

TALLENTEX Biology

Sample Paper – 4

Duration: 23 Minutes

Maximum Marks: 60

Instructions

- This paper contains **15** Multiple Choice Questions (Single Correct Answer), modelled on the Biology portion of **TALLENTEX** entrance.
- Each correct answer carries **+4 marks**. There is a **penalty of –1 mark** for incorrect answers. Unattempted questions carry no penalty.
- Only **one** option is correct. Choose carefully.
- Syllabus: **NCERT Class 9 and Class 10 Biology**
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited.

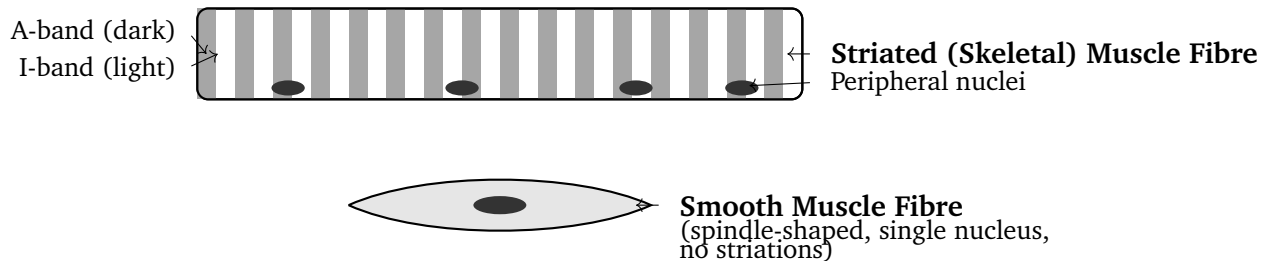
Multiple Choice Questions (Single Correct)

- Q1.** Ribosomes are found in prokaryotic cells, eukaryotic cells, and also inside mitochondria and chloroplasts. Their primary function is:
- (A) Energy production
 - (B) Lipid synthesis
 - (C) Intracellular digestion
 - (D) Protein synthesis by translating mRNA
- Q2.** When a plant cell is placed in a hypertonic (concentrated sugar) solution, water leaves the cell by osmosis. This causes the cell membrane to shrink away from the cell wall — a phenomenon called:
- (A) Plasmolysis
 - (B) Turgidity
 - (C) Endosmosis



(D) Crenation (only for animal cells)

Q3. Study the figure of muscle fibres below and answer the question that follows.



Striated (skeletal) muscle fibres differ from smooth muscle fibres in that striated muscle:

- (A) Is involuntary and has a single nucleus per cell
- (B) Shows cross-striations, is multinucleate, and is under voluntary control
- (C) Is found in the walls of hollow organs like the intestine
- (D) Has no visible sarcomere pattern

Q4. Pteridophytes (like ferns) represent an important step in plant evolution. Which combination correctly describes pteridophytes?

- (A) No vascular tissue, no seeds, reproduce by spores
- (B) Vascular tissue present, seeds present, no flowers
- (C) Vascular tissue present, no seeds, reproduce by spores
- (D) No vascular tissue, seeds present, flowers present

Q5. Transpiration in plants is the loss of water vapour mainly through stomata. Which of the following is a direct benefit of transpiration to the plant?

- (A) It increases the CO_2 concentration inside the leaf
- (B) It slows down the rate of photosynthesis



- (C) It causes wilting during daytime
- (D) It creates a transpiration pull that helps draw water and minerals from roots to leaves

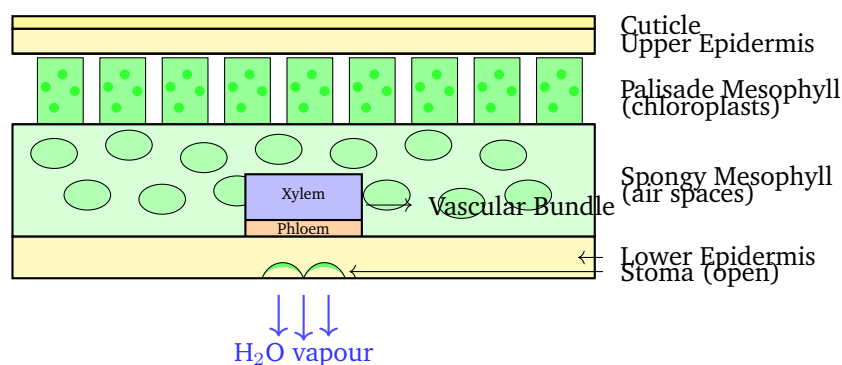
Q6. The primary function of the large intestine (colon) in humans is:

- (A) Absorption of water and formation of solid faeces from undigested food
- (B) Digestion of proteins with pepsin
- (C) Absorption of digested nutrients into the bloodstream
- (D) Production of bile

Q7. Glycolysis, the first stage of cellular respiration in which glucose is broken down to pyruvate, occurs in the:

- (A) Mitochondrial matrix
- (B) Cytoplasm (cytosol)
- (C) Inner mitochondrial membrane
- (D) Nucleus

Q8. Study the cross-section of a dicot leaf shown below and answer the question that follows.



In the cross-section of a leaf, the palisade mesophyll cells are located just below the upper epidermis. They are elongated and densely packed with chloroplasts mainly because:



- (A) They are responsible for mechanical support
- (B) They transport water and minerals
- (C) They are maximally exposed to incoming sunlight for efficient photosynthesis
- (D) They regulate the opening and closing of stomata

Q9. Sweat (produced by sweat glands in the skin) contains water, salts, and traces of urea. This makes the skin:

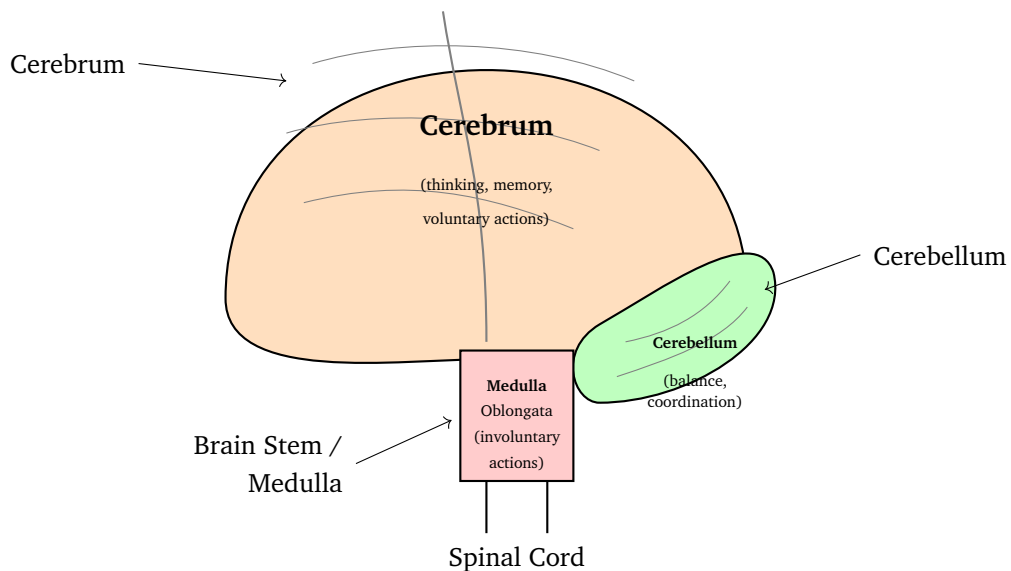
- (A) Only a sense organ
- (B) Only a thermoregulatory organ
- (C) A site of gas exchange
- (D) An accessory excretory organ in addition to being a thermoregulatory organ

Q10. Insulin, secreted by the beta cells of the Islets of Langerhans in the pancreas, controls blood glucose levels by:

- (A) Stimulating cells to take up glucose from the blood and promoting its storage as glycogen in liver and muscle
- (B) Breaking down glycogen to release glucose into the blood
- (C) Stimulating breakdown of fats to provide energy
- (D) Reducing the rate of digestion of carbohydrates

Q11. Study the diagram of the human brain shown below and answer the question that follows.





The cerebellum in the human brain is responsible for:

- (A) Conscious thought, memory, and voluntary movement
- (B) Coordination of muscular activity and maintaining balance and posture
- (C) Regulating breathing and heartbeat automatically
- (D) Processing visual information from the eyes

Q12. Double fertilisation, a unique feature of angiosperms (flowering plants), results in:

- (A) Formation of two embryos from one ovule
- (B) The male gamete fusing with two polar nuclei only
- (C) Formation of an embryo (from fusion of one male gamete + egg) and a triploid endosperm (from fusion of another male gamete + two polar nuclei)
- (D) The pollen tube reaching the ovule twice

Q13. In humans, sex is determined by the sex chromosomes. Which statement is correct?

- (A) Females are XY and males are XX
- (B) Both males and females have one X and one Y chromosome



- (C) The mother's chromosomes determine the sex of the child
- (D) Males are XY; they contribute either an X or a Y chromosome through sperm, thus determining the sex of the offspring

Q14. Biomagnification (biological magnification) refers to:

- (A) The progressive increase in the concentration of non-biodegradable pollutants (like DDT or heavy metals) at successively higher trophic levels in a food chain
- (B) The increase in population size of organisms at higher trophic levels
- (C) The magnification of cells using a biological microscope
- (D) The increase in body size of organisms in colder climates

Q15. Which of the following statements correctly explains why antibiotics are NOT effective against viral infections?

- (A) Viruses are too small to be reached by antibiotics
- (B) Antibiotics are destroyed by the immune system before they can reach viruses
- (C) Antibiotics target specific bacterial structures (like cell walls) that viruses lack, since viruses are not cells and have no cell wall or ribosomes
- (D) Viruses produce enzymes that break down antibiotics



Detailed Solutions

Sol. 1.

Solution

Concept: Ribosomes are the sites of protein synthesis in all living cells.

Analysis:

- Ribosomes are made of ribosomal RNA (rRNA) and proteins. They are found free in the cytoplasm or bound to the endoplasmic reticulum (rough ER).
- They are also present inside semi-autonomous organelles — mitochondria (70S type, like prokaryotes) and chloroplasts.
- Their function is **translation**: reading the mRNA sequence and assembling the corresponding chain of amino acids into a polypeptide (protein).
- (A) Energy production — function of mitochondria (ATP synthesis), not ribosomes.
- (B) Lipid synthesis — performed by the smooth ER and associated enzymes.
- (C) Intracellular digestion — function of lysosomes.

Conclusion: Ribosomes translate mRNA into proteins, making (D) the correct answer.

Answer: (D) [Go Back to Q 1](#)

Sol. 2.

Solution

Concept: Osmosis and plasmolysis in plant cells.

Analysis:

- In a hypertonic solution, the external concentration of solutes is higher than inside the cell. Water therefore moves **out** of the cell by osmosis.
- This loss of water causes the vacuole to shrink and the cell membrane (plasma membrane) to pull away from the rigid cell wall. This is **plasmolysis**.
- (B) Turgidity — occurs when a plant cell absorbs water (placed in hypotonic solution); the vacuole swells and presses against the wall.



- (C) Endosmosis — inward movement of water; opposite of what is described.
- (D) Crenation — applies to animal cells (e.g., RBCs), not plant cells (which have a cell wall).

Conclusion: The phenomenon described is plasmolysis, so the answer is (A).

Answer: (A) [Go Back to Q 2](#)

Sol. 3.

Solution

Concept: Types of muscle tissue and their distinguishing features.

Analysis:

- **Striated (skeletal) muscle:** Shows alternating dark (A-bands, myosin-rich) and light (I-bands, actin-rich) bands visible under a microscope — the cross-striations. The fibres are very long, **multinucleate** (multiple peripheral nuclei per fibre), and are under **voluntary control**.
- **Smooth muscle:** Spindle-shaped cells, each with a **single central nucleus**, no visible striations, and **involuntary** control. Found in hollow organ walls (intestine, urinary bladder, blood vessels).
- (A) Involuntary, single nucleus — describes smooth muscle, not striated.
- (C) Walls of hollow organs — characteristic of smooth muscle.
- (D) No sarcomere pattern — incorrect; striated muscle has a well-defined sarcomere.

Conclusion: Cross-striations + multinucleate + voluntary = striated muscle. Answer is (B).

Answer: (B) [Go Back to Q 3](#)



Sol. 4.

Solution

Concept: Classification of the plant kingdom — characteristics of Pteridophyta.

Analysis:

- Pteridophytes (ferns, horsetails, clubmosses) were the first land plants to develop a **true vascular system** (xylem and phloem) for transport of water and nutrients.
- They do **not** produce seeds; instead they reproduce by **spores** (asexual, from sporangia).
- (A) No vascular tissue — describes bryophytes (mosses, liverworts), not pteridophytes.
- (B) Seeds present — seeds appear only in gymnosperms and angiosperms.
- (D) No vascular tissue + seeds — self-contradictory and incorrect.

Conclusion: Vascular tissue present + no seeds + spore reproduction = Pteridophyta. Answer is (C).

Answer: (C) [Go Back to Q 4](#)

Sol. 5.

Solution

Concept: Transpiration and the transpiration pull (cohesion–tension mechanism).

Analysis:

- Water evaporates from the mesophyll cell surfaces and exits through stomata. This creates a water potential gradient (tension) that “pulls” water upward through xylem vessels from roots to leaves — the **transpiration pull**.
- This pull also carries dissolved mineral ions absorbed from the soil.
- (A) Increases CO₂ inside leaf — transpiration does not directly change CO₂; CO₂ enters through stomata by diffusion.
- (B) Slows photosynthesis — excessive water loss may close stomata (reducing CO₂ entry), but transpiration itself is not the cause; this is a consequence, not a benefit.



- (C) Causes wilting — wilting is a harmful effect of excessive water loss, not a benefit.

Conclusion: The transpiration pull is the key beneficial function. Answer is (D).

Answer: (D) [Go Back to Q 5](#)

Sol. 6.

Solution

Concept: Functions of different parts of the human digestive system.

Analysis:

- By the time chyme reaches the large intestine (colon), most digestion and nutrient absorption have already occurred in the small intestine.
- The colon's primary role is **reabsorption of water** from the remaining liquid mass, gradually forming semi-solid and then solid **faeces** (stool), which are stored in the rectum until elimination.
- (B) Protein digestion with pepsin — occurs in the stomach (gastric glands produce pepsin).
- (C) Absorption of digested nutrients — primary function of the **small intestine** (mainly ileum), with its villi and microvilli.
- (D) Production of bile — bile is produced by the **liver** and stored in the gallbladder.

Conclusion: Water absorption and faeces formation = large intestine. Answer is (A).

Answer: (A) [Go Back to Q 6](#)

Sol. 7.

Solution

Concept: Location of the stages of cellular respiration.

Analysis:

- **Glycolysis** (from Greek *glykys* = sweet, *lysis* = splitting): a 10-step enzymatic pathway that converts one molecule of glucose (6C) into two



molecules of pyruvate (3C), producing a net yield of 2 ATP and 2 NADH. It requires **no oxygen** and occurs entirely in the **cytoplasm (cytosol)**.

- (A) Mitochondrial matrix — site of the Krebs (citric acid) cycle.
- (C) Inner mitochondrial membrane — site of the electron transport chain (oxidative phosphorylation).
- (D) Nucleus — contains DNA; not a site of respiratory reactions.

Conclusion: Glycolysis takes place in the cytoplasm. Answer is (B).

Answer: (B) [Go Back to Q 7](#)

Sol. 8.

Solution

Concept: Leaf anatomy and the role of palisade mesophyll in photosynthesis.

Analysis:

- The palisade mesophyll cells are positioned immediately beneath the transparent upper epidermis, directly in the path of incoming light.
- They are elongated (tall, column-like) and densely packed with **chloroplasts** — up to 70–80 per cell — to maximize light absorption and photosynthesis.
- Their arrangement minimises the distance light must travel before reaching a chloroplast.
- (A) Mechanical support — provided by collenchyma and sclerenchyma, not mesophyll.
- (B) Transport of water and minerals — function of xylem in the vascular bundle.
- (D) Opening/closing of stomata — regulated by guard cells in the lower (and sometimes upper) epidermis.

Conclusion: Palisade cells maximise light capture for photosynthesis. Answer is (C).

Answer: (C) [Go Back to Q 8](#)



Sol. 9.

Solution**Concept:** Multiple functions of the skin as an organ system.**Analysis:**

- Sweat contains water, NaCl, and small amounts of **urea** (a nitrogenous waste product normally excreted by kidneys). By releasing sweat, the skin excretes some urea along with water.
- This means the skin acts as an **accessory excretory organ** — supplementing the kidneys.
- Simultaneously, evaporation of sweat cools the body surface, making the skin a **thermoregulatory organ**.
- (A) Only a sense organ — the skin contains sensory receptors, but that is not its only function.
- (B) Only a thermoregulatory organ — incomplete; excretion of urea in sweat adds another function.
- (C) Site of gas exchange — negligible gaseous exchange occurs through human skin (unlike amphibians).

Conclusion: Skin = thermoregulatory + accessory excretory organ. Answer is (D).**Answer: (D)** [Go Back to Q 9](#)

Sol. 10.

Solution**Concept:** Action of insulin in blood glucose regulation.**Analysis:**

- After a carbohydrate-rich meal, blood glucose rises. Beta cells of the **Islets of Langerhans** (in the pancreas) secrete **insulin**.
- Insulin binds to receptors on body cells (especially liver, muscle, adipose tissue), triggering **uptake of glucose** from the blood and its conversion to **glycogen** (glycogenesis) for storage.
- This lowers blood glucose back to normal levels.
- (B) Breaking down glycogen to release glucose — that is the action of



glucagon (secreted by alpha cells of the Islets of Langerhans).

- (C) Breakdown of fats — glucagon and adrenaline promote this, not insulin.
- (D) Reducing rate of carbohydrate digestion — insulin does not act on the digestive process itself.

Conclusion: Insulin promotes glucose uptake and glycogen storage. Answer is (A).

Answer: (A) [Go Back to Q 10](#)

Sol. 11.

Solution

Concept: Functions of different regions of the human brain.

Analysis:

- **Cerebrum:** The largest part of the brain. Its outer cortex is responsible for conscious thought, reasoning, memory, language, voluntary movement, and sensory perception.
- **Cerebellum:** Located posterior and inferior to the cerebrum. Its primary role is to **coordinate voluntary muscle movements**, maintain **balance and posture**, and fine-tune motor activity. It does not initiate movement but refines it.
- **Medulla oblongata (brain stem):** Controls **involuntary** (autonomic) functions such as breathing, heart rate, blood pressure, swallowing, and vomiting.
- (A) Conscious thought, memory, voluntary movement — function of the **cerebrum**.
- (C) Breathing and heartbeat — function of the **medulla oblongata**.
- (D) Processing visual information — occurs in the occipital lobe of the **cerebrum**.

Conclusion: Balance and coordination = cerebellum. Answer is (B).

Answer: (B) [Go Back to Q 11](#)



Sol. 12.

Solution**Concept:** Double fertilisation in angiosperms.**Analysis:**

- The pollen tube delivers **two male gametes** into the ovule.
- **First fertilisation:** One male gamete (n) fuses with the **egg cell** (n) $\rightarrow$ **zygote** ($2n$) $\rightarrow$ develops into the **embryo**.
- **Second fertilisation:** The other male gamete (n) fuses with the **two polar nuclei** ($n + n$) $\rightarrow$ **primary endosperm nucleus** ($3n$, triploid) $\rightarrow$ develops into the **endosperm** (food storage tissue for the seed).
- (A) Two embryos — only one embryo forms per fertilisation event; twins arise from a single zygote splitting or two separate ovules.
- (B) Only polar nuclei fused — only half the story; the egg is also fertilised.
- (D) Pollen tube reaching ovule twice — the tube reaches once but releases two gametes.

Conclusion: Double fertilisation produces an embryo ($2n$) and triploid endosperm ($3n$). Answer is (C).**Answer: (C)** [Go Back to Q 12](#)

Sol. 13.

Solution**Concept:** Chromosomal basis of sex determination in humans.**Analysis:**

- Human females have two X chromosomes (**XX**) and are **homogametic** — they produce only one type of egg (all carry X).
- Human males have one X and one Y chromosome (**XY**) and are **heterogametic** — they produce two types of sperm: those carrying X and those carrying Y.
- If a Y-bearing sperm fertilises the egg $\rightarrow$ XY $\rightarrow$ **male offspring**.
- If an X-bearing sperm fertilises the egg $\rightarrow$ XX $\rightarrow$ **female offspring**.
- Therefore, it is the **father's sperm** (not the mother) that determines the sex



of the child.

- (A) Females XY, males XX — reversed; completely incorrect.
- (B) Both have X and Y — females are XX, not XY.
- (C) Mother determines sex — mothers can only contribute X; the sex-determining chromosome comes from the father.

Conclusion: Males are XY; sperm type determines offspring sex. Answer is (D).

Answer: (D) [Go Back to Q 13](#)

Sol. 14.

Solution

Concept: Biomagnification of persistent pollutants in food chains.

Analysis:

- Certain pollutants — DDT, mercury, PCBs — are **non-biodegradable**: they cannot be broken down by organisms and accumulate in fatty tissues.
- At each trophic level, a consumer eats many prey organisms, ingesting all their accumulated pollutants. The concentration therefore **increases** at each step: producers < primary consumers < secondary consumers < top predators.
- Classic example: DDT in water → plankton → small fish → large fish → fish-eating birds (e.g., pelicans, eagles) — DDT concentration at the top level is thousands of times higher than in water.
- (B) Population increase at higher trophic levels — population size typically *decreases* at higher trophic levels (ecological pyramid of numbers).
- (C) Magnification by microscope — this is a laboratory technique, not a biological process in ecosystems.
- (D) Body size increase in colder climates — this is Bergmann's Rule, a concept in evolutionary ecology, not biomagnification.

Conclusion: Biomagnification = accumulation of non-biodegradable pollutants up the food chain. Answer is (A).

Answer: (A) [Go Back to Q 14](#)



Sol. 15.

Solution**Concept:** Mechanism of action of antibiotics and why they fail against viruses.**Analysis:**

- Antibiotics work by targeting structures or processes **unique to bacteria**: peptidoglycan cell walls (penicillin, amoxicillin), bacterial ribosomes (tetracycline, erythromycin), DNA replication enzymes (fluoroquinolones), etc.
- **Viruses are not cells**. They have no cell wall, no ribosomes of their own, no metabolic machinery. They are particles (nucleic acid + protein coat) that **hijack host cell machinery** to replicate.
- Because viruses lack the bacterial targets, antibiotics have **nothing to act on** in a viral infection. They are simply ineffective.
- (A) Too small to be reached — size is not the issue; antibiotics circulate in body fluids and reach all tissues.
- (B) Destroyed by the immune system — antibiotics are designed to be stable in the body; the immune system does not specifically destroy them (though metabolism occurs in the liver).
- (D) Viruses produce enzymes that break down antibiotics — a few *bacteria* produce antibiotic-degrading enzymes (like beta-lactamases); viruses do not.

Conclusion: Antibiotics target bacterial structures absent in viruses. Answer is (C).**Answer: (C)** [Go Back to Q 15](#)

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	D	2	A	3	B	4	C	5	D
6	A	7	B	8	C	9	D	10	A
11	B	12	C	13	D	14	A	15	C

