option is wrong:

- (B) Starch is digested by amylase, not trypsin.
- (C) Fats are digested by lipase (helped by bile).
- (D) Nucleic acids are digested by nucleases.

Key point: Both pepsin (stomach, acidic) and trypsin (small intestine, alkaline) digest proteins, but trypsin comes from the pancreas and works in an alkaline gut.

Final Answer: Proteins $\Rightarrow$ A

Answer: (A) Go Back to Q12

Q13.

Solution

Concept — Villi of the small intestine: The inner lining of the small intestine is folded into millions of tiny finger-like projections called villi. Each villus has a rich blood supply and a lymph vessel (lacteal). By projecting into the gut, the villi enormously increase the surface area, so that the digested food (glucose, amino acids, fatty acids) is absorbed quickly and efficiently into the blood and lymph.

Step 1 — Read the figure: finger-like projections rising from the intestinal wall are villi.

Step 2 — State the role: they increase the surface area for absorption of digested food.

Why each other option is wrong:

- (A) Bile is made by the liver, not secreted by villi.
- (B) Hydrochloric acid is produced in the stomach, not by villi.
- (C) Churning of food is done by muscular movements (peristalsis), not by villi.

Key point: Villi = more surface area = faster absorption. The small intestine is the main site of both digestion completion and absorption.

Final Answer: Increase surface area for absorption $\Rightarrow$ D

Answer: (D) Go Back to Q13

Q14.

Solution

Concept — Universal donor: In the ABO blood group system, red cells may carry antigen A, antigen B, both, or neither. Blood group O carries *neither* A nor B antigen on its red cells, so when given to a recipient there is no A or B antigen for the recipient's antibodies to attack. For this reason group O (specifically O negative) is called the universal donor.

Step 1 — Identify the clue: red cells with no A and no B antigen.

Step 2 — Name the group: that is blood group O, the universal donor.

Why each other option is wrong:

- (A) Group AB has *both* antigens and is the universal *recipient*, not donor.
- (C) Group A carries the A antigen, so it cannot be given to all groups.
- (D) Group B carries the B antigen, so it too cannot be given to all groups.

Key point: O = universal donor (no antigens); AB = universal recipient (no antibodies in plasma). Do not confuse the two.

Final Answer: O $\Rightarrow$ B

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — The mature red blood cell: A mature mammalian red blood cell (erythrocyte) is a biconcave disc that loses its nucleus as it matures. Having no nucleus (and no other major organelles) leaves the whole cell free to be packed with haemoglobin, so it can carry the maximum amount of oxygen. The biconcave shape also adds surface area for gas exchange.

Step 1 — Recall the special feature: a human RBC has no nucleus.

Step 2 — Link to function: this leaves more room for haemoglobin and oxygen

carriage.

Why each other option is wrong:

- (B) RBCs have no nucleus at all, let alone many.
- (C) Chlorophyll is a plant pigment; blood cells carry haemoglobin instead.
- (D) The largest human cell is the ovum (egg), not the red blood cell.

Key point: Mammalian RBCs are enucleate (no nucleus) and biconcave — both features maximise oxygen transport. (In camels and other animals exceptions exist, but in humans RBCs lack a nucleus.)

Final Answer: Lacks a nucleus $\Rightarrow$ A

Answer: (A) Go Back to Q15

Q16.

Solution

Concept — Arteries: Arteries are the blood vessels that carry blood *away* from the heart to the body organs. They have thick, elastic, muscular walls to withstand the high pressure of blood pumped by the heart. With one exception (the pulmonary artery), arteries carry oxygenated blood and have no valves along their length.

Step 1 — Recall the definition: artery = vessel taking blood away from the heart.

Step 2 — Confirm: this matches option (A).

Why each other option is wrong:

- (B) Carrying blood *towards* the heart is the job of veins, not arteries.
- (C) Valves along the length are a feature of veins (to stop backflow), not arteries.
- (D) The smallest, one-cell-thick vessels are the capillaries.

Key point: Arteries carry blood *away* from the heart, veins carry it *towards* the heart; remember "A for Away".

Final Answer: Carry blood away from the heart $\Rightarrow$ A

Answer: (A) Go Back to Q16

Q17.

Solution

Concept — Reflex action and the spinal cord: A reflex action is a quick, automatic, involuntary response to a stimulus. The nerve pathway it follows is the reflex arc: a receptor senses the stimulus, a sensory neuron carries the message to the spinal cord, a relay neuron passes it to a motor neuron, and the motor neuron makes a muscle respond — all without waiting for the brain. The spinal cord is the centre that controls most such reflexes.

Step 1 — Identify the response: an instant, automatic withdrawal from a hot object.

Step 2 — Name the controller: the spinal cord, through the reflex arc.

Why each other option is wrong:

- (A) The cerebrum controls thinking and voluntary actions, which are slower than a reflex.
- (B) The cerebellum controls balance and coordination, not reflex withdrawal.
- (D) The pituitary gland secretes hormones; it has no role in reflexes.

Key point: A reflex is processed by the spinal cord so the body acts *before* the brain feels the pain; this protects the body from harm.

Final Answer: Spinal cord (reflex arc) $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q17

Q18.

Solution

Concept — The thyroid gland and thyroxine: The thyroid gland, located in the neck, secretes the hormone thyroxine. Thyroxine controls the basal metabolic rate (how fast the body uses energy) and is needed for normal growth and development. To make thyroxine, the gland must have the mineral iodine; a lack of iodine in the diet leads to the swelling of the thyroid called goitre.

Step 1 — Name the hormone: the thyroid secretes thyroxine.

Step 2 — Name the required mineral: thyroxine contains and needs iodine.

Why each other option is wrong:

- (A) Insulin is from the pancreas, not the thyroid, and is not iodine-based.

- (C) Adrenaline is from the adrenal gland, and does not need calcium to be made.
- (D) Growth hormone is from the pituitary, not the thyroid.

Key point: Thyroid → thyroxine → needs iodine; iodine deficiency causes goitre. This is why common salt is iodised.

Final Answer: Thyroxine, needing iodine ⇒ B

Answer: (B) Go Back to Q18

Q19.

Solution

Concept — Adrenaline, the fight-or-flight hormone: Adrenaline (epinephrine) is secreted by the adrenal glands, which sit like caps on top of the two kidneys. In moments of fear, anger, or excitement it prepares the body for emergency "fight or flight": it speeds up the heartbeat and breathing, widens the air passages, and sends more blood to the muscles.

Step 1 — Identify the hormone: the emergency "fight-or-flight" hormone is adrenaline.

Step 2 — Name the gland: it is secreted by the adrenal gland.

Why each other option is wrong:

- (A) The thyroid secretes thyroxine, which controls metabolism.
- (B) The pancreas secretes insulin and glucagon to control blood sugar.
- (C) The pituitary is the master gland; it secretes growth hormone and others, not adrenaline.

Key point: Adrenal glands sit atop the kidneys and release adrenaline for emergencies; "adrenal" and "renal (kidney)" share the same root because of this location.

Final Answer: Adrenal gland ⇒ D

Answer: (D) Go Back to Q19

Q20.

Solution

Concept — Human gametes: Gametes are the reproductive cells that fuse during fertilization. In humans the male gamete is the sperm — a small, motile cell with a head, a middle piece, and a long whip-like tail that lets it swim. The female gamete is the ovum (egg) — a large, rounded, non-motile cell that stores food for the early embryo.

Step 1 — Read the figure: the tiny tadpole-shaped cell with a tail on the left is the sperm; the large round cell on the right is the ovum.

Step 2 — Name them in order: left = sperm (male gamete), right = ovum/egg (female gamete).

Why each other option is wrong:

- (A) This reverses the order; the small tailed cell is the sperm, not the ovum.
- (B) A zygote forms only *after* fertilization; it is not a gamete.
- (D) An embryo is a later developmental stage, not a single gamete.

Key point: Male gamete = sperm (small, motile, with a tail); female gamete = ovum (large, rounded, non-motile). Their fusion gives the zygote.

Final Answer: Sperm and ovum $\Rightarrow$ C

Answer: (C) Go Back to Q20

Q21.

Solution

Concept — Pollination: Pollination is the transfer of pollen grains from the anther (the male part) to the stigma (the female part) of a flower. It may be self-pollination (within the same flower or plant) or cross-pollination (between two flowers), and is carried out by agents such as wind, water, and insects. Pollination must happen before fertilization can occur.

Step 1 — Identify the event: pollen moving from anther to stigma.

Step 2 — Name it: this transfer is called pollination.

Why each other option is wrong:

- (A) Germination is the sprouting of a seed or pollen tube, a later event.
- (B) Fertilization is the fusion of male and female gametes, which happens *after* pollination.

- (C) Transpiration is the loss of water vapour from a plant, unrelated to pollen.

Key point: Pollination (pollen transfer) comes first; fertilization (gamete fusion) follows. Do not confuse the two steps.

Final Answer: Pollination $\Rightarrow$ D

Answer: (D) Go Back to Q21

Q22.

Solution

Concept — The placenta: The placenta is a special disc-shaped organ that develops in the uterus during pregnancy. It forms a close connection between the mother's blood and the foetus's blood (without the two mixing). Through it, oxygen and nutrients pass from the mother to the foetus, and carbon dioxide and other wastes pass from the foetus back to the mother. The foetus is linked to the placenta by the umbilical cord.

Step 1 — Identify the role: the structure that nourishes the foetus and removes its wastes.

Step 2 — Name it: this is the placenta.

Why each other option is wrong:

- (B) The ovary produces eggs and hormones; it does not nourish the foetus.
- (C) The fallopian tube is where fertilization occurs, not where the foetus is fed.
- (D) The cervix is the narrow lower opening of the uterus, not a feeding organ.

Key point: The placenta is the foetus's lifeline for nutrition, gas exchange, and waste removal; the umbilical cord connects the foetus to it.

Final Answer: Placenta $\Rightarrow$ A

Answer: (A) Go Back to Q22

Q23.

Solution

Concept — The father of genetics: Gregor Johann Mendel, an Austrian monk, carried out careful breeding experiments on garden pea plants. From them he worked out the basic laws of inheritance — the law of dominance, the law of segregation, and the law of independent assortment. For this pioneering work he is called the Father of Genetics.

Step 1 — Recall the work: laws of inheritance from pea-plant experiments.

Step 2 — Name the scientist: Gregor Mendel.

Why each other option is wrong:

- (A) Charles Darwin is known for the theory of evolution by natural selection.
- (C) Hugo de Vries proposed the mutation theory of evolution.
- (D) Carolus Linnaeus founded binomial nomenclature and taxonomy.

Key point: Mendel = Father of Genetics (pea-plant laws). His work was rediscovered decades after his death and forms the basis of modern genetics.

Final Answer: Gregor Mendel $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q23

Q24.

Solution

Concept — Dominant and recessive alleles: An allele is one form of a gene. In a heterozygote, the two alleles are different. The dominant allele is the one whose effect is actually expressed (seen) in the organism, masking the other. The masked allele is the recessive allele, which shows its effect only when present in two copies (homozygous recessive).

Step 1 — Read the situation: a heterozygote carries two different alleles.

Step 2 — Identify the expressed one: the allele that is expressed is the dominant allele.

Why each other option is wrong:

- (A) The recessive allele is the one hidden in a heterozygote, not expressed.
- (C) "Hybrid" describes the heterozygous individual, not a type of allele.
- (D) A mutant allele is simply an altered allele; it need not be the expressed one.

Key point: In Tt, the dominant T is expressed (e.g. tall) while the recessive t is masked; a recessive trait shows only in tt.

Final Answer: Dominant allele $\Rightarrow$ B

Answer: (B) Go Back to Q24

Q25.

Solution

Concept — The dihybrid cross: A dihybrid cross follows two traits at once. When Mendel crossed pea plants differing in two traits (for example seed shape and seed colour) and self-pollinated the F_1 (RrYy $\times$ RrYy), the 16 boxes of the Punnett square gave four kinds of plants in the F_2 generation in the ratio 9 : 3 : 3 : 1.

Step 1 — Read the figure: the 4×4 grid of 16 boxes is the Punnett square of a dihybrid cross.

Step 2 — Group by phenotype: the boxes sort into four phenotype groups of 9, 3, 3, and 1.

Step 3 — Write the ratio: the F_2 phenotypic ratio is $9 : 3 : 3 : 1$.

Why each other option is wrong:

- (A) $3 : 1$ is the F_2 phenotype ratio of a *monohybrid* (one-trait) cross.
- (B) $1 : 2 : 1$ is the *genotype* ratio of a monohybrid cross.
- (D) $1 : 1 : 1 : 1$ is the ratio from a dihybrid *test cross*, not a self-cross.

Key point: Dihybrid F_2 phenotype $= 9 : 3 : 3 : 1$; monohybrid F_2 phenotype $= 3 : 1$. The $9 : 3 : 3 : 1$ comes from $(3 : 1) \times (3 : 1)$.

Final Answer: $9 : 3 : 3 : 1 \Rightarrow$ C

Answer: (C) Go Back to Q25

Q26.

Solution

Concept — Homozygous and heterozygous: For any gene, an organism carries two alleles. If the two alleles are identical — both dominant (TT) or both recessive (tt) — the organism is homozygous ("pure") for that trait and breeds true. If the two alleles are different (Tt), the organism is heterozygous (a hybrid).

Step 1 — Read the situation: two *identical* alleles, e.g. TT or tt.

Step 2 — Name the condition: this is homozygous.

Why each other option is wrong:

- (A) Heterozygous means the two alleles are *different* (Tt), the opposite of what is asked.
- (B) "Hybrid" is another word for heterozygous, again the opposite.
- (C) A "carrier" is a heterozygote that hides a recessive allele, not an organism with two identical alleles.

Key point: Homozygous = same alleles (TT or tt); heterozygous = different alleles (Tt). A homozygous plant breeds true for that trait.

Final Answer: Homozygous $\Rightarrow$ D

Answer: (D) Go Back to Q26

Q27.

Solution

Concept — Tuberculosis: Tuberculosis (TB) is an infectious disease that chiefly attacks the lungs. It is caused by the bacterium *Mycobacterium tuberculosis*, which spreads from an infected person to others through droplets released by coughing and sneezing. It can be prevented by the BCG vaccine and treated with a course of antibiotics.

Step 1 — Classify the pathogen: TB is caused by a bacterium.

Step 2 — Name it: the bacterium is *Mycobacterium tuberculosis*.

Why each other option is wrong:

- (A) A virus causes diseases such as AIDS, influenza, and the common cold, not TB.
- (B) A protozoan causes malaria, not tuberculosis.

- (C) A fungus causes diseases such as ringworm, not TB.

Key point: TB is bacterial (*Mycobacterium tuberculosis*); it is preventable by the BCG vaccine and curable with antibiotics taken for the full course.

Final Answer: A bacterium $\Rightarrow$ D

Answer: (D) Go Back to Q27

Q28.

Solution

Concept — Immunity: Immunity is the body's natural ability to recognise and resist disease-causing germs (pathogens) so that a person does not fall ill on being exposed to them. It is provided by the immune system — white blood cells, antibodies, and barriers such as the skin. Immunity may be inborn (innate) or acquired after an infection or vaccination.

Step 1 — Identify the ability described: resisting and fighting off disease germs.

Step 2 — Name it: this ability is called immunity.

Why each other option is wrong:

- (A) Digestion is the breaking down of food, not disease resistance.
- (B) Respiration is the release of energy from food using oxygen.
- (D) Excretion is the removal of metabolic wastes from the body.

Key point: Immunity = disease resistance, carried out by the immune system. Vaccination boosts acquired immunity by training the body against a specific germ.

Final Answer: Immunity $\Rightarrow$ C

Answer: (C) Go Back to Q28

Q29.

Solution

Concept — Human insulin by recombinant DNA technology: Recombinant DNA technology (genetic engineering) is the process of inserting a desired gene into the DNA of a host (usually a bacterium such as *E. coli*). The human insulin gene is put into bacteria, which then produce large amounts of genuine human insulin. This is safer and more reliable than the older method of extracting insulin from animal pancreas.

Step 1 — Recall how modern insulin is made: the human insulin gene is expressed in genetically engineered bacteria.

Step 2 — Name the method: recombinant DNA technology.

Why each other option is wrong:

- (B) Distillation of plasma does not produce insulin; insulin is a protein hormone made by cells.
- (C) Grinding the human pancreas is not a feasible or ethical commercial source.
- (D) Insulin is too large and complex a protein to be made by ordinary test-tube chemical synthesis on a commercial scale.

Key point: Modern human insulin is made by recombinant DNA technology in bacteria (first marketed as "Humulin"), giving a pure, plentiful, human-identical hormone.

Final Answer: Recombinant DNA technology $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q29

Q30.

Solution

Concept — Producers: In a food chain, energy flows from one feeding (trophic) level to the next. The green plants at the very start make their own food from carbon dioxide and water by photosynthesis. Because they produce food for the whole ecosystem and form the first trophic level, they are called producers (autotrophs). All other organisms depend, directly or indirectly, on them.

Step 1 — Read the figure: the green plant is the starting organism of the chain (first trophic level).

Step 2 — Name this group: the food-making first-level organisms are the producers.

Why each other option is wrong:

- (A) Herbivores (like the grasshopper) eat plants; they form the second trophic level (primary consumers).
- (B) Carnivores (like the bird) eat other animals; they are consumers, not producers.
- (C) Decomposers (bacteria, fungi) break down dead matter; they do not

occupy the first level here.

Key point: Producers = green plants = first trophic level (autotrophs). All consumers ultimately depend on producers for energy.

Final Answer: Producers $\Rightarrow$ D

Answer: (D) Go Back to Q30

Answer Key

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