

TALLENTEX Biology

Sample Paper – 3

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.

Questions

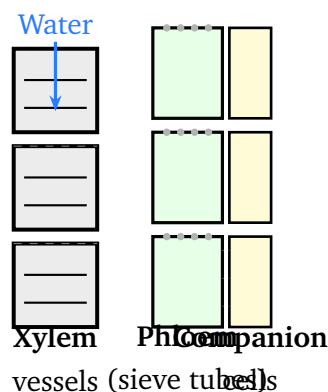
- Q1.** The large central vacuole in a mature plant cell is mainly responsible for:
- (A) Protein synthesis
 - (B) ATP production
 - (C) Maintaining cell turgidity and storing waste products
 - (D) Cell division
- Q2.** Chromoplasts found in petals and ripe fruits get their colour from:
- (A) Chlorophyll
 - (B) Phytochrome
 - (C) Carotenoids stored in leucoplasts
 - (D) Carotenoid pigments (carotenes and xanthophylls) stored in them
- Q3.** Cartilage is a type of connective tissue. Which of the following correctly describes a key property of cartilage?



- (A) It has a rigid, calcified matrix
- (B) It has a flexible, non-vascularised matrix made of chondroitin sulphate
- (C) It contracts in response to stimuli
- (D) It transmits nerve impulses

Q4. The diagram below shows a simplified view of vascular tissue. Xylem vessels are well suited for transport of water because:

Vascular Bundle (T.S. view)



- (A) They are hollow, dead, lignified tubes that form a continuous channel from roots to leaves
- (B) They are living cells with large vacuoles
- (C) They contain sieve plates for filtering
- (D) They actively pump water using ATP

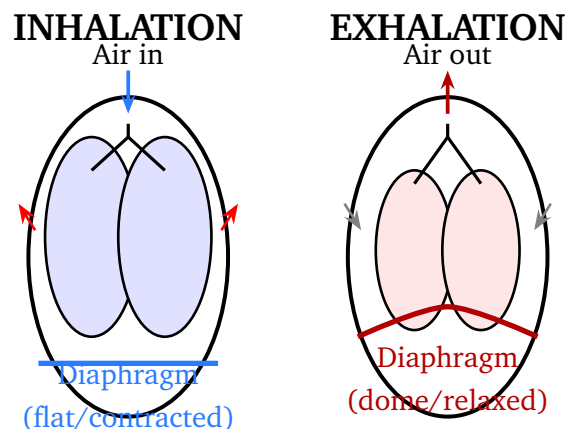
Q5. Which combination of features correctly identifies a mammal?

- (A) Cold-blooded, three-chambered heart, lay eggs
- (B) Warm-blooded, four-chambered heart, possess mammary glands and body hair
- (C) Exoskeleton, open circulatory system, antennae
- (D) Moist skin, three-chambered heart, external fertilisation

Q6. *Cuscuta* (dodder) is an example of a parasitic plant. It obtains nutrients by:

- (A) Photosynthesis using its own chlorophyll
- (B) Decomposing dead organic matter
- (C) Trapping and digesting insects
- (D) Attaching haustoria (sucking roots) to the host plant's phloem to absorb organic nutrients

Q7. The diagram below shows two states of the thoracic cavity during breathing. During inhalation, the diaphragm:



- (A) Contracts and flattens, increasing the volume of the thoracic cavity and drawing air into the lungs
- (B) Relaxes and bulges upward, increasing air pressure in lungs
- (C) Moves upward, decreasing thoracic volume
- (D) Remains stationary while the ribcage expands

Q8. Lymph (tissue fluid) is important in the body because it:

- (A) Carries oxygen directly to cells
- (B) Produces red blood cells
- (C) Returns excess interstitial fluid and proteins back to the blood, and transports absorbed fats from the intestine
- (D) Filters blood in the kidneys

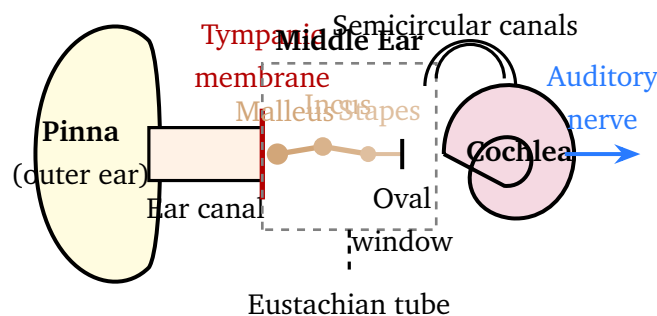
Q9. Haemodialysis (kidney dialysis) functions on the principle of:

- (A) Osmosis only



- (B) Diffusion of waste products across a semipermeable membrane from blood into a dialysing fluid
- (C) Active transport of urea
- (D) Filtration under high pressure like in the glomerulus

Q10. The diagram below shows a simplified cross-section of the human ear. Vibrations of the tympanic membrane (eardrum) are transmitted to the cochlea by:



- (A) The auditory nerve
 - (B) The semicircular canals
 - (C) The Eustachian tube
 - (D) The three ossicles of the middle ear — malleus, incus, and stapes
- Q11.** Gibberellins are plant hormones that primarily promote:
- (A) Stem elongation and germination of seeds
 - (B) Root growth and inhibition of shoot elongation
 - (C) Leaf fall (abscission)
 - (D) Closure of stomata during water stress
- Q12.** Cross-pollination (transfer of pollen between different plants of the same species) is evolutionarily advantageous mainly because it:
- (A) Produces genetically identical offspring
 - (B) Does not require a pollinating agent
 - (C) Introduces genetic variation in the offspring, which is the raw material for evolution



(D) Produces more seeds per flower than self-pollination in all cases

Q13. Mendel crossed plants that were homozygous dominant for two traits (**RRYY**) with plants that were homozygous recessive (**rryy**). In the F_2 generation (obtained by selfing F_1 plants), the phenotypic ratio of the four classes is:

(A) 1:1:1:1

(B) 9:3:3:1

(C) 3:1

(D) 1:2:1

Q14. In a food chain, only about 10% of the energy is transferred from one trophic level to the next. The remaining 90% is:

(A) Stored as chemical energy in prey tissues

(B) Transferred to decomposers immediately

(C) Reflected back as sunlight

(D) Lost mainly as heat during metabolic processes (respiration)

Q15. The forelimbs of a whale, bat, horse, and human show the same basic bone arrangement (humerus, radius, ulna, carpals, phalanges) despite having different functions. This is an example of:

(A) Analogous organs — similar function, different origin

(B) Convergent evolution

(C) Homologous organs — common ancestry but divergent functions

(D) Vestigial organs



Detailed Solutions

Sol. 1.

Solution

Concept: The large central vacuole occupies up to 90% of the volume of a mature plant cell. It is bounded by a membrane called the tonoplast.

Key function: It maintains turgor pressure by accumulating water through osmosis, keeping the cell firm. It also serves as a storage compartment for waste products, pigments, sugars, and secondary metabolites.

Why other options are wrong:

- (A) Protein synthesis occurs at ribosomes on the rough ER, not in the vacuole.
- (B) ATP is produced in mitochondria (and chloroplasts in light reactions).
- (D) Cell division occurs at the cell cycle level involving the nucleus and is coordinated by the cell plate/phragmoplast, not the vacuole.

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

Sol. 2.

Solution

Concept: Plastids are double-membrane organelles found in plant cells. They are of three types: chloroplasts (green, for photosynthesis), chromoplasts (coloured, non-green), and leucoplasts (colourless, for storage).

Key fact: Chromoplasts contain carotenoid pigments — specifically carotenes (orange-red) and xanthophylls (yellow). These pigments give colour to flowers, ripe tomatoes, carrots, and chillies, attracting pollinators and seed dispersers.

Why other options are wrong:

- (A) Chlorophyll is in chloroplasts, not chromoplasts.
- (B) Phytochrome is a photoreceptor pigment in the cytoplasm, unrelated to colour of petals.
- (C) Leucoplasts are colourless storage plastids; they do *not* contain carotenoids.

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



Sol. 3.

Solution

Concept: Cartilage is a specialised connective tissue produced by cells called chondrocytes. The matrix (ground substance) is secreted by chondrocytes and is rich in chondroitin sulphate, a glycosaminoglycan that makes it firm yet flexible.

Key properties:

- Avascular (no blood vessels) — nutrients reach chondrocytes by diffusion.
- Flexible because the matrix is not calcified (unlike bone).
- Found in the nose, ears, trachea, and joint surfaces.

Why other options are wrong:

- (A) Rigid, calcified matrix describes bone, not cartilage.
- (C) Contraction in response to stimuli is a property of muscle tissue.
- (D) Transmitting nerve impulses is the function of nerve/neural tissue.

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

Sol. 4.

Solution

Concept: Xylem is a complex permanent vascular tissue responsible for upward transport of water and dissolved minerals from roots to leaves (ascent of sap).

Why xylem vessels are ideal for water transport:

- They are dead at maturity — no living contents to obstruct the flow.
- Their walls are impregnated with lignin, making them strong and preventing collapse under tension (negative pressure).
- Successive vessel elements are joined end-to-end with dissolved perforation plates, forming a continuous hollow tube.

Why other options are wrong:

- (B) Living cells with large vacuoles describe parenchyma, not xylem vessels.
- (C) Sieve plates are found in phloem (sieve tube elements), not in xylem.
- (D) Water moves passively through xylem by transpiration pull; no ATP is used.



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

Sol. 5.

Solution

Concept: Class Mammalia (Phylum Chordata) is characterised by a unique combination of features that no other class shares completely.

Defining features of mammals:

- **Warm-blooded** (endothermic) — maintain constant body temperature.
- **Four-chambered heart** — complete separation of oxygenated and deoxygenated blood.
- **Mammary glands** — produce milk to nourish young.
- **Body hair/fur** — for insulation.

Why other options are wrong:

- (A) Cold-blooded, three-chambered heart, lay eggs — describes most reptiles/amphibians.
- (C) Exoskeleton, open circulatory system, antennae — describes arthropods (insects).
- (D) Moist skin, three-chambered heart, external fertilisation — describes amphibians.

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

Sol. 6.

Solution

Concept: *Cuscuta* (dodder) is a holoparasite — it lacks chlorophyll and cannot photosynthesise. It is entirely dependent on its host for organic nutrients and water.

Mechanism:

- *Cuscuta* twines around the host stem and sends specialised penetrating organs called **haustoria** into the host's vascular tissue.
- Haustoria penetrate the host phloem and withdraw sugars (sucrose) and



amino acids.

Why other options are wrong:

- (A) *Cuscuta* has no chlorophyll; it is yellow-orange coloured.
- (B) Decomposing dead matter is saprotrophic nutrition (e.g., fungi, bacteria).
- (C) Trapping and digesting insects is insectivorous nutrition (e.g., *Nepenthes*, *Drosera*).

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

Sol. 7.

Solution

Concept: Breathing (ventilation) involves two phases: inhalation (inspiration) and exhalation (expiration). The diaphragm is a dome-shaped muscular partition between the thoracic and abdominal cavities.

During inhalation:

- Diaphragm muscles **contract** $\Rightarrow$ diaphragm flattens/descends.
- External intercostal muscles contract $\Rightarrow$ ribs move up and outward.
- Thoracic volume **increases** $\Rightarrow$ pressure inside lungs **decreases** (below atmospheric).
- Air rushes in from outside to equalise pressure.

Why other options are wrong:

- (B) Diaphragm bulging upward happens during *exhalation* when it relaxes.
- (C) Diaphragm moving upward would decrease thoracic volume — that is exhalation.
- (D) The diaphragm actively participates in breathing; it does not remain stationary.

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



Sol. 8.

Solution

Concept: The lymphatic system is a network of vessels, nodes, and organs that complements the circulatory system.

Functions of lymph:

- **Fluid balance:** Tissue fluid (interstitial fluid) is formed when plasma leaks from capillaries. Lymph vessels collect this excess fluid and proteins and drain them back into the bloodstream via the thoracic duct and right lymphatic duct.
- **Fat absorption:** Specialised lymph capillaries called **lacteals** in the villi of the small intestine absorb dietary fats (chylomicrons) that are too large for blood capillaries.
- **Immune function:** Lymph nodes filter lymph and house lymphocytes.

Why other options are wrong:

- (A) Oxygen is carried by haemoglobin in red blood cells in blood.
- (B) Red blood cells are produced in red bone marrow (haematopoiesis).
- (D) Blood filtration in kidneys is done by the glomerulus and Bowman's capsule.

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

Sol. 9.

Solution

Concept: The kidneys filter blood, removing urea, creatinine, excess salts, and water. When kidneys fail, haemodialysis artificially performs this function.

Principle of haemodialysis:

- Patient's blood is pumped through tubing made of a **semipermeable membrane** (e.g., cellulose acetate).
- This tubing is bathed in a **dialysing fluid** whose composition is similar to normal plasma (containing salts and glucose but no urea).
- Waste molecules (urea, creatinine) are present at high concentration in blood and absent from dialysing fluid $\Rightarrow$ they diffuse across the membrane by **simple diffusion** (concentration gradient).



- Useful molecules (glucose, amino acids) have equal concentrations on both sides, so they do not diffuse out.

Why other options are wrong:

- (A) Osmosis involves movement of water, not the primary mechanism for waste removal in dialysis.
- (C) Urea is not actively transported; it moves passively.
- (D) Glomerular filtration uses hydrostatic pressure; dialysis uses diffusion.

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

Sol. 10.

Solution

Concept: Sound waves enter the ear canal and strike the tympanic membrane (eardrum), causing it to vibrate. These vibrations are then amplified and transmitted to the inner ear through a chain of three tiny bones (ossicles) in the middle ear.

Sequence of sound transmission:

- Sound waves → Tympanic membrane vibrates → Malleus → Incus → Stapes → Oval window → Cochlea (fluid waves) → Hair cells stimulated → Auditory nerve → Brain.

Why other options are wrong:

- (A) The auditory nerve carries electrical signals from the cochlea to the brain; it does not transmit mechanical vibrations from the eardrum.
- (B) The semicircular canals detect rotational movement (balance), not sound.
- (C) The Eustachian tube equalises air pressure on either side of the eardrum; it does not transmit sound.

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



Sol. 11.

Solution

Concept: Plant hormones (phytohormones) regulate growth and development. Gibberellins were discovered from the fungus *Gibberella fujikuroi*, which caused “bakanae” (foolish seedling) disease in rice — excessive stem elongation.

Functions of gibberellins:

- **Stem elongation:** Stimulate cell elongation and division, causing internode extension.
- **Seed germination:** Promote germination by activating amylase to break down starch in seeds.
- Used commercially to increase fruit size (seedless grapes) and to break dormancy.

Why other options are wrong:

- (B) Root growth promotion and inhibition of shoot elongation are associated with cytokinins (root) and abscisic acid (growth inhibitor).
- (C) Leaf fall (abscission) is promoted by **abscisic acid** and ethylene.
- (D) Stomatal closure under water stress is triggered by **abscisic acid**.

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

Sol. 12.

Solution

Concept: Pollination is the transfer of pollen from anther to stigma. Self-pollination occurs within the same flower or plant; cross-pollination occurs between different plants of the same species.

Advantage of cross-pollination:

- Combines genes from two genetically different parents $\Rightarrow$ offspring are genetically **varied**.
- Genetic variation is the raw material for **natural selection** and **evolution**.
- Increases adaptability of the population to environmental changes.

Why other options are wrong:



- (A) Genetically identical offspring result from self-pollination or vegetative reproduction.
- (B) Cross-pollination *requires* a pollinating agent (wind, insects, birds, water).
- (D) Seed production per flower depends on fertilisation success, not mode of pollination in all cases.

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

Sol. 13.

Solution

Concept: Mendel's Law of Independent Assortment states that genes for different traits assort independently during gamete formation (when the genes are on different chromosomes).

Working out the dihybrid cross:

- P: RRYy × rryy ⇒ F₁: RrYy (all round yellow).
- F₁ × F₁: RrYy × RrYy ⇒ F₂ in a 4×4 Punnett square giving 16 combinations.
- Phenotypic classes: Round Yellow (R_Y_) : Round Green (R_yy) : Wrinkled Yellow (rrY_) : Wrinkled Green (rryy) = **9:3:3:1**.

Why other options are wrong:

- (A) 1:1:1:1 is the test cross ratio for a dihybrid.
- (C) 3:1 is the monohybrid F₂ phenotypic ratio.
- (D) 1:2:1 is the monohybrid F₂ genotypic ratio.

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

Sol. 14.

Solution

Concept: Energy flow in an ecosystem follows the **10% rule** (Lindeman's Law). Of the total energy available at one trophic level, only about 10% is passed on to the next level.

Where does the 90% go?



- The bulk (approximately 90%) is **lost as heat** during cellular respiration (metabolic processes) at each trophic level.
- Additional losses occur in excretion, incomplete digestion, and material not consumed.

Implication: This is why food chains are short (typically 3–5 levels) — there is not enough energy to support many levels.

Why other options are wrong:

- (A) Only about 10% is actually stored in prey tissues.
- (B) Energy goes to decomposers when organisms die, not immediately at each trophic transfer.
- (C) Energy is not reflected as sunlight; once fixed by producers, it is chemical energy.

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

Sol. 15.

Solution

Concept: Evolutionary biology distinguishes between:

- **Homologous organs:** Same basic structural plan (same origin/ancestry), but adapted for different functions due to divergent evolution. Example: forelimbs of whale (paddling), bat (flying), horse (running), human (grasping).
- **Analogous organs:** Different structural origin but similar function due to convergent evolution. Example: wings of a bird and wings of an insect.

Key evidence in the question: The same bone arrangement (humerus-radius-ulna-carpals-phalanges) in very different animals performing different functions clearly indicates a **common ancestor** — the hallmark of homology.

Why other options are wrong:

- (A) Analogous organs have similar function but different structural origin — the opposite situation.
- (B) Convergent evolution produces analogous organs; homologous organs result from *divergent* evolution.



- (D) Vestigial organs are non-functional remnants (e.g., human appendix); these forelimbs are functional.

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



Answer Key

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

