

UNIQUE STUDY POINT

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Class: X	Subject: Science	Session: 2025-26
Chapter: 06 - Control and Coordination	Time: 1½ Hours	Max. Marks: 40

General Instructions:

1. All questions are compulsory.
2. This question paper contains 20 questions divided into five sections A, B, C, D and E.
3. Section A contains 10 MCQs of 1 mark each.
4. Section B contains 4 questions of 2 marks each.
5. Section C contains 3 questions of 3 marks each.
6. Section D contains 1 question of 5 marks.
7. Section E contains 2 Case Study Based questions of 4 marks each.

SECTION A - Multiple Choice Questions (1 mark each)

Q1. The central nervous system in humans consists of:

- (a) Brain only
- (b) Spinal cord only
- (c) Brain and spinal cord
- (d) All nerves in the body

Q2. Olfactory receptors detect:

- (a) Taste
- (b) Smell
- (c) Touch
- (d) Sound

Q3. Which type of plant movement is independent of growth?

- (a) Phototropism
- (b) Geotropism
- (c) Movement in *Mimosa pudica*
- (d) Thigmotropism

Q4. Where is auxin synthesized in plants?

- (a) Root tip
- (b) Shoot tip
- (c) Leaves
- (d) Stem

Q5. The brain is contained in a fluid-filled balloon for:

- (a) Nutrition
- (b) Shock absorption
- (c) Temperature regulation
- (d) Waste removal

Q6. Which of the following is NOT an endocrine gland?

- (a) Pituitary
- (b) Thyroid
- (c) Salivary gland
- (d) Adrenal

Q7. Reflex arcs are evolved because:

- (a) They are less expensive
- (b) Thinking is too slow
- (c) Brain is not involved
- (d) They are voluntary

Q8. Shoots grow upward showing:

- (a) Positive geotropism
- (b) Negative geotropism
- (c) Positive phototropism
- (d) Both (b) and (c)

Q9. Which hormone helps in fight or flight response?

- (a) Insulin
- (b) Thyroxin
- (c) Adrenaline
- (d) Oestrogen

Q10. Information from receptors in sense organs is sent to the brain through:

- (a) Motor neurons
- (b) Sensory neurons
- (c) Relay neurons
- (d) All neurons

SECTION B - Short Answer Questions (2 marks each)

Q11. Why is electrical transmission of information faster than chemical transmission?

Q12. How is movement in animals different from movement in plants? Give one example of each.

Q13. Why do we need control and coordination systems in multicellular organisms?

Q14. What happens when there is damage to the cerebellum? Why?

SECTION C - Short Answer Questions (3 marks each)

Q15. A person's hand accidentally touches a hot pan. (a) Will he/she be able to withdraw the hand even if the nerves from the arm to the brain are damaged? (b) Will he/she feel the pain? Explain your

answer.

Q16. Complete the following table comparing different types of tropism in plants:

Type of Tropism	Stimulus	Example
Phototropism	_____	_____
_____	Gravity	_____
_____	_____	Roots growing toward water

Q17. How do muscle cells move in response to nerve impulses? Explain the role of special proteins in muscle cells.

SECTION D - Long Answer Question (5 marks)

Q18. Explain with examples how plants coordinate their activities using hormones. Describe at least four plant hormones, their sites of synthesis, and their roles in plant growth and development.

SECTION E - Case Study Based Questions (4 marks each)

Q19. Case Study 1: A doctor was examining three patients with different hormonal disorders. Patient A had a swollen neck and low metabolic rate. Patient B was extremely tall with continued bone growth even in adulthood. Patient C had high blood sugar levels and frequent urination. The doctor diagnosed them with goitre, acromegaly, and diabetes respectively.

Based on this case, answer the following questions:

- Which hormone deficiency caused Patient A's condition? (1 mark)
- Which gland and hormone is responsible for Patient B's condition? (1 mark)
- Explain why Patient C needs insulin injections and how insulin works to control blood sugar. (2 marks)

Q20. Case Study 2: In a laboratory experiment, a scientist removed the shoot tip from several young seedlings. After a few days, she observed that these plants did not show any bending toward light when exposed to unilateral illumination. However, control plants with intact shoot tips showed normal phototropic bending. When she applied a paste containing plant hormones to the cut surface of experimental plants, they started showing phototropic response again.

Based on this experiment, answer the following questions:

- Why did plants without shoot tips fail to show phototropism? (1 mark)
- Which hormone did the scientist apply to restore phototropic response? (1 mark)
- Explain how this experiment proves that the hormone is synthesized at the shoot tip and how it causes phototropic bending. (2 marks)

SECTION A - Answers to MCQs

Ans 1. (c) Brain and spinal cord

The central nervous system (CNS) consists of the brain and spinal cord, which receive and integrate information from all parts of the body.

Ans 2. (b) Smell

Olfactory receptors, located in the nose, detect smell. Gustatory receptors detect taste.

Ans 3. (c) Movement in Mimosa pudica

The folding of leaves in Mimosa pudica (sensitive plant) is independent of growth and occurs due to changes in water content of cells.

Ans 4. (b) Shoot tip

Auxin is synthesized at the shoot tip and then diffuses to other parts where it acts to promote cell elongation.

Ans 5. (b) Shock absorption

The cerebrospinal fluid surrounding the brain acts as a cushion, providing shock absorption and protection from injury.

Ans 6. (c) Salivary gland

Salivary gland is an exocrine gland that secretes saliva through ducts. Endocrine glands secrete hormones directly into the bloodstream.

Ans 7. (b) Thinking is too slow

Reflex arcs evolved because the thinking process of the brain is not fast enough to respond to urgent situations. Reflexes provide quick protective responses.

Ans 8. (d) Both (b) and (c)

Shoots show negative geotropism (grow away from gravity) and positive phototropism (grow toward light), both causing upward growth.

Ans 9. (c) Adrenaline

Adrenaline, secreted by adrenal glands during emergencies, prepares the body for fight or flight response.

Ans 10. (b) Sensory neurons

Sensory neurons (afferent neurons) carry information from receptors in sense organs to the central nervous system.

SECTION B - Answers to Short Answer Questions

Ans 11.

Electrical transmission is faster than chemical transmission because:

Electrical transmission: Uses electrical impulses that travel rapidly along nerve fibers at high speeds (up to 100 m/s), allowing instant communication.

Chemical transmission: Relies on hormones transported through blood circulation, which is much slower. Hormones must be secreted, travel through bloodstream, and then bind to target cells - this process takes seconds to minutes or even hours.

Ans 12.

Movement in Animals: Animals have specialized muscle tissue and nervous tissue for rapid, voluntary movements. Movements are not restricted to one place and can be very fast. Example: A dog running, a bird flying, or a person walking.

Movement in Plants: Plants lack muscle and nervous tissue. Their movements are much slower, often growth-dependent, and directional based on environmental stimuli. Example: Stem bending toward light (phototropism) or roots growing downward (geotropism).

Ans 13.

Multicellular organisms need control and coordination systems because:

1. Different parts of the body must work together in an organized manner to perform complex activities.
2. Environmental changes must be detected and appropriate responses coordinated across different organs and tissues.
3. Various life processes like digestion, respiration, excretion need to be regulated and synchronized for the organism's survival and optimal functioning.

Ans 14.

Damage to the cerebellum causes:

- Loss of balance and coordination
- Inability to maintain proper posture
- Imprecise voluntary movements (like difficulty in walking straight, picking up objects accurately)

Reason: The cerebellum is responsible for precision of voluntary actions and maintaining posture and balance of the body. It coordinates muscle activity and ensures smooth, accurate movements. Without it, movements become jerky and uncoordinated.

SECTION C - Answers to Short Answer Questions

Ans 15.

(a) Yes, the person will be able to withdraw the hand even if nerves from arm to brain are damaged. This is because the reflex arc for withdrawal is completed at the spinal cord level itself. The sensory neurons carry information from the hand to the spinal cord, where they synapse with motor neurons that send signals back to arm muscles to withdraw the hand. The brain is not required for this reflex action.

(b) No, the person will NOT feel pain if the nerves from arm to brain are damaged. Although the hand will withdraw reflexively, the sensation of pain requires the information to reach the brain for

conscious perception. Since the nerves carrying signals to the brain are damaged, the pain signals cannot reach the brain, and therefore the person will not be aware of the pain. This demonstrates that reflex action and pain sensation involve different pathways.

Ans 16.

Completed Table:

Type of Tropism	Stimulus	Example
Phototropism	Light	Shoots bending toward light
Geotropism (Gravitropism)	Gravity	Roots growing downward
Hydrotropism	Water	Roots growing toward water

[Additional acceptable tropisms: Thigmotropism (Touch - Tendrils coiling around support), Chemotropism (Chemicals - Pollen tubes growing toward ovules)]

Ans 17.

Muscle cells move in response to nerve impulses through the following mechanism:

1. When a nerve impulse reaches a muscle cell through the neuromuscular junction, it triggers a response in the muscle fiber.
2. Muscle cells contain special proteins (primarily actin and myosin) that can change both their shape and their arrangement within the cell.
3. In response to the nervous electrical impulse, these proteins interact with each other, sliding past one another to create contraction.
4. This interaction and new arrangement of proteins causes the muscle cells to shorten or contract, producing movement.
5. When the nerve stimulation stops, the proteins return to their relaxed arrangement, and the muscle relaxes.

This protein-based mechanism converts the electrical signal from nerves into mechanical movement, enabling all voluntary and involuntary muscle movements in the body.

SECTION D - Answer to Long Answer Question

Ans 18.

Coordination in Plants Using Hormones:

Plants use chemical coordination through hormones (also called phytohormones or plant growth regulators) to control and coordinate their growth, development, and responses to environment. Unlike animals, plants lack a nervous system, so hormones are their primary means of coordination.

Major Plant Hormones:

1. AUXIN:

- **Site of Synthesis:** Shoot tip (apical meristem)
- **Functions:**
 - Promotes cell elongation and growth
 - Responsible for phototropism (bending toward light)
 - Controls apical dominance
- **Example:** When light falls on a plant from one side, auxin diffuses to the shady side, causing cells there to elongate more, making the shoot bend toward light.

2. GIBBERELLINS:

- **Site of Synthesis:** Young leaves, root tips, and developing seeds
- **Functions:**
 - Promote stem elongation and growth
 - Help in seed germination
 - Break dormancy
- **Example:** Application of gibberellins can make dwarf plants grow taller by stimulating stem growth.

3. CYTOKININS:

- **Site of Synthesis:** Root tips and developing fruits and seeds
- **Functions:**
 - Promote cell division (cytokinesis)
 - Delay aging in leaves
 - Promote cell differentiation
- **Example:** High concentrations are found in areas of rapid cell division like fruits and seeds, stimulating their growth and development.

4. ABSCISIC ACID:

- **Site of Synthesis:** Leaves, especially in response to stress
- **Functions:**
 - Inhibits growth
 - Promotes dormancy in seeds and buds
 - Causes closure of stomata during water stress
 - Promotes wilting and falling of leaves
- **Example:** During drought conditions, abscisic acid is produced, causing stomata to close and preventing water loss.

MECHANISM OF HORMONE ACTION:

Plant hormones are synthesized at one location and diffuse to the area where they act. They work by altering the pattern of cell growth and development. For instance, in phototropism, unequal distribution of auxin causes differential growth rates on different sides of the stem, resulting in bending.

CONCLUSION: Through these diverse hormones working in coordination, plants can respond to environmental stimuli, regulate growth, and survive in changing conditions despite lacking a nervous system.

SECTION E - Answers to Case Study Based Questions

(a) Patient A's condition (goitre) is caused by deficiency of iodine, which is needed to synthesize thyroxin hormone. Low thyroxin levels lead to enlarged thyroid gland and decreased metabolic rate.

(b) Patient B's condition (acromegaly) is caused by excess secretion of growth hormone from the pituitary gland. In adults, this leads to continued bone growth, especially in hands, feet, and face.

(c) Patient C (diabetes) needs insulin injections because the pancreas is not producing enough insulin or cells are not responding to it properly.

How insulin works:

- Insulin acts as a key that allows glucose to enter cells from the bloodstream
- It promotes uptake of glucose by body cells, where it can be used for energy or stored as glycogen
- Without sufficient insulin, glucose accumulates in blood (high blood sugar) and is excreted in urine (causing frequent urination)
- Insulin injections supplement the body's insulin supply, helping maintain normal blood sugar levels and preventing complications of diabetes

Ans 20.

(a) Plants without shoot tips failed to show phototropism because auxin, the hormone responsible for phototropic response, is synthesized at the shoot tip. Without the shoot tip, no auxin was produced, so there could be no differential growth response to light.

(b) The scientist applied auxin to restore the phototropic response.

(c) This experiment proves auxin synthesis and function in two ways:

Proof of Synthesis at Shoot Tip:

- Removal of shoot tip eliminated phototropic response, showing that something essential was being produced there
- Application of auxin to the cut surface restored the response, confirming that auxin was the missing factor
- This proves auxin is synthesized at the shoot tip

How Auxin Causes Phototropic Bending:

- In normal plants, when light comes from one side, auxin from the shoot tip diffuses toward the shady side
- Higher auxin concentration on the shady side causes those cells to elongate more than cells on the lit side
- This unequal growth causes the shoot to bend toward the light source
- The experiment demonstrates that auxin is both necessary and sufficient for phototropic response