

# TALLENTEX Biology

## Sample Paper – 7

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.** The cell membrane is described by the fluid mosaic model. What does the term “**fluid**” in this model refer to?
- (A) The cell membrane is permeable to all fluids.
- (B) The phospholipid molecules can move laterally within the bilayer, giving it flexibility.
- (C) The cell membrane dissolves in water.
- (D) Membrane proteins are fixed rigidly in place.
- Q2.** In a chloroplast, the light-dependent reactions of photosynthesis (which produce ATP and NADPH) take place in which region?
- (A) Stroma
- (B) Outer membrane
- (C) Thylakoid membranes (grana)

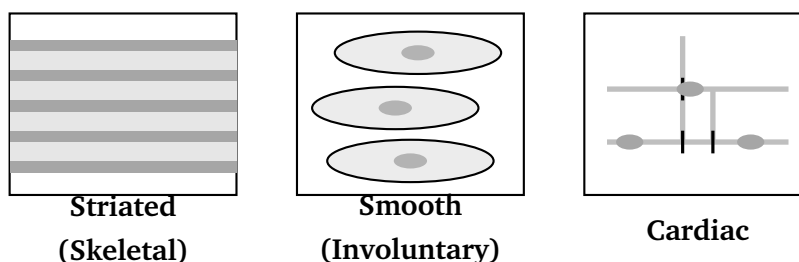


(D) Intermembrane space

**Q3.** The rate of diffusion across a membrane increases when:

- (A) The concentration gradient across the membrane increases.
- (B) The thickness of the membrane increases.
- (C) The size of the diffusing molecules increases.
- (D) The temperature decreases.

**Q4.** Examine the diagram below showing three types of muscle tissue. Which type of muscle tissue is found in the walls of internal organs (like the intestine and bladder) and is **involuntary** and **non-striated**?



- (A) Striated (skeletal) muscle
- (B) Cardiac muscle
- (C) Both striated and cardiac muscle
- (D) Smooth (involuntary) muscle

**Q5.** Earthworms belong to the phylum Annelida. Which of the following is a characteristic feature of earthworms?

- (A) Segmented body with bristle-like setae that aid in locomotion.
- (B) A hard exoskeleton made of chitin.
- (C) An open circulatory system with no blood vessels.
- (D) Reproduction exclusively by budding.

**Q6.** Hydrochloric acid (HCl) is secreted by the stomach lining. What is its role in digestion?

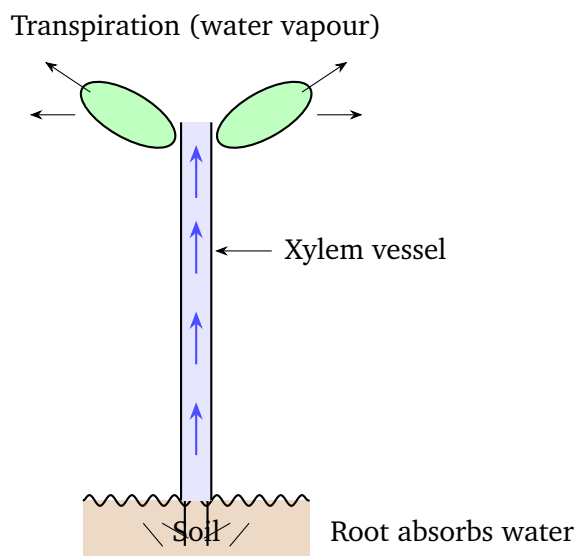


- (A) It directly digests carbohydrates into glucose.
- (B) It neutralises stomach contents before they enter the small intestine.
- (C) It creates an acidic environment that kills bacteria and activates pepsinogen into pepsin.
- (D) It emulsifies fats for lipase action.

**Q7.** In yeast cells during anaerobic fermentation of glucose, the products are:

- (A) Lactic acid and  $\text{CO}_2$
- (B) Ethanol (ethyl alcohol) and  $\text{CO}_2$
- (C) Lactic acid and water
- (D) Ethanol and water

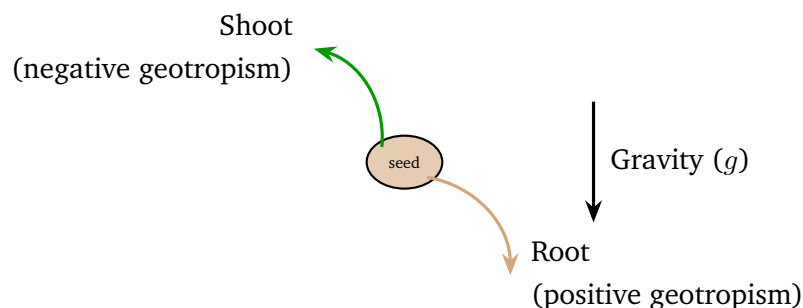
**Q8.** Study the diagram below showing the pathway of water movement in a plant. The upward movement of water through the xylem from root to leaf is primarily driven by which process?



- (A) Root pressure alone
- (B) Capillary action in small roots
- (C) Active pumping by xylem cells
- (D) Transpiration pull (cohesion-tension mechanism)



- Q9.** During a blood pressure reading of **120/80 mmHg**, what does the value **120** (systolic pressure) represent?
- (A) The pressure exerted on artery walls when the left ventricle contracts and pumps blood out.
  - (B) The pressure when the heart is at rest between beats.
  - (C) The pressure in the pulmonary artery.
  - (D) The average pressure in the veins.
- Q10.** Antidiuretic hormone (ADH), secreted by the posterior pituitary, acts on the kidneys to regulate water balance. When the body is dehydrated, ADH level in blood is high. What is the effect of high ADH on the collecting duct of the nephron?
- (A) It makes the collecting duct impermeable to water, causing dilute urine.
  - (B) It stimulates the collecting duct to secrete more urea into the filtrate.
  - (C) It increases the permeability of the collecting duct to water, causing more water to be reabsorbed and concentrated urine to be produced.
  - (D) It closes the renal artery to reduce blood flow to the kidney.
- Q11.** Study the diagram of a germinated seed below. What term describes the **downward growth of roots** in response to gravity?



- (A) Phototropism
- (B) Positive geotropism
- (C) Thigmotropism



(D) Chemotropism

**Q12.** Testosterone is secreted by the testes. Which of the following is a **secondary sexual characteristic** in human males brought about by testosterone during puberty?

(A) Development of mammary glands

(B) Broadening of the pelvis

(C) Commencement of the menstrual cycle

(D) Growth of facial hair and deepening of the voice

**Q13.** Planaria (flatworm) has a remarkable ability for regeneration. If a Planaria is cut into several pieces, what happens?

(A) Each piece regenerates into a complete organism.

(B) Only the head piece survives and regenerates.

(C) All pieces die since they are incomplete.

(D) The pieces fuse together to form one larger organism.

**Q14.** When Mendel self-pollinated tall F1 pea plants ( $Tt \times Tt$ ), the F2 generation showed a phenotypic ratio of **3 tall : 1 dwarf**. Which genotype among F2 plants is responsible for the **dwarf (recessive) phenotype**?

(A) TT

(B) Tt

(C) tt

(D) Both TT and Tt

**Q15.** Decomposers such as fungi and bacteria break down dead organic matter. What is the **ecological importance** of decomposers in a food web?

(A) They are the primary producers that fix solar energy.

(B) They consume living prey and control population sizes.



- (C) They store carbon in their bodies permanently.
- (D) They release nutrients (such as nitrogen and phosphorus) locked in dead organisms back into the soil, making them available to producers.



## Detailed Solutions

Q1.

### Solution

**Concept:** Fluid Mosaic Model of the cell membrane.

The cell membrane is composed of a phospholipid bilayer in which protein molecules are embedded, like tiles in a mosaic. The term “**fluid**” refers to the fact that the phospholipid molecules are not rigidly fixed; they can move **laterally** (sideways) within the layer. This lateral movement gives the membrane its flexibility and allows proteins to drift within it. The membrane is selectively permeable, not universally permeable to all fluids.

**Why other options are wrong:**

- (A) The membrane is *selectively* permeable, not permeable to all fluids. Many large or charged molecules cannot pass freely.
- (C) The membrane does not dissolve in water; it is amphiphilic and forms a stable bilayer in aqueous environments.
- (D) This is the opposite of “fluid”; proteins are *not* rigidly fixed — they can move laterally, which is precisely what the “mosaic” and “fluid” parts of the model describe.

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

Q2.

### Solution

**Concept:** Chloroplast structure and sites of photosynthesis reactions.

Inside the chloroplast, there are flattened, membrane-bound sacs called **thylakoids**, which are stacked into grana. The thylakoid membranes contain chlorophyll and other pigments and are the site of the **light-dependent reactions** (also called light reactions), where sunlight drives the production of ATP and NADPH. The **stroma** (fluid surrounding the thylakoids) is where the light-independent (Calvin cycle / dark) reactions occur, using the ATP and NADPH from the thylakoids.

**Why other options are wrong:**

- (A) The stroma is the site of the Calvin cycle (light-independent reactions), not the light-dependent reactions.



- (B) The outer membrane is a boundary membrane; it plays no role in photosynthetic reactions.
- (D) The intermembrane space lies between the two outer membranes of the chloroplast envelope and is not involved in photosynthetic reactions.

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

Q3.

### Solution

**Concept:** Factors affecting the rate of diffusion (Fick's Law).

According to Fick's First Law, the rate of diffusion is **directly proportional to the concentration gradient** (the difference in concentration across the membrane). A steeper gradient means more net movement from high to low concentration per unit time. Other factors: rate is *inversely* proportional to membrane thickness; smaller, non-polar molecules diffuse faster; higher temperature increases kinetic energy and raises diffusion rate.

**Why other options are wrong:**

- (B) Increasing membrane thickness *decreases* the rate of diffusion (longer path to cross).
- (C) Larger molecules diffuse *more slowly* through a membrane due to greater resistance.
- (D) Decreasing temperature reduces kinetic energy and therefore *slows* diffusion.

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

Q4.

### Solution

**Concept:** Types of muscle tissue — striated, smooth, and cardiac.

There are three types of muscle tissue in the human body:

- **Striated (skeletal) muscle:** voluntary, attached to bones, shows alternating dark and light bands (striations).
- **Smooth (involuntary) muscle:** found in walls of hollow internal organs



such as the stomach, intestine, urinary bladder, and blood vessels. Cells are spindle-shaped, non-striated, and controlled involuntarily by the autonomic nervous system.

- **Cardiac muscle:** found only in the heart, branched, striated, involuntary.

Smooth muscle is **non-striated** and **involuntary** — it matches the description in the question exactly.

**Why other options are wrong:**

- (A) Striated (skeletal) muscle is *voluntary* and shows striations; it moves bones, not internal organ walls.
- (B) Cardiac muscle is striated and found *only* in the heart, not in intestines or the bladder.
- (C) Neither striated nor cardiac muscle forms the walls of hollow internal organs like the intestine.

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

Q5.

### Solution

**Concept:** Characteristic features of phylum Annelida (earthworms).

Earthworms (*Lumbricus terrestris* / *Pheretima*) belong to phylum Annelida, meaning “ringed”. Their body is divided into ring-like **segments** (metameres). Each segment (except the first and last few) has tiny bristle-like structures called **setae** (chaetae) that grip the soil and enable locomotion by anchoring alternate segments. Annelids also have a **closed circulatory system** with blood vessels, and they reproduce sexually (hermaphrodites) — not by budding. They do not have a chitin exoskeleton.

**Why other options are wrong:**

- (B) A hard chitin exoskeleton is a feature of phylum Arthropoda (insects, crustaceans), not Annelida.
- (C) Earthworms have a *closed* circulatory system with well-developed blood vessels; an open system (no vessels) is typical of insects or molluscs.
- (D) Earthworms reproduce sexually via cross-fertilisation, not exclusively by budding. Budding is seen in organisms like Hydra.



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

Q6.

### Solution

**Concept:** Role of HCl in gastric digestion.

The gastric glands of the stomach secrete **hydrochloric acid (HCl)**, which serves two major functions: (1) it **kills most ingested bacteria and microorganisms**, providing a defence against infection; and (2) it converts the inactive enzyme precursor **pepsinogen into active pepsin**, which then begins protein digestion. The acidic pH (around 2) is optimal for pepsin activity. HCl does not digest carbohydrates, emulsify fats, or neutralise stomach contents.

**Why other options are wrong:**

- (A) Carbohydrate digestion (starch to maltose) is carried out by salivary amylase in the mouth and pancreatic amylase in the small intestine — not by HCl.
- (B) HCl makes the stomach highly acidic. It is the *pancreatic bicarbonate* (in the duodenum) that neutralises the acidic chyme after it leaves the stomach.
- (D) Emulsification of fats is performed by *bile salts* (from the liver/gall bladder) in the small intestine, not by HCl.

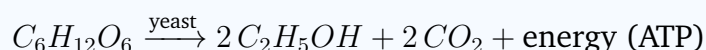
Answer: (C) [Go Back to Q 6](#)

Q7.

### Solution

**Concept:** Anaerobic fermentation in yeast.

When yeast cells undergo **anaerobic respiration** (fermentation) in the absence of oxygen, glucose is partially oxidised. The process can be summarised as:



The products are **ethanol (ethyl alcohol)** and **carbon dioxide**. This is different from anaerobic respiration in human muscle cells, where the product is **lactic acid** (and no  $CO_2$ ).

**Why other options are wrong:**

- (A) Lactic acid and  $CO_2$  — lactic acid is produced in human/animal muscle



cells during anaerobic respiration, not in yeast. Yeast produces ethanol.

- (C) Lactic acid and water — water is a product of *aerobic* respiration; lactic acid fermentation (in muscles) does not produce CO<sub>2</sub> or water as major products.
- (D) Ethanol and water — yeast fermentation produces ethanol and CO<sub>2</sub>, not water as the second product.

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

Q8.

### Solution

**Concept:** Ascent of water in plants — transpiration pull (cohesion-tension mechanism).

Water moves upward through xylem vessels against gravity because of the **transpiration pull**. As water evaporates from the leaf surface (transpiration), it creates a negative pressure (tension) in the leaf mesophyll cells. Due to the **cohesion** (hydrogen bonding) between water molecules and their **adhesion** to xylem walls, this tension is transmitted all the way down to the roots, pulling the continuous water column upward. This is the dominant mechanism for tall trees and is called the **cohesion-tension mechanism**.

**Why other options are wrong:**

- (A) Root pressure can push water a short distance but is far too weak to account for water reaching the tops of tall trees.
- (B) Capillary action alone is sufficient only for very narrow tubes over short distances; it cannot raise water metres high in a tree.
- (C) Xylem vessels are *dead* cells (in mature xylem) and therefore cannot actively pump anything; they have no metabolic activity for active transport.

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



Q9.

**Solution**

**Concept:** Blood pressure — systolic and diastolic values.

Blood pressure is recorded as two values: **systolic / diastolic**. The **systolic pressure** (upper value, 120 mmHg in a normal adult) is the pressure exerted on the arterial walls at the moment the **left ventricle contracts** (systole) and forces blood out into the aorta. The **diastolic pressure** (lower value, 80 mmHg) is the pressure when the heart is **relaxed between beats** (diastole). A reading of 120/80 mmHg is considered normal/healthy.

**Why other options are wrong:**

- (B) The pressure when the heart is at rest is the *diastolic* pressure, which is the lower value (80 mmHg), not 120.
- (C) Pulmonary arterial pressure is much lower (normally around 25/10 mmHg) and is not what is measured in a standard blood pressure cuff on the arm.
- (D) Veins carry blood at very low pressure (close to zero); they are not what is measured in a blood pressure reading.

**Answer: (A)** [Go Back to Q 9](#)

Q10.

**Solution**

**Concept:** Antidiuretic hormone (ADH) and water reabsorption in the nephron.

When the body is **dehydrated**, the hypothalamus detects the rise in blood osmolarity and signals the posterior pituitary to release more **ADH**. ADH acts on the **collecting duct** (and distal convoluted tubule) of the nephron by inserting water channel proteins (*aquaporins*) into the duct wall, making it **more permeable to water**. More water is therefore reabsorbed from the filtrate back into the blood, producing **concentrated (scanty) urine**. This reduces water loss and restores blood volume.

**Why other options are wrong:**

- (A) This describes the *absence* of ADH (low ADH leads to impermeable collecting duct and dilute urine — as in diabetes insipidus).
- (B) ADH does not primarily affect urea secretion; its principal action is on water permeability via aquaporins.



- (D) ADH does not constrict the renal artery; it acts on the tubular cells of the collecting duct.

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

Q11.

### Solution

**Concept:** Geotropism (gravitropism) in plants.

**Tropism** is the directional growth of a plant organ in response to an external stimulus. **Geotropism** (also called gravitropism) is the growth response to gravity. Roots grow **downward toward gravity** — this is **positive geotropism**. Shoots grow **upward away from gravity** — this is **negative geotropism**. The hormone auxin accumulates on the lower side due to gravity, promoting elongation in shoots (curving up) and inhibiting elongation in roots (curving down).

**Why other options are wrong:**

- (A) Phototropism is the growth response to *light* (e.g., shoots bending toward light), not gravity.
- (C) Thigmotropism is the response to *touch or contact* (e.g., tendrils of climbers coiling around a support).
- (D) Chemotropism is the response to *chemical stimuli* (e.g., pollen tube growth toward the ovule following a sugar gradient).

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

Q12.

### Solution

**Concept:** Testosterone and secondary sexual characteristics in human males.

**Testosterone** is the primary male sex hormone (androgen) secreted by the Leydig cells of the testes. During puberty, rising testosterone levels cause the development of **secondary sexual characteristics** in boys, which include: growth of facial, axillary, and pubic hair; **deepening of the voice** (larynx enlargement); increased muscle mass; broadening of shoulders; and the development of the penis and scrotum. These features distinguish the biological male body after puberty.

**Why other options are wrong:**



- (A) Development of mammary glands is a secondary sexual characteristic of *females*, driven by oestrogen, not testosterone.
- (B) Broadening of the pelvis is a female secondary sexual characteristic driven by oestrogen (to facilitate childbirth), not a male characteristic.
- (C) The menstrual cycle is a female reproductive event controlled by oestrogen and progesterone; it does not occur in males.

Answer: (D) [Go Back to Q 12](#)

Q13.

### Solution

**Concept:** Regeneration as a mode of asexual reproduction in Planaria.

**Regeneration** is the ability of an organism to regrow lost or damaged body parts. *Planaria* (a free-living flatworm) is a classic example of remarkable regenerative ability. If a Planaria is cut into multiple pieces, **each piece can develop into a complete, fully-functional organism** through the differentiation of specialised undifferentiated cells called **neoblasts**. This means a single organism can give rise to several identical organisms by being cut, which is a form of asexual reproduction.

**Why other options are wrong:**

- (B) It is not only the head that regenerates; *every* piece, including tail fragments, can regenerate a complete Planaria.
- (C) The pieces do *not* die; each one regenerates into a new individual, demonstrating Planaria's exceptional cellular totipotency.
- (D) Pieces do *not* fuse; they regenerate independently into separate, genetically identical organisms.

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



Q14.

**Solution**

**Concept:** Mendelian genetics — monohybrid cross and genotype for recessive phenotype.

In Mendel's monohybrid cross, tall F<sub>1</sub> plants have genotype **Tt**. Self-pollination (**Tt** × **Tt**) gives the F<sub>2</sub> Punnett square:

|   | T  | t  |
|---|----|----|
| T | TT | Tt |
| t | Tt | tt |

F<sub>2</sub> genotypic ratio: 1 **TT** : 2 **Tt** : 1 **tt**. **TT** and **Tt** plants are both tall (**T** is dominant), while **tt** plants are dwarf because they carry only the recessive allele, and no dominant allele is present to mask it. The phenotypic ratio is 3 tall : 1 dwarf; only **tt** shows the dwarf (recessive) phenotype.

**Why other options are wrong:**

- (A) **TT** is homozygous dominant — these plants are tall, not dwarf.
- (B) **Tt** is heterozygous — one dominant allele **T** masks the recessive **t**, so these plants are tall.
- (D) Both **TT** and **Tt** are tall phenotypes. Only **tt** gives the dwarf phenotype.

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

Q15.

**Solution**

**Concept:** Role of decomposers in nutrient cycling and ecosystem functioning.

**Decomposers** (saprotrophic bacteria and fungi) break down the complex organic molecules in dead organisms and organic waste into simpler inorganic substances. This process is called **decomposition** or **mineralisation**. It releases essential mineral nutrients — especially **nitrogen** (as ammonium/nitrates) and **phosphorus** — back into the soil and water. These nutrients are then absorbed by plants (producers), completing the **nutrient cycle** (e.g., nitrogen cycle, phosphorus cycle). Without decomposers, nutrients would remain locked in dead organic matter and ecosystems would collapse.

**Why other options are wrong:**



- (A) Primary producers (plants, algae, cyanobacteria) fix solar energy via photosynthesis; decomposers cannot photosynthesise.
- (B) Predators (carnivores) consume living prey and control populations; decomposers only act on dead matter.
- (C) Decomposers do *not* permanently store carbon — they *release* carbon as CO<sub>2</sub> during respiration, returning it to the atmosphere.

Answer: (D) [Go Back to Q 15](#)



**Answer Key**

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

