

KIITEE Biology Sample Paper – 10

Duration: 50 Minutes

Maximum Marks: 160

Instructions

- This paper contains **40** Multiple Choice Questions (Single Correct Answer), modelled on the Biology portion of KIITEE entrance.
- Each correct answer carries **+4 marks**. There is **-1 mark per wrong answer**; unattempted questions score **0**.
- Only **one** option is correct. Choose carefully.
- Syllabus level: **Class 11 & 12 (10+2) Biology — Diversity of Life, Cell Biology, Plant & Human Physiology, Reproduction, Genetics & Evolution, Biotechnology and Ecology.**
- The test is computer based. Personal calculators, log tables, mobile phones, and other electronic gadgets are strictly prohibited.

Q1. A major criterion that R.H. Whittaker used to separate Kingdom Plantae from Kingdom Animalia was their mode of nutrition. On this basis the two kingdoms are distinguished as:

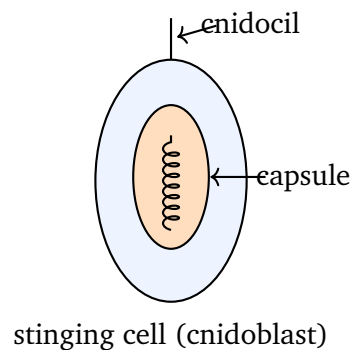
- (A) Prokaryotic versus eukaryotic
- (B) Unicellular versus multicellular
- (C) Autotrophic versus heterotrophic
- (D) Aquatic versus terrestrial

Q2. The class Deuteromycetes is popularly called “Fungi Imperfecti” because in these fungi only:

- (A) The sexual (perfect) stage is known
- (B) The asexual or vegetative phase is known
- (C) The obligate parasitic phase is known
- (D) The motile flagellated spore stage is known



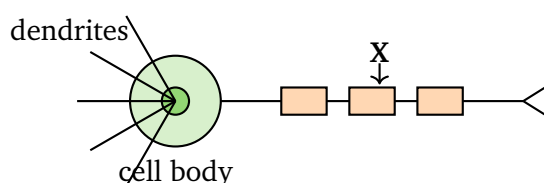
- Q3.** Cnidarians such as *Hydra* bear specialised stinging cells (cnidoblasts) on their tentacles. Each cnidoblast contains the capsule shown below, used to anchor prey and inject toxin. This stinging capsule is the:



- (A) Choanocyte
 (B) Flame cell
 (C) Collar cell
 (D) Nematocyst
- Q4.** The epithelium that bears motile hair-like projections on its free surface and lines the trachea and the fallopian tubes to propel mucus or the ovum is:

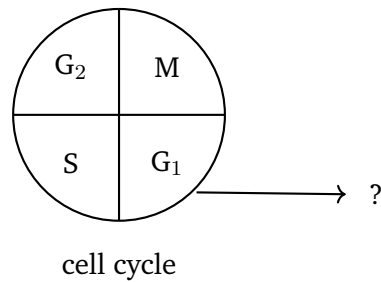
- (A) Ciliated columnar epithelium
 (B) Simple squamous epithelium
 (C) Glandular cuboidal epithelium
 (D) Stratified epithelium

- Q5.** In the neuron shown below, the single long process labelled X that conducts the nerve impulse away from the cell body towards the synapse is the:



- (A) Dendrite
(B) Nissl granule
(C) Axon
(D) Cyton (cell body)
- Q6.** A flower that can be divided into two equal halves by only one particular vertical plane (for example, pea and *Cassia*) is said to be:
- (A) Actinomorphic
(B) Zygomorphic
(C) Asymmetric
(D) Radially symmetrical
- Q7.** Colourless plastids that store food materials such as starch, oils and proteins, found mainly in the underground storage organs of plants, are called:
- (A) Chloroplasts
(B) Chromoplasts
(C) Etioplasts
(D) Leucoplasts
- Q8.** Several water-soluble vitamins serve as precursors of coenzymes. The coenzyme NAD^+ , a hydrogen acceptor in cellular respiration, is derived from the vitamin:
- (A) Niacin (vitamin B_3)
(B) Ascorbic acid (vitamin C)
(C) Retinol (vitamin A)
(D) Calciferol (vitamin D)
- Q9.** In the cell-cycle wheel shown, some cells leave the cycle and enter an inactive, non-dividing state (for example, mature neurons). This state is labelled and called:





- (A) The S phase
- (B) The quiescent G_0 phase
- (C) The M phase
- (D) The G_2 phase

Q10. In a plant tissue, the thin layer rich in calcium pectate that cements the walls of two adjacent cells together is the:

- (A) Primary wall
- (B) Secondary wall
- (C) Middle lamella
- (D) Plasma membrane

Q11. The plant hormone that promotes the closure of stomata during water stress and is therefore known as the “stress hormone” is:

- (A) Abscisic acid
- (B) Auxin
- (C) Gibberellin
- (D) Cytokinin

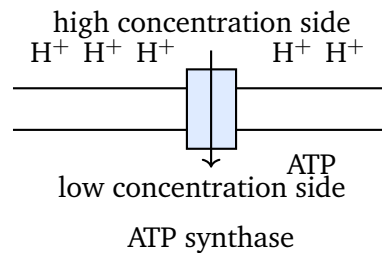
Q12. Deficiency of certain mineral elements such as magnesium or iron causes loss of chlorophyll, giving a yellowing of the leaves. This yellowing is specifically termed:

- (A) Etiolation
- (B) Necrosis



- (C) Senescence
- (D) Chlorosis

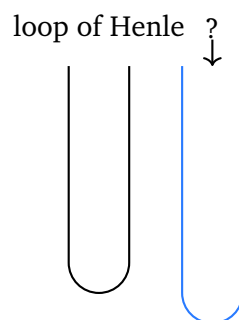
Q13. According to the chemiosmotic hypothesis, ATP is synthesised by ATP synthase using the energy stored in a gradient built up across the membrane, as shown. This gradient is a gradient of:



- (A) Sodium ions
 - (B) Electrons
 - (C) Protons (H⁺)
 - (D) Calcium ions
- Q14.** During alcoholic fermentation carried out by yeast in the absence of oxygen, each molecule of pyruvate is finally converted mainly into:
- (A) Lactic acid and water
 - (B) Ethanol and carbon dioxide
 - (C) Acetyl CoA and NADH
 - (D) Citric acid and oxygen
- Q15.** Practically no digestion of food occurs in the large intestine; its main physiological function is the absorption of:
- (A) Amino acids and glucose
 - (B) Fatty acids and glycerol
 - (C) Vitamins and proteins
 - (D) Water and electrolytes



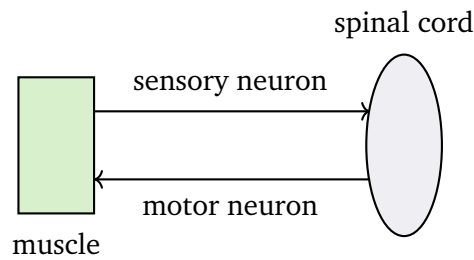
- Q16.** The basic rhythm of breathing in humans is generated and regulated by the respiratory centre located in the:
- (A) Medulla oblongata
 - (B) Cerebellum
 - (C) Hypothalamus
 - (D) Lower spinal cord
- Q17.** The normal blood pressure of a healthy human adult is about 120/80 mm Hg. The value 120 mm Hg represents the:
- (A) Diastolic pressure when ventricles relax
 - (B) Systolic pressure during ventricular contraction
 - (C) Pressure inside the right atrium
 - (D) Mean pressure in the pulmonary vein
- Q18.** In the diagram of the renal medulla, the U-shaped blood vessel drawn running parallel to the loop of Henle, which helps maintain the medullary concentration gradient by counter-current exchange, is the:



- (A) Afferent arteriole
 - (B) Cortical peritubular capillary
 - (C) Vasa recta
 - (D) Glomerular capillary tuft
- Q19.** The knee-jerk (stretch) reflex shown follows the path: receptor → sensory neuron → spinal cord → motor neuron → effector muscle. The



minimum number of neurons taking part in this simple (monosynaptic) reflex arc is:



- (A) Four
 - (B) Three, with two interneurons
 - (C) Only one
 - (D) Two: one sensory and one motor neuron
- Q20.** The hormone secreted by the adrenal cortex that increases the reabsorption of sodium ions and water from the renal tubules, raising blood volume, is:
- (A) Aldosterone
 - (B) Insulin
 - (C) Calcitonin
 - (D) Glucagon
- Q21.** The joint between the atlas vertebra and the axis, which allows the head to be turned from side to side, is an example of a:
- (A) Ball-and-socket joint
 - (B) Hinge joint
 - (C) Pivot joint
 - (D) Gliding joint
- Q22.** In many bisexual flowers the anthers and the stigma mature at different times, so that self-pollination is avoided. This outbreeding device is called:



- (A) Self-incompatibility
- (B) Dichogamy
- (C) Herkogamy
- (D) Dioecy

Q23. Human semen consists of sperms suspended in the secretions of the male accessory glands. The single largest contribution to the volume of seminal fluid comes from the:

- (A) Seminal vesicles
- (B) Testes
- (C) Bulbourethral glands
- (D) Epididymis

Q24. The appearance of secondary sexual characters such as a deepened voice and facial hair in human males at puberty is brought about mainly by:

- (A) Follicle-stimulating hormone
- (B) Oxytocin
- (C) Progesterone
- (D) Testosterone

Q25. The slogan “Hum Do Hamare Do” and the statutory raising of the minimum marriageable age are measures associated with which national programme?

- (A) The Pulse Polio programme
- (B) The family-planning (population control) programme
- (C) The Green Revolution
- (D) The universal immunisation programme

Q26. When the sources of the male and female gametes are interchanged between two parental types, so that one cross is repeated with the sexes reversed, the pair of crosses is called a:



- (A) Test cross
- (B) Back cross
- (C) Reciprocal cross
- (D) Dihybrid cross

Q27. A gene mutation in which one base pair in the DNA is replaced by a different base pair, altering a single codon, is known as a:

- (A) Deletion
- (B) Insertion
- (C) Frameshift mutation
- (D) Substitution (point) mutation

Q28. In honeybees the males (drones) develop from unfertilised eggs and are haploid, while the females develop from fertilised eggs and are diploid. This mechanism of sex determination is called:

- (A) Haplodiploidy
- (B) The XO mechanism
- (C) The ZW mechanism
- (D) Environmental sex determination

Q29. The two nucleic acids are compared in the figure below. Which feature is present in RNA but absent in DNA?

DNA (double)	RNA (single)
T A	C
C G	G
G C	U
A T	A

- (A) The sugar deoxyribose
- (B) The base uracil in place of thymine
- (C) A double-helical structure

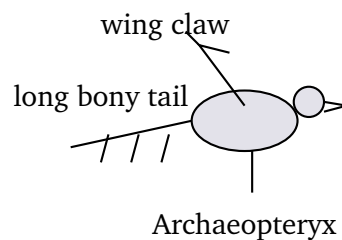


(D) Phosphodiester bonds in the backbone

Q30. A structural chromosomal aberration in which a segment of a chromosome breaks off, turns through 180° , and rejoins so that its gene order is reversed, is called:

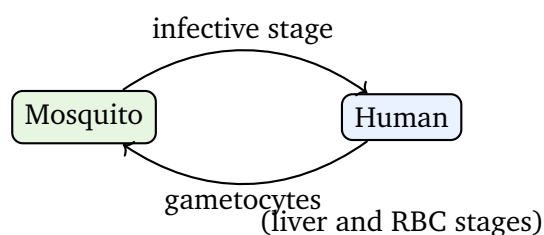
- (A) Duplication
- (B) Deletion
- (C) Inversion
- (D) Translocation

Q31. The fossil *Archaeopteryx*, sketched below, is regarded as a “connecting link” in evolution because it possessed characters of two different groups, namely:



- (A) Fishes and amphibians
- (B) Amphibians and reptiles
- (C) Reptiles and mammals
- (D) Reptiles and birds

Q32. In the life cycle of *Plasmodium* shown, the parasite passes between the human host and the mosquito. The infective stage that enters the human body when an infected female *Anopheles* mosquito bites is the:



- (A) Sporozoite
- (B) Merozoite
- (C) Gametocyte
- (D) Trophozoite

Q33. Streptokinase, produced by *Streptococcus* and modified by genetic engineering, is used clinically as a:

- (A) Cholesterol-lowering agent
- (B) Clot-dissolving (clot-buster) agent
- (C) Promoter of blood clotting
- (D) General painkiller

Q34. Morphine and heroin (smack), obtained from the latex of the poppy *Papaver somniferum*, are examples of which class of abused drugs?

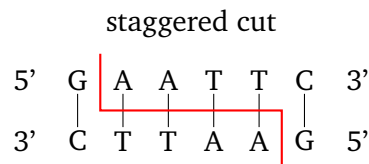
- (A) Cannabinoids
- (B) Stimulants
- (C) Opioids
- (D) Hallucinogens

Q35. In molecular diagnosis, a single-stranded labelled DNA or RNA molecule that detects a complementary mutant gene by base pairing (hybridisation) is called a:

- (A) Primer
- (B) Cloning vector
- (C) Restriction enzyme
- (D) Probe

Q36. The recognition sequence of the restriction enzyme EcoRI is shown below. Reading in the 5' → 3' direction, both strands have the same sequence (GAATTC). Such a sequence is described as:





- (A) A palindrome
- (B) A codon
- (C) An intron
- (D) A replication fork

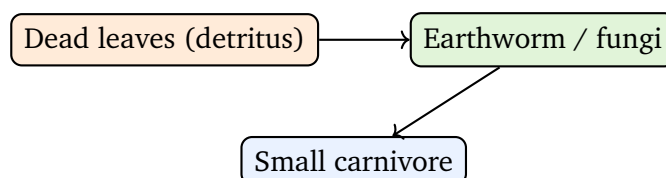
Q37. The polymerase chain reaction (PCR) can detect extremely small amounts of a pathogen's nucleic acid. This property makes it especially valuable for the very early diagnosis of:

- (A) Anaemia by a blood smear
- (B) Diabetes by a urine test
- (C) HIV infection in suspected patients, before antibodies appear
- (D) Vitamin deficiency

Q38. The complete functional role of a species in an ecosystem — what it feeds on, how and when it uses resources, together with the conditions it tolerates — is best described as its:

- (A) Habitat
- (B) Ecological niche
- (C) Biome
- (D) Population

Q39. The food chain shown below begins not with living green plants but with dead organic matter (detritus). The organisms that obtain their energy by breaking down this dead matter are called:



- (A) Producers
- (B) Primary consumers (herbivores)
- (C) Top carnivores
- (D) Decomposers (detritivores)

Q40. Rain water turns into “acid rain” (pH below 5.6) chiefly because certain atmospheric pollutants dissolve in it to form strong acids. These pollutants are mainly:

- (A) Oxides of sulphur and nitrogen (SO_2 , NO_2)
- (B) Carbon dioxide and methane
- (C) Chlorofluorocarbons
- (D) Ozone and oxygen



Detailed Solutions

Q1.

Solution

Concept — Five-kingdom criteria: Whittaker (1969) classified organisms using cell structure, body organisation, mode of nutrition, reproduction and phylogenetic relationships.

Step 1 — Compare Plantae and Animalia: Both are multicellular eukaryotes, so cell type and cell number cannot separate them.

Step 2 — Apply the nutrition criterion: Plants make their own food (autotrophic, by photosynthesis); animals take in ready-made food (heterotrophic, holozoic). Mode of nutrition is the dividing line.

Why other options are wrong:

- Option A: both kingdoms are eukaryotic.
- Option B: both are multicellular.
- Option D: habitat is not a kingdom-level criterion.

Final Answer: Plantae and Animalia differ in being autotrophic versus heterotrophic ⇒

Answer: (C) [Go Back to Q1](#)

Q2.

Solution

Concept — Deuteromycetes: This is an artificial, “form” class created for fungi whose complete life cycle is not fully known.

Step 1 — Why “imperfect”: In these fungi only the asexual (conidial) or vegetative phase has been observed; the sexual (perfect) stage is unknown or absent.

Step 2 — Note the consequence: If the sexual stage of such a fungus is later discovered, it is reclassified into Ascomycetes or Basidiomycetes.

Why other options are wrong:

- Option A: the sexual stage is precisely what is missing.
- Option C: many are saprophytes or parasites, but that is not the basis of the name.
- Option D: they reproduce by non-motile conidia, not motile spores.



Final Answer: Only the asexual or vegetative phase is known \Rightarrow **B**

Answer: (B) [Go Back to Q2](#)

Q3.

Solution

Concept — Cnidaria: Members of phylum Cnidaria (Coelenterata) possess cnidoblasts (cnidocytes) on the tentacles and body.

Step 1 — Read the diagram: Each cnidoblast holds a coiled, thread-bearing capsule with a trigger (cnidocil) on the surface.

Step 2 — Name the capsule: This stinging capsule is the nematocyst; on stimulation it discharges its thread to anchor prey and inject toxin (hypnotoxin).

Why other options are wrong:

- Options A and C (choanocytes / collar cells) are the food-trapping cells of sponges.
- Option B (flame cell) is the excretory cell of flatworms.

Final Answer: The stinging capsule of a cnidoblast is the nematocyst \Rightarrow **D**

Answer: (D) [Go Back to Q3](#)

Q4.

Solution

Concept — Epithelial tissues: Columnar or cuboidal cells may bear cilia on their free surface to move substances along the lining.

Step 1 — Match the feature: Motile, hair-like cilia that sweep mucus or an ovum identify ciliated columnar epithelium.

Step 2 — Confirm the sites: It lines the trachea (moves mucus up) and the fallopian tubes (moves the ovum towards the uterus).

Why other options are wrong:

- Option B (squamous) is flat, for diffusion, e.g. alveoli.
- Option C (cuboidal) lines glands and ducts.
- Option D (stratified) is many-layered, for protection.

Final Answer: The cilia-bearing lining is ciliated columnar epithelium \Rightarrow **A**



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

Q5.

Solution

Concept — Neuron structure: A neuron has a cell body (cyton) with short branching dendrites and one long axon.

Step 1 — Read the diagram: The single long process X leaves the cell body, is wrapped by myelin (orange), and ends in synaptic terminals.

Step 2 — Link to function: Dendrites bring impulses towards the cyton; the axon carries the impulse away from the cyton to the next cell. Hence X is the axon.

Why other options are wrong:

- Option A (dendrite) is short and receives impulses.
- Option B (Nissl granule) is rough ER inside the cyton.
- Option D (cyton) is the cell body itself, not the long process.

Final Answer: The impulse-conducting long process is the axon \Rightarrow **C**

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

Q6.

Solution

Concept — Floral symmetry: A flower is actinomorphic if it can be cut into equal halves by any vertical plane, and zygomorphic if only one plane gives equal halves.

Step 1 — Analyse the example: Pea and *Cassia* flowers are bilaterally symmetrical: only one vertical plane divides them into mirror halves.

Step 2 — Name the condition: Such bilateral symmetry is called zygomorphic.

Why other options are wrong:

- Options A and D (actinomorphic / radial) allow many planes, e.g. mustard, *Datura*.
- Option C (asymmetric) has no plane of symmetry, e.g. *Canna*.

Final Answer: A one-plane (bilateral) flower is zygomorphic \Rightarrow **B**

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



Q7.

Solution

Concept — Plastids: Plastids are of three kinds: chloroplasts (green, photosynthetic), chromoplasts (coloured) and leucoplasts (colourless, storage).

Step 1 — Match the function: Colourless plastids that store starch, oils and proteins are leucoplasts.

Step 2 — Note the sub-types: Amyloplasts store starch, elaioplasts store oils, and aleuroplasts store proteins — all leucoplasts, common in underground organs like potato.

Why other options are wrong:

- Option A (chloroplast) contains chlorophyll and does photosynthesis.
- Option B (chromoplast) bears yellow/orange/red pigments.
- Option C (etioplast) is a chloroplast precursor formed in darkness.

Final Answer: Colourless storage plastids are leucoplasts \Rightarrow

[Go Back to Q7](#)

Q8.

Solution

Concept — Vitamins as coenzymes: Many B-complex vitamins are converted into coenzymes that assist enzyme action.

Step 1 — Identify the source of NAD^+ : NAD^+ (and NADP^+) contain nicotinamide, derived from niacin (vitamin B_3).

Step 2 — Note the role: NAD^+ accepts hydrogen (electrons) during glycolysis and the Krebs cycle, becoming NADH .

Why other options are wrong:

- Option B (vitamin C) is an antioxidant, not a coenzyme for NAD^+ .
- Option C (vitamin A) functions in vision.
- Option D (vitamin D) regulates calcium metabolism.

Final Answer: NAD^+ is derived from niacin (vitamin B_3) \Rightarrow

[Go Back to Q8](#)



Q9.

Solution

Concept — Cell cycle: The cycle runs $G_1 \rightarrow S \rightarrow G_2 \rightarrow M$, but some cells leave it.

Step 1 — Read the wheel: The arrow points out of the cycle from G_1 into a resting state.

Step 2 — Name the state: Cells that stop dividing exit into the quiescent G_0 phase, where they remain metabolically active but do not replicate DNA. Mature neurons and heart muscle cells are typical examples.

Why other options are wrong:

- Option A (S): DNA is actively synthesised, not resting.
- Option C (M): the cell is dividing.
- Option D (G_2): the cell is preparing for mitosis.

Final Answer: The non-dividing resting state is the G_0 phase \Rightarrow **B**

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

Q10.

Solution

Concept — Plant cell wall: The wall has a middle lamella, a primary wall and sometimes a secondary wall.

Step 1 — Identify the cementing layer: The middle lamella is the outermost layer shared by adjacent cells.

Step 2 — Note its composition: It is made chiefly of calcium and magnesium pectate, which glues neighbouring cells together.

Why other options are wrong:

- Options A and B (primary / secondary wall) are cellulose layers belonging to one cell.
- Option D (plasma membrane) lies inside the wall and is not cementing material.

Final Answer: The calcium-pectate cementing layer is the middle lamella \Rightarrow **C**

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



Q11.

Solution

Concept — Plant hormones: Abscisic acid (ABA) is an inhibitory hormone active during stress and dormancy.

Step 1 — Match the action: Under water shortage, ABA accumulates in guard cells and triggers stomatal closure, reducing water loss.

Step 2 — Note the nickname: Because it helps the plant cope with drought and other stresses, ABA is called the “stress hormone”.

Why other options are wrong:

- Option B (auxin) governs cell elongation and apical dominance.
- Option C (gibberellin) promotes stem elongation.
- Option D (cytokinin) promotes cell division and delays senescence.

Final Answer: The stomata-closing stress hormone is abscisic acid \Rightarrow

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

Q12.

Solution

Concept — Mineral deficiency symptoms: Lack of elements needed for chlorophyll formation shows up first in the leaves.

Step 1 — Identify the symptom: Loss of chlorophyll causing yellowing of leaves is called chlorosis.

Step 2 — Link to elements: It results from deficiency of N, Mg, Fe, Mn, Zn or S, which are required for chlorophyll synthesis or function.

Why other options are wrong:

- Option A (etiolation) is excessive elongation and paleness in the dark.
- Option B (necrosis) is death of tissue, giving brown dead patches.
- Option C (senescence) is natural ageing of the plant.

Final Answer: Yellowing from chlorophyll loss is chlorosis \Rightarrow

Answer: (D) [Go Back to Q12](#)



Q13.

Solution

Concept — Chemiosmosis: Peter Mitchell's hypothesis explains ATP synthesis by the energy of an electrochemical gradient across a membrane.

Step 1 — Read the diagram: H^+ ions are accumulated on one side of the membrane, creating a difference in their concentration.

Step 2 — Couple to ATP synthase: As protons flow back through ATP synthase, their potential energy drives the phosphorylation of ADP to ATP. Hence it is a proton (H^+) gradient.

Why other options are wrong:

- Options A and D (Na^+ , Ca^{2+}) are not the ions pumped here.
- Option B (electrons) move along the transport chain but the gradient that powers ATP synthase is of protons.

Final Answer: ATP synthesis is driven by a proton (H^+) gradient \Rightarrow **C**

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

Q14.

Solution

Concept — Fermentation: In anaerobic conditions, pyruvate from glycolysis is reduced to regenerate NAD^+ .

Step 1 — Identify the pathway in yeast: Yeast first decarboxylates pyruvate to acetaldehyde, releasing CO_2 .

Step 2 — Complete the conversion: Acetaldehyde is then reduced by NADH to ethanol. The net products are ethanol and carbon dioxide.

Why other options are wrong:

- Option A (lactic acid) is the product in muscle / *Lactobacillus*, not yeast.
- Option C describes aerobic entry into the Krebs cycle.
- Option D (citric acid, oxygen) does not arise in fermentation.

Final Answer: Yeast fermentation yields ethanol and $CO_2 \Rightarrow$ **B**

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



Q15.

Solution

Concept — Large intestine: No significant digestive enzymes act here; the colon mainly conditions the undigested residue.

Step 1 — Identify its role: The large intestine absorbs water and electrolytes (mineral ions) from the remaining material.

Step 2 — Note the outcome: This concentrates the residue into semi-solid faeces, which are then eliminated.

Why other options are wrong:

- Options A and B (amino acids, glucose, fats) are absorbed in the small intestine.
- Option C: proteins are digested and absorbed earlier, not in the colon.

Final Answer: The large intestine absorbs water and electrolytes \Rightarrow **D**

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

Q16.

Solution

Concept — Neural control of breathing: Respiration is rhythmically controlled by a centre in the brain stem.

Step 1 — Locate the centre: The respiratory rhythm centre lies in the medulla oblongata.

Step 2 — Note the helpers: A pneumotaxic centre in the pons can moderate this rhythm, and a chemosensitive area responds to rising CO_2/H^+ , but the basic rhythm is set in the medulla.

Why other options are wrong:

- Option B (cerebellum) controls balance and coordination.
- Option C (hypothalamus) regulates temperature and the endocrine system.
- Option D (spinal cord) only relays the motor output.

Final Answer: The breathing rhythm centre is in the medulla oblongata \Rightarrow **A**

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



Q17.

Solution

Concept — Blood pressure: Arterial pressure swings between a high value during heart contraction and a low value during relaxation.

Step 1 — Read the figures: In 120/80 mm Hg, the first (higher) number, 120, is the systolic pressure.

Step 2 — Link to the cardiac cycle: Systolic pressure is produced when the ventricles contract and force blood into the arteries; 80 mm Hg is the diastolic pressure during relaxation.

Why other options are wrong:

- Option A describes the diastolic value (80, not 120).
- Option C (right atrial pressure) is very low.
- Option D (pulmonary vein) is unrelated to the systemic reading.

Final Answer: 120 mm Hg is the systolic pressure \Rightarrow **B**

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

Q18.

Solution

Concept — Counter-current system: The kidney keeps the medulla hyperosmotic using two parallel U-shaped structures.

Step 1 — Read the diagram: The blue U-shaped vessel running alongside the loop of Henle is the vasa recta.

Step 2 — Link to function: The vasa recta forms a counter-current exchanger that removes reabsorbed water and solutes without washing out the medullary salt gradient, helping to concentrate urine.

Why other options are wrong:

- Option A (afferent arteriole) supplies blood to the glomerulus.
- Option B (cortical peritubular capillary) surrounds the convoluted tubules in the cortex.
- Option D (glomerular tuft) is the site of filtration, not medullary exchange.

Final Answer: The vessel parallel to the loop of Henle is the vasa recta \Rightarrow **C**

Answer: (C) [Go Back to Q18](#)



Q19.

Solution

Concept — Reflex arc: A reflex arc is the pathway of a reflex action from receptor to effector.

Step 1 — Read the diagram: The sensory neuron carries the impulse into the spinal cord, where it synapses directly with the motor neuron, which runs back to the muscle.

Step 2 — Count the neurons: The knee-jerk is a monosynaptic reflex with no interneuron, so it uses just two neurons — one sensory and one motor.

Why other options are wrong:

- Options A and B (four / three with interneurons) describe polysynaptic arcs.
- Option C (only one) cannot form a complete sensory-to-motor pathway.

Final Answer: The monosynaptic knee-jerk arc uses two neurons \Rightarrow

[Go Back to Q19](#)

Q20.

Solution

Concept — Adrenal cortex hormones: The adrenal cortex secretes mineralocorticoids that regulate ion and water balance.

Step 1 — Identify the hormone: Aldosterone is the chief mineralocorticoid.

Step 2 — Note its action: It acts on the distal tubule and collecting duct to reabsorb Na^+ (and water), while promoting K^+ excretion, thus raising blood volume and pressure.

Why other options are wrong:

- Option B (insulin) lowers blood glucose.
- Option C (calcitonin) lowers blood calcium.
- Option D (glucagon) raises blood glucose.

Final Answer: The Na^+ -retaining adrenal hormone is aldosterone \Rightarrow

[Go Back to Q20](#)



Q21.

Solution

Concept — Types of synovial joints: Movable joints are classified by the kind of movement they allow.

Step 1 — Analyse the joint: The atlas–axis joint lets the skull rotate (turn) around the odontoid process of the axis.

Step 2 — Classify it: Rotational movement about a single axis is the property of a pivot joint.

Why other options are wrong:

- Option A (ball-and-socket) allows movement in all planes, e.g. shoulder.
- Option B (hinge) allows movement in one plane, e.g. elbow.
- Option D (gliding) allows sliding, e.g. between carpals.

Final Answer: The atlas–axis rotational joint is a pivot joint ⇒

[Go Back to Q21](#)

Q22.

Solution

Concept — Outbreeding devices: Plants use several strategies to discourage self-pollination and encourage cross-pollination.

Step 1 — Identify the device: When anthers and stigma of the same flower mature at different times, it is called dichogamy.

Step 2 — Note its forms: If anthers mature first it is protandry; if the stigma matures first it is protogyny. Either way self-pollination is prevented.

Why other options are wrong:

- Option A (self-incompatibility) is a genetic block to self-pollen germination, not a timing difference.
- Option C (herkogamy) is a physical separation of anther and stigma.
- Option D (dioecy) means male and female flowers on separate plants.

Final Answer: Different maturation times of anther and stigma is dichogamy ⇒

[Go Back to Q22](#)



Q23.

Solution

Concept — Semen: Semen is sperm plus the combined secretions of the seminal vesicles, prostate and bulbourethral glands.

Step 1 — Compare the contributions: The seminal vesicles secrete a fructose-rich, alkaline fluid that makes up the largest fraction (about 60–70%) of semen volume.

Step 2 — Note the role: This fluid nourishes the sperms and helps neutralise the acidity of the female tract.

Why other options are wrong:

- Option B (testes) supply the sperms, but only a small part of the fluid volume.
- Option C (bulbourethral glands) add only a small lubricating secretion.
- Option D (epididymis) stores and matures sperm; it is not the main fluid source.

Final Answer: The largest part of seminal fluid comes from the seminal vesicles ⇒

[Go Back to Q23](#)

Q24.

Solution

Concept — Secondary sexual characters: These traits appear at puberty under the control of sex hormones.

Step 1 — Identify the male hormone: In males, the testes secrete testosterone from the Leydig (interstitial) cells.

Step 2 — Link to the characters: Testosterone drives the deepening of voice, growth of facial and body hair, and muscular development.

Why other options are wrong:

- Option A (FSH) stimulates spermatogenesis but does not itself cause these characters.
- Option B (oxytocin) acts in childbirth and milk ejection.
- Option C (progesterone) is a female hormone of pregnancy.

Final Answer: Male secondary sexual characters are due to testosterone ⇒



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

Q25.

Solution

Concept — Population control: India launched a family-planning programme to slow the rapid growth of population.

Step 1 — Match the measures: The slogan “Hum Do Hamare Do” and raising the marriageable age (21 for men, 18 for women) are tools of the family-planning programme.

Step 2 — Note the aim: These measures encourage smaller families and delayed marriage to lower the birth rate.

Why other options are wrong:

- Option A (Pulse Polio) targets polio eradication.
- Option C (Green Revolution) increased food-grain production.
- Option D (immunisation) prevents infectious diseases.

Final Answer: These are family-planning (population control) measures ⇒ **B**

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

Q26.

Solution

Concept — Crosses in genetics: Different crosses are named by the way parents are combined.

Step 1 — Define the cross: When the same two parental types are crossed twice with the sexes of the contributing parents reversed, the pair is a reciprocal cross.

Step 2 — Note its use: Identical results from both directions show autosomal inheritance; different results suggest sex linkage or cytoplasmic inheritance.

Why other options are wrong:

- Option A (test cross) is a cross with a homozygous recessive parent.
- Option B (back cross) is a cross of an offspring with a parent.
- Option D (dihybrid cross) involves two character pairs.

Final Answer: Crossing with the sexes reversed is a reciprocal cross ⇒ **C**



Answer: (C) [Go Back to Q26](#)

Q27.

Solution

Concept — Gene (point) mutations: Changes within a single gene may add, remove or replace bases.

Step 1 — Identify the change: Replacement of one base pair by another is a substitution, also called a point mutation.

Step 2 — Note the effect: A substitution alters only one codon and may be silent, missense or nonsense, but it does not shift the reading frame.

Why other options are wrong:

- Options A and B (deletion / insertion) add or remove bases.
- Option C (frameshift) results from insertion or deletion of bases not in multiples of three, shifting the reading frame.

Final Answer: Replacing one base pair by another is a substitution (point) mutation ⇒

Answer: (D) [Go Back to Q27](#)

Q28.

Solution

Concept — Sex determination: Different animal groups determine sex by different mechanisms.

Step 1 — Analyse the honeybee: Drones (males) arise from unfertilised eggs and are haploid; workers and queens (females) arise from fertilised eggs and are diploid.

Step 2 — Name the mechanism: This dependence of sex on ploidy is called haplodiploidy.

Why other options are wrong:

- Option B (XO) operates in grasshoppers.
- Option C (ZW) operates in birds.
- Option D (environmental) determines sex by temperature, e.g. in some reptiles.



Final Answer: Sex by ploidy in honeybees is haplodiploidy \Rightarrow **A**

Answer: (A) [Go Back to Q28](#)

Q29.

Solution

Concept — DNA versus RNA: Both are nucleic acids but differ in sugar, one base, and strandedness.

Step 1 — Read the diagram: DNA is double-stranded with A–T and G–C pairing; the RNA strand carries A, U, G, C.

Step 2 — Spot the unique feature: RNA contains uracil (U) in place of thymine (T); this base is found only in RNA.

Why other options are wrong:

- Option A (deoxyribose) is the DNA sugar; RNA has ribose.
- Option C (double helix) is a DNA feature; RNA is usually single-stranded.
- Option D (phosphodiester bonds) occur in both.

Final Answer: Uracil in place of thymine is unique to RNA \Rightarrow **B**

Answer: (B) [Go Back to Q29](#)

Q30.

Solution

Concept — Structural chromosomal aberrations: These alter the arrangement or amount of chromosome segments.

Step 1 — Identify the change: A segment that breaks, rotates by 180° , and rejoins so its gene order is reversed is an inversion.

Step 2 — Note the result: The total gene content stays the same, but the sequence of genes in that region is reversed.

Why other options are wrong:

- Option A (duplication) repeats a segment.
- Option B (deletion) loses a segment.
- Option D (translocation) moves a segment to a non-homologous chromosome.



Final Answer: A reversed (180° rotated) segment is an inversion \Rightarrow

Answer: (C) [Go Back to Q30](#)

Q31.

Solution

Concept — Connecting links: A connecting link is a fossil or organism showing characters of two different groups, indicating common ancestry.

Step 1 — Read the diagram: *Archaeopteryx* had feathers and a wishbone (bird features) along with teeth, a long bony tail and clawed wings (reptilian features).

Step 2 — Identify the two groups: These mixed characters make it a connecting link between reptiles and birds.

Why other options are wrong:

- Options A and B (fish/amphibian, amphibian/reptile) do not match its features.
- Option C (reptile/mammal) is illustrated instead by forms such as the cynodonts, not *Archaeopteryx*.

Final Answer: *Archaeopteryx* links reptiles and birds \Rightarrow

Answer: (D) [Go Back to Q31](#)

Q32.

Solution

Concept — Malarial life cycle: *Plasmodium* is a digenetic parasite, completing its cycle in humans and in the female *Anopheles* mosquito.

Step 1 — Read the diagram: The arrow from mosquito to human marks the infective stage entering the body during the mosquito's bite.

Step 2 — Name the stage: The infective form injected with the mosquito's saliva is the sporozoite, which then reaches the liver and later the red blood cells.

Why other options are wrong:

- Option B (merozoite) is formed inside human liver/RBCs, not injected by the mosquito.
- Option C (gametocyte) is the stage taken up by the mosquito from human blood.



- Option D (trophozoite) is a feeding stage inside the RBC.

Final Answer: The mosquito injects the sporozoite stage ⇒ **A**

Answer: (A) [Go Back to Q32](#)

Q33.

Solution

Concept — Bioactive molecules from microbes: Several therapeutic agents are obtained from microorganisms.

Step 1 — Identify the action: Streptokinase, from *Streptococcus* (genetically engineered for medical use), dissolves blood clots.

Step 2 — Note the use: It is given to patients with myocardial infarction to remove clots blocking the coronary arteries, hence a “clot-buster”.

Why other options are wrong:

- Option A (cholesterol-lowering) describes statins, not streptokinase.
- Option C is the opposite of its action; it breaks, not promotes, clots.
- Option D (painkiller) is unrelated to its function.

Final Answer: Streptokinase is a clot-dissolving agent ⇒ **B**

Answer: (B) [Go Back to Q33](#)

Q34.

Solution

Concept — Classes of abused drugs: Drugs of abuse are grouped as opioids, cannabinoids, hallucinogens and stimulants/depressants.

Step 1 — Identify the source: Morphine and heroin are obtained from the latex of *Papaver somniferum* (opium poppy).

Step 2 — Classify them: Drugs that bind opioid receptors in the central nervous system and act as depressants are called opioids.

Why other options are wrong:

- Option A (cannabinoids) come from *Cannabis sativa*.
- Option B (stimulants) such as cocaine excite the nervous system.
- Option D (hallucinogens) such as LSD distort perception.



Final Answer: Morphine and heroin are opioids \Rightarrow

Answer: (C) [Go Back to Q34](#)

Q35.

Solution

Concept — Molecular diagnosis: A defective gene can be detected by a labelled complementary nucleic acid.

Step 1 — Define the tool: A single-stranded DNA or RNA carrying a radioactive or fluorescent label that base-pairs with a target (mutant) sequence is called a probe.

Step 2 — Note the detection: Where the probe hybridises, a signal appears, revealing the presence of the mutant gene even before symptoms develop.

Why other options are wrong:

- Option A (primer) starts DNA synthesis in PCR; it is short and unlabelled for detection.
- Option B (vector) carries genes into a host cell.
- Option C (restriction enzyme) cuts DNA, it does not detect a sequence by hybridisation.

Final Answer: The labelled hybridising molecule is a probe \Rightarrow

Answer: (D) [Go Back to Q35](#)

Q36.

Solution

Concept — Restriction sites: Restriction endonucleases recognise specific short sequences in DNA.

Step 1 — Read the sequence: EcoRI recognises GAATTC. Reading each strand $5' \rightarrow 3'$ gives the same order on both strands.

Step 2 — Name the property: A sequence that reads identically in the $5' \rightarrow 3'$ direction on both strands is a palindrome; the staggered cut leaves single-stranded “sticky ends”.

Why other options are wrong:

- Option B (codon) is a triplet of mRNA bases coding an amino acid.



- Option C (intron) is a non-coding sequence within a gene.
- Option D (replication fork) is the Y-shaped region where DNA unwinds during replication.

Final Answer: A sequence reading the same 5' → 3' on both strands is a palindrome ⇒

Answer: (A) [Go Back to Q36](#)

Q37.

Solution

Concept — PCR in diagnosis: PCR amplifies even a few copies of a pathogen's nucleic acid into detectable amounts.

Step 1 — Identify the advantage: Because it detects the genetic material directly, PCR finds an infection before the body makes detectable antibodies.

Step 2 — Apply to disease: This allows very early detection of HIV in suspected patients, well before the antibody-based tests turn positive.

Why other options are wrong:

- Option A (anaemia) is diagnosed by blood counts, not PCR.
- Option B (diabetes) is detected by blood/urine glucose.
- Option D (vitamin deficiency) is assessed biochemically, not by PCR.

Final Answer: PCR enables early detection of HIV infection ⇒

Answer: (C) [Go Back to Q37](#)

Q38.

Solution

Concept — Niche and habitat: Habitat is the physical address of a species; niche is its functional profession.

Step 1 — Read the definition: The total functional role — food, timing, resource use and tolerances — of a species is its ecological niche.

Step 2 — Contrast with habitat: Many species may share one habitat, but each occupies its own distinct niche, which reduces competition.

Why other options are wrong:



- Option A (habitat) is only the physical place where it lives.
- Option C (biome) is a large climatic-vegetation zone.
- Option D (population) is a group of individuals of one species.

Final Answer: The functional role of a species is its ecological niche \Rightarrow **B**

Answer: (B) [Go Back to Q38](#)

Q39.

Solution

Concept — Detritus food chain: Unlike the grazing food chain, this chain starts from dead organic matter (detritus).

Step 1 — Read the diagram: Energy flows from dead leaves to organisms like earthworms and fungi.

Step 2 — Name those organisms: Organisms that feed on and break down dead matter are decomposers (detritivores), such as bacteria, fungi and earthworms; they release nutrients back to the soil.

Why other options are wrong:

- Option A (producers) are green plants that make food, not break it down.
- Option B (herbivores) feed on living plants.
- Option C (top carnivores) occupy the highest level, feeding on other animals.

Final Answer: Organisms breaking down detritus are decomposers (detritivores) \Rightarrow **D**

Answer: (D) [Go Back to Q39](#)

Q40.

Solution

Concept — Acid rain: Certain gaseous pollutants react with atmospheric moisture to form strong acids that lower the pH of rain.

Step 1 — Identify the pollutants: Oxides of sulphur (SO_2) and nitrogen (NO_2), released mainly by burning fossil fuels, are the chief culprits.

Step 2 — Form the acids: These oxides dissolve in rain to give sulphuric and nitric acids, taking the pH below 5.6.

Why other options are wrong:



- Option B (CO₂, methane) are greenhouse gases causing warming.
- Option C (CFCs) damage the ozone layer.
- Option D (ozone, oxygen) do not acidify rain.

Final Answer: Acid rain is caused mainly by oxides of sulphur and nitrogen ⇒

Answer: [Go Back to Q40](#)



Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	C	2	B	3	D	4	A	5	C
6	B	7	D	8	A	9	B	10	C
11	A	12	D	13	C	14	B	15	D
16	A	17	B	18	C	19	D	20	A
21	C	22	B	23	A	24	D	25	B
26	C	27	D	28	A	29	B	30	C
31	D	32	A	33	B	34	C	35	D
36	A	37	C	38	B	39	D	40	A

