TALLENTEX Biology

Sample Paper – 8

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. Centrioles are found in animal cells but are absent in most plant cells. What is the role of centrioles during cell division?

(A) Synthesis of proteins for the spindle fibres

(B) Providing energy (ATP) for chromosome separation

(C) Organising the spindle fibres (spindle apparatus) that pull chromosomes to the poles during mitosis

(D) Forming the cell plate during cytokinesis

Q2. A freshly cut celery stalk becomes crisp when placed in water. This is because water enters the cells by osmosis, increasing the internal pressure. This pressure exerted by the cell contents against the cell wall is called:

(A) Turgor pressure

(B) Osmotic potential

(C) Wall pressure

(D) Root pressure

Q3. Study the diagrams below showing cell division in an animal cell and a plant cell. During cytokinesis, what is the key difference between plant cells and animal cells?

Animal Cell **Plant Cell**

(A) Plant cells divide by constriction (cleavage furrow); animal cells form a cell plate

(B) Only animal cells undergo cytokinesis; plant cells skip this step

(C) Both plant and animal cells divide by forming a cleavage furrow

(D) Plant cells form a cell plate (new cell wall grows from the centre outward), whereas animal cells divide by a cleavage furrow (pinching inward)

Q4. Sclerenchyma is a type of simple permanent plant tissue. What is the distinguishing feature of sclerenchyma cells that makes them useful for mechanical support?

(A) They are living cells with large vacuoles

(B) They are dead cells with thick, lignified secondary cell walls

(C) They contain chloroplasts and perform photosynthesis

(D) They store starch as a food reserve

Q5. Plants in the class Monocotyledonae and Dicotyledonae differ in several ways. Which of the following correctly distinguishes dicots from monocots?

(A) Monocots have two seed leaves (cotyledons); dicots have one

(B) Monocots have reticulate (net-like) venation in leaves; dicots have parallel venation

(C) Dicots have two seed leaves (cotyledons) and reticulate venation; monocots have one seed leaf and parallel venation

(D) Both groups have the same number of cotyledons

Q6. A plant is kept in darkness for 24 hours and then moved to bright light. Which of the following factors, when increased from a limiting level, will most directly increase the rate of photosynthesis?

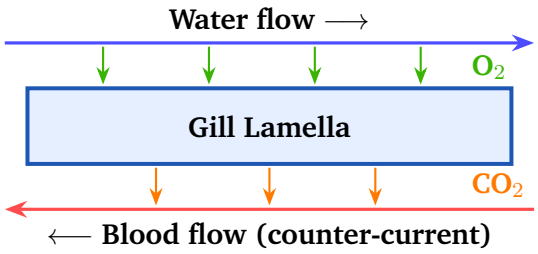
(A) Light intensity

(B) Concentration of oxygen

(C) Concentration of glucose

(D) Concentration of water vapour

Q7. Study the diagram below showing a gill lamella and the direction of water and blood flow. The gill lamellae in fish have a rich blood supply and thin walls. Their structure is adapted for gas exchange because:



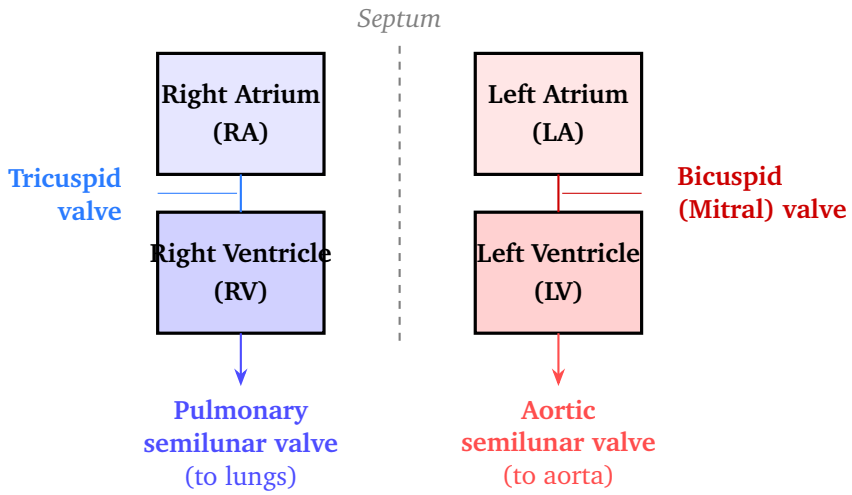
(A) They are covered with scales to protect against infection

(B) They produce haemoglobin directly from water

(C) They pump water using muscular action to speed up exchange

(D) They provide a large surface area with thin walls and a good blood supply, maximising oxygen absorption from water

Q8. Study the simplified diagram of the human heart below. Which valve prevents backflow of blood from the left ventricle into the left atrium during ventricular contraction?



(A) Tricuspid valve

(B) Bicuspid (mitral) valve

(C) Pulmonary semilunar valve

(D) Aortic semilunar valve

Q9. The liver performs many functions related to digestion and metabolism. Which of the following correctly describes the role of the liver in the digestive process?

(A) It secretes pepsin to digest proteins in the stomach

(B) It produces insulin to regulate blood glucose after a meal

(C) It produces bile, which is stored in the gall bladder and emulsifies fats in the small intestine

(D) It secretes amylase to digest starch directly in the mouth

Q10. The rhythmic beating of the heart is initiated by specialised cardiac muscle cells. Which structure is called the natural pacemaker of the heart?

(A) Sino-atrial (SA) node, located in the right atrium

(B) Atrioventricular (AV) node

(C) Bundle of His

(D) Purkinje fibres

Q11. Both the nervous system and the endocrine (hormonal) system coordinate body activities, but they differ in speed and duration. Which comparison is CORRECT?

(A) Nervous signals are slow and long-lasting; hormonal signals are fast and brief

(B) Both systems work at the same speed and use the same messenger molecules

(C) Hormonal signals travel along nerve fibres; nervous signals travel in the blood

(D) Nervous signals are fast (milliseconds) and short-lived; hormonal signals are slow (seconds to hours) but longer-lasting

Q12. Ethylene is a gaseous plant hormone. Which of the following is a well-known effect of ethylene in plants?

(A) Promoting cell elongation in the shoot tip

(B) Promoting fruit ripening and causing leaf abscission (leaf fall)

(C) Stimulating flowering in long-day plants

(D) Inhibiting seed germination and promoting dormancy

Q13. *Rhizopus* reproduces asexually by spore formation. In this process, special structures called sporangia develop. What is the correct sequence of events in asexual reproduction by spores in *Rhizopus*?

(A) Spores germinate $\rightarrow$ sporangium forms $\rightarrow$ spores disperse

(B) Sporangia burst $\rightarrow$ sexual fusion of spores $\rightarrow$ new mycelium grows

(C) Sporangium develops on the sporangiophore $\rightarrow$ mitosis produces spores $\rightarrow$ spores disperse and germinate into new mycelium

(D) *Rhizopus* only reproduces sexually; spores are a sexual structure

Q14. Mendel's Law of Independent Assortment states that:

(A) Alleles of different genes on non-homologous chromosomes segregate independently of each other during gamete formation

(B) Two alleles of the same gene always move together to the same gamete

(C) The dominant allele always masks the recessive allele completely

(D) Traits blend in the F1 generation and re-separate in F2

Q15. Soil erosion is a serious environmental problem. Which of the following is a method used for soil conservation?

(A) Removing vegetation from slopes to allow easy inspection

(B) Planting trees and grasses (afforestation) and constructing bunds or terraces on slopes to reduce runoff

(C) Ploughing land along the slope so rainwater runs off quickly

(D) Using large quantities of chemical fertilisers to replace lost nutrients

Detailed Solutions

Q1.

Solution

Concept: Centrosome and centriole function in cell division

Centrioles are cylindrical organelles present in pairs within the centrosome of animal cells. During mitosis, the centrosome duplicates and the two centriole pairs migrate to opposite poles of the cell. They **organise the spindle fibres (mitotic spindle apparatus)** — a network of microtubules that attach to chromosomes at the kinetochore and physically pull the chromatids towards opposite poles. This ensures accurate chromosome segregation. Most higher plant cells lack centrioles yet still form a spindle using other microtubule-organising centres, confirming that centrioles are specifically about spindle organisation, not energy supply or protein synthesis.

Why other options are wrong:

- **(A)** Spindle protein synthesis occurs on ribosomes in the cytoplasm, not in centrioles.
- **(B)** ATP for cell division is produced by mitochondria, not centrioles.
- **(D)** Cell plate formation during cytokinesis in plant cells is guided by the phragmoplast (derived from Golgi vesicles), not centrioles.

Answer: (C) Go Back to Q 1

Q2.

Solution

Concept: Turgor pressure in plant cells

When a plant cell is placed in a hypotonic solution (such as pure water), water enters by osmosis. The cell membrane presses against the rigid cell wall, and the cell contents exert a pressure outward on the cell wall. This outward pressure exerted by the cell contents against the cell wall is called **turgor pressure**. It makes cells turgid and gives herbaceous plants their structural rigidity. A celery stalk becomes crisp precisely because the parenchyma cells become turgid.

Why other options are wrong:

- **(B)** Osmotic potential (or osmotic pressure) refers to the potential of water to move by osmosis — it is a property of the solution, not the mechanical

pressure on the wall.

- **(C)** Wall pressure is the inward pressure exerted by the cell wall *back* on the cell contents (reaction to turgor); it is not the pressure exerted by cell contents on the wall.
- **(D)** Root pressure is the pressure generated in root xylem that pushes water upward, a different phenomenon.

Answer: (A) Go Back to Q 2

Q3.

Solution

Concept: Cytokinesis — plant cells vs. animal cells

Cytokinesis (division of the cytoplasm after nuclear division) differs fundamentally between plant and animal cells because of the rigid cell wall in plants.

In **animal cells**: the cell membrane is pinched inward at the equator by an actin-myosin contractile ring, forming a *cleavage furrow* that deepens until the two daughter cells separate.

In **plant cells**: the rigid cell wall prevents pinching. Instead, Golgi-derived vesicles accumulate at the equatorial plane (organised by the phragmoplast), fuse, and form a new *cell plate* that grows outward from the centre until it joins the existing cell wall, creating two daughter cells.

Why other options are wrong:

- **(A)** The descriptions are reversed — plant cells use cell plate, animal cells use cleavage furrow.
- **(B)** Both plant and animal cells undergo cytokinesis; the method differs, not whether it occurs.
- **(C)** Only animal cells use a cleavage furrow; plant cells do not.

Answer: (D) Go Back to Q 3

Q4.

Solution

Concept: Sclerenchyma — simple permanent tissue

Sclerenchyma cells are simple permanent plant tissue cells that are **dead at maturity**. Their cell walls are extremely thick due to the deposition of **lignin** (a complex polymer) in secondary cell walls. This lignification makes the walls rigid and hard, providing excellent mechanical support and protection to the plant body. Sclerenchyma is found in the husk of coconut, jute fibres, and around vascular bundles, as well as in the hard shells of nuts and seeds.

Why other options are wrong:

- **(A)** Parenchyma cells are living and may have large vacuoles; sclerenchyma cells are dead at maturity.
- **(C)** Chlorenchyma (a type of parenchyma) contains chloroplasts and performs photosynthesis; sclerenchyma does not.
- **(D)** Starch storage is a function of parenchyma (e.g., in potato tubers), not sclerenchyma.

Answer: (B) Go Back to Q 4

Q5.

Solution

Concept: Monocot vs. dicot distinguishing features

Flowering plants (Angiosperms) are divided into two classes based on the number of seed leaves (cotyledons) in the embryo:

- **Monocotyledonae**: one cotyledon, parallel venation in leaves, floral parts in multiples of 3, fibrous root system.
- **Dicotyledonae**: two cotyledons, reticulate (net-like) venation in leaves, floral parts in multiples of 4 or 5, tap root system.

Option (C) correctly captures both key distinguishing features — number of cotyledons and leaf venation.

Why other options are wrong:

- **(A)** Reverses the number of cotyledons; monocots have *one*, dicots have *two*.

- **(B)** Reverses the venation; monocots have *parallel*, dicots have *reticulate* venation.
- **(D)** Both groups do *not* have the same number of cotyledons; that is the key diagnostic difference.

Answer: (C) Go Back to Q 5

Q6.

Solution

Concept: Limiting factors in photosynthesis

The **Law of Limiting Factors** (Blackman, 1905) states that when a process is governed by several factors, its rate is limited by the factor present in the least favourable amount. For a plant that has been kept in darkness for 24 hours, **light intensity** is the primary limiting factor. The light-dependent reactions of photosynthesis (occurring in the thylakoid membranes) require photons to split water, generate ATP and NADPH, and drive electron transport. Increasing light intensity from a low/zero level will directly and immediately increase the rate of photosynthesis until another factor (e.g. CO_2 concentration) becomes limiting.

Why other options are wrong:

- **(B)** Oxygen is a *product* of photosynthesis (from light reactions), not a reactant; increasing $[O_2]$ does not drive photosynthesis and can even inhibit it via photorespiration.
- **(C)** Glucose is also a *product* of photosynthesis (Calvin cycle), not a substrate that drives the reaction.
- **(D)** Water vapour concentration is not directly limiting; it is liquid water used in photolysis that matters, and stomatal opening (affected by humidity) is a secondary effect.

Answer: (A) Go Back to Q 6

Q7.

Solution

Concept: Gill lamella adaptations for gas exchange in fish

Fish extract dissolved oxygen from water using gills. The gill lamellae (secondary lamellae) are the primary gas exchange surfaces. Their adaptations include:

- **Large surface area**: numerous thin, flattened lamellae maximise contact with water.
- **Thin walls**: the diffusion distance between water and blood is very small ($<1\ \mu$m), allowing rapid diffusion.
- **Rich blood supply**: capillaries run through each lamella, maintaining a steep concentration gradient.
- **Counter-current flow**: blood flows in the opposite direction to water, maintaining a diffusion gradient along the entire length of the lamella (as shown in the diagram), making gas exchange highly efficient.

Why other options are wrong:

- **(A)** Scales cover the body surface; gill lamellae are not covered with scales — they must remain exposed to water.
- **(B)** Haemoglobin is synthesised in red blood cells (erythrocytes) in the bone marrow, not produced from water.
- **(C)** Water movement over gills is powered by the opercular pumping mechanism and/or ram ventilation (swimming with mouth open), not by muscular action of the gill lamellae themselves.

Answer: (D) Go Back to Q 7

Q8.

Solution

Concept: Heart valves and their functions

The heart has four valves that ensure unidirectional blood flow:

- **Tricuspid valve**: between right atrium (RA) and right ventricle (RV) — prevents backflow from RV to RA.
- **Bicuspid (Mitral) valve**: between left atrium (LA) and left ventricle (LV) —

prevents backflow from LV to LA.

- **Pulmonary semilunar valve**: at the exit of the right ventricle into the pulmonary artery.
- **Aortic semilunar valve**: at the exit of the left ventricle into the aorta.

During ventricular systole (contraction), the left ventricle generates high pressure to push blood into the aorta. The **bicuspid (mitral) valve** closes to prevent blood from flowing back into the left atrium.

Why other options are wrong:

- **(A)** The tricuspid valve is on the *right* side, between RA and RV.
- **(C)** The pulmonary semilunar valve prevents backflow from the pulmonary artery into the *right* ventricle.
- **(D)** The aortic semilunar valve prevents backflow from the aorta into the left ventricle — not into the left atrium.

Answer: (B) Go Back to Q 8

Q9.

Solution

Concept: Role of the liver in digestion

The liver is the largest gland in the body and plays a central role in digestion. Its primary digestive function is the production of **bile** — a greenish-yellow alkaline fluid. Bile is produced continuously by hepatocytes (liver cells) and stored in the **gall bladder**. When fatty food enters the duodenum, bile is released via the bile duct. Bile does not contain enzymes, but it **emulsifies fats** — breaks large fat droplets into smaller ones, dramatically increasing the surface area available for lipase enzymes to act upon.

Why other options are wrong:

- **(A)** Pepsin is secreted by the gastric glands (chief cells) of the stomach, not by the liver.
- **(B)** Insulin is produced by the β-cells of the islets of Langerhans in the *pancreas*, not the liver (the liver responds to insulin but does not produce it).
- **(D)** Salivary amylase (ptyalin) is produced by the salivary glands in the mouth; pancreatic amylase is from the pancreas. The liver does not secrete

amylase.

Answer: (C) Go Back to Q 9

Q10.

Solution

Concept: SA node as the natural pacemaker of the heart

The heart has the property of **autorhythmicity** — it can generate its own electrical impulses without stimulation from the nervous system. The **sino-atrial (SA) node**, located in the wall of the right atrium near the entry of the superior vena cava, spontaneously generates electrical impulses at a rate of about 60–100 per minute (in a healthy adult). These impulses spread across both atria, causing them to contract, then reach the AV node, Bundle of His, bundle branches, and Purkinje fibres, causing ventricular contraction. Because the SA node sets the pace for the entire heart, it is called the **natural pacemaker**.

Why other options are wrong:

- **(B)** The AV (atrioventricular) node delays the impulse to allow atrial contraction to complete before ventricular contraction; it is a relay station, not the initiator.
- **(C)** The Bundle of His conducts impulses from the AV node to the ventricles via left and right bundle branches.
- **(D)** Purkinje fibres rapidly conduct impulses through the ventricular muscle to cause synchronised contraction; they do not initiate the heartbeat.

Answer: (A) Go Back to Q 10

Q11.

Solution

Concept: Nervous vs. hormonal coordination — speed and duration

The two major coordination systems of the body differ in several important ways:

Feature	Nervous System	Endocrine System
Messenger	Nerve impulse (electrical/chemical)	Hormones (chemical)
Speed	Very fast (milliseconds)	Slow (seconds to hours)
Duration	Short-lived	Longer-lasting
Transmission	Along nerve fibres	Through bloodstream

Option (D) correctly states that nervous signals are fast and short-lived, while hormonal signals are slow but longer-lasting.

Why other options are wrong:

- **(A)** Reverses the properties — nervous signals are *fast*, hormonal signals are *slow*.
- **(B)** The two systems operate at different speeds and use different messengers (nerve impulses vs. hormones).
- **(C)** Reverses the transmission medium — hormones travel in *blood*; nervous impulses travel along *nerve fibres*.

Answer: (D) Go Back to Q 11

Q12.

Solution

Concept: Ethylene — gaseous plant hormone

Ethylene (also written as ethene, $CH_2{=}CH_2$) is unique among plant hormones because it is a gas at room temperature. Its key effects include:

- **Fruit ripening**: ethylene triggers ripening in climacteric fruits (e.g., bananas, tomatoes, apples) by promoting starch-to-sugar conversion, colour changes, and softening of cell walls. This is why placing a ripe banana next to unripe fruit speeds ripening.
- **Leaf abscission**: ethylene promotes the formation of the abscission zone at the base of the leaf stalk, leading to leaf fall.
- Inhibition of stem elongation and promotion of lateral growth.

Why other options are wrong:

- **(A)** Cell elongation in the shoot tip is primarily promoted by *auxin* (IAA).
- **(C)** Flowering in long-day plants is controlled by photoperiodism (phy-

tochrome system) and certain conditions; ethylene is not the primary hormone for this.

- **(D)** Seed dormancy and inhibition of germination is primarily a function of *abscisic acid (ABA)*, not ethylene.

Answer: (B) Go Back to Q 12

Q13.

Solution

Concept: Asexual reproduction by spores in *Rhizopus*

Rhizopus (bread mould) reproduces asexually by spore formation in the following sequence:

1. The mycelium produces erect hyphal branches called **sporangiophores**.
2. At the tip of each sporangiophore, a rounded sac called the **sporangium** develops, containing a large number of spores produced by mitosis.
3. When the sporangium matures, it **bursts open**, releasing spores into the environment.
4. Spores **disperse** (by air currents), land on a suitable moist substrate, and **germinate** to produce a new mycelium.

Option (C) correctly describes this sequence (sporangium develops $\rightarrow$ spores produced by mitosis $\rightarrow$ disperse and germinate).

Why other options are wrong:

- **(A)** The sequence is inverted — sporangia form *before* spores are released, not after germination.
- **(B)** Sexual fusion does not occur in asexual spore formation; spores are asexual structures produced by mitosis.
- **(D)** *Rhizopus* reproduces both asexually (spores) and sexually (conjugation/zygospore formation); this statement is false.

Answer: (C) Go Back to Q 13

Q14.

Solution

Concept: Mendel's Law of Independent Assortment

Gregor Mendel's **Law of Independent Assortment** (Second Law) states that alleles of **different genes** assort independently of one another during the formation of gametes — provided the genes are located on **non-homologous chromosomes** (or are sufficiently far apart on the same chromosome). This means the inheritance of one trait does not influence the inheritance of another. This was demonstrated by Mendel's dihybrid crosses (e.g., seed shape $\times$ seed colour), which gave a 9:3:3:1 phenotypic ratio in F2, indicating independent segregation of each gene pair.

Why other options are wrong:

- **(B)** The Law of *Segregation* (First Law) states that the two alleles of a single gene separate during gamete formation — not that they move together.
- **(C)** Dominance (Mendel's principle of dominance) states that the dominant allele masks the recessive; this is a separate principle from Independent Assortment.
- **(D)** Blending inheritance was the pre-Mendelian theory that Mendel's experiments actually disproved; traits do *not* blend.

Answer: (A) Go Back to Q 14

Q15.

Solution

Concept: Soil conservation methods

Soil erosion — the removal of topsoil by wind, water, or human activity — is a major environmental threat. Effective **soil conservation** strategies include:

- **Afforestation**: planting trees and grasses; roots bind the soil particles together and reduce the impact of raindrops, while canopies slow wind speed.
- **Contour bunding and terracing**: constructing earthen bunds or stone walls along the contour lines of slopes creates steps that reduce the velocity of surface runoff, allowing water to infiltrate rather than erode the soil.
- **Contour ploughing**: ploughing along contour lines (not down the slope) reduces runoff channels.
- Windbreaks, cover cropping, and mulching also help.

Option (B) correctly identifies two effective, widely practised methods.

Why other options are wrong:

- **(A)** Removing vegetation *accelerates* soil erosion by exposing the soil surface to rain and wind; roots bind the soil and removal of plants removes this protection.
- **(C)** Ploughing *along* the slope (up and down) creates channels for runoff to flow faster, increasing erosion; *contour* ploughing (across the slope) is the conservation method.
- **(D)** Chemical fertilisers replace *nutrients* but do not physically prevent soil erosion; overuse can actually damage soil structure and lead to further degradation.

Answer: (B) Go Back to Q 15

Answer Key

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