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CLASS X · SCIENCE (086) · BIOLOGY · CBSE BOARD EXAMINATION 2027

CHAPTER 6

Control and Coordination

Neuron · Auxin
Insulin

Answer Booklet · CBSE marking-scheme answers with marks for every point

Every question of the chapter booklet | Marks shown point by point | MCQ keys with reasons

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HOW TO USE THE ANSWERS

1. Answer the question in your notebook **first**. Open this booklet only to check.
2. Each answer is written the way the CBSE marking scheme sets it out: **value points**, with the **mark for each point** in orange beside it.
3. Give yourself marks point by point. Use the same **key words** in your own answers.
4. Equations must be balanced; diagrams must be labelled; numericals need formula, substitution and unit.
5. Copy every wrong answer to the My Mistakes page of your booklet.

READ THIS FIRST

Marking Guide

Model answers to every question in the chapter booklet, set out the way a CBSE examiner marks them.

HOW MARKS ARE GIVEN IN SCIENCE ANSWERS

1. **MCQ and assertion–reason (1 mark):** only the correct option scores. The reason given here is for your understanding.
2. **2 and 3 marks:** one mark (or ½) for each correct **value point**. The examiner looks for the key word – a long answer without it scores less than a short answer with it.
3. **Equations:** a correct balanced equation earns its full mark; an unbalanced one, or one with wrong formulae, usually earns ½ or nothing.
4. **Numericals:** formula, substitution and the final answer **with unit** are marked separately.
5. **Diagrams:** marks for a correct drawing and for the labels asked for. An unlabelled diagram earns little.
6. **Case study (4 marks):** 1 + 1 + 2. **Long answer (5 marks):** the split is shown beside each point.

PART A · ANSWERS

A NCERT Practice – Answers

Marking-scheme answers for every question in Part A of the chapter booklet.

Nervous system

A1. How is a reflex action different from walking? **[2]**

A reflex action is sudden, automatic and involuntary; it is controlled by the spinal cord without thinking. — 1

Walking is a voluntary action, done by choice and controlled by the brain (forebrain, with the cerebellum for balance). — 1

A2. What happens at the synapse between two neurons? **[2]**

When the impulse reaches the end of the axon, it releases chemicals into the synapse (the small gap). — 1

These chemicals cross the gap and start a similar electrical impulse in the dendrite of the next neuron. — 1

A3. Which part of the brain maintains posture and balance of the body? **[1]**

Cerebellum (part of the hindbrain). — 1

A4. How do we detect the smell of an agarbatti (incense stick)? **[2]**

Olfactory receptors in the nose detect the smell and produce nerve impulses. — 1

Sensory nerves carry the impulses to the smell area of the forebrain, which interprets them as the smell of the agarbatti. — 1

A5. What is the role of the brain in a reflex action? [2]

The response in a reflex action is decided by the spinal cord, without involving the brain. 1

The information also reaches the brain, so we become aware of what happened and can think about it later. 1

A6. Describe the structure of a neuron and the function of its parts. [3]

Dendrites – pick up information and start an electrical impulse. 1

Cell body (with nucleus) – receives the impulse; axon – a long fibre that carries the impulse away from the cell body. 1

Nerve ending – releases chemicals at the synapse to pass the impulse to the next cell. 1

A7. What is the function of receptors? What problems may arise if they do not work properly? [2]

Receptors detect stimuli (light, sound, smell, taste, heat, touch) and send impulses to the brain or spinal cord. 1

If they do not work, we cannot sense changes – e.g. we may not feel a hot object and get burnt, or not smell gas or spoilt food. 1

A8. How are the brain and the spinal cord protected? [2]

The brain is inside a bony box (the skull), within a fluid-filled balloon that absorbs shocks. 1

The spinal cord is protected by the vertebral column (backbone). 1

A9. Name the parts of the central nervous system and of the peripheral nervous system. [2]

CNS: brain and spinal cord. 1

PNS: cranial nerves (from the brain) and spinal nerves (from the spinal cord). 1

A10. Which signals get disrupted when the spinal cord is injured? [2]

Reflex actions controlled by that part of the spinal cord fail. 1

Messages from the body to the brain, and orders from the brain to the muscles below the injury, cannot pass – so feeling and movement are lost. 1

A11. What is a reflex arc? Show the path of a reflex arc by a flow chart. [3]

The pathway followed by nerve impulses in a reflex action is a reflex arc. 1

Stimulus → receptor → sensory neuron → relay neuron in the spinal cord → motor neuron → effector (muscle/gland) → response. 2

Coordination in plants

A12. How does a shoot bend towards light? [3]

Auxin is made at the shoot tip. 1

When light comes from one side, auxin moves to the shaded side of the shoot. 1

Auxin makes cells on the shaded side grow longer, so the shoot bends towards the light (phototropism). 1

A13. Name a plant hormone that promotes growth and one that inhibits growth. [2]

Promotes growth: auxin (or gibberellin / cytokinin). 1

Inhibits growth: abscisic acid. 1

A14. How is the movement of leaves of the touch-me-not plant different from the movement of a shoot towards light? [3]

Touch-me-not: immediate response to touch; no growth is involved. 1

It happens because cells change shape by changing their water content, and the message passes from cell to cell by electrical-chemical means. 1

Shoot towards light: a slow, directional movement due to growth (more growth on the shaded side caused by auxin). 1

A15. How do the tendrils of a pea plant climb a support? [2]

When a tendril touches a support, the part in contact grows slowly. 1

The part away from the support grows faster, so the tendril coils around the support. 1

A16. Design an experiment to show hydrotropism. [3]

Fill a box with dry soil and sow a few seeds in it. Bury a porous clay pot filled with water in the soil at one side. 1

Water the seeds lightly only once; then let them grow for a few days. 1

Dig out the seedlings: the roots have grown towards the porous pot (water) – roots are positively hydrotropic. 1

Hormones in animals

A17. How does chemical coordination take place in animals? [2]

Endocrine glands release chemical messengers called hormones directly into the blood. 1

Blood carries the hormones to target organs, which respond to them. 1

A18. Why is the use of iodised salt advised? [2]

Iodine is needed by the thyroid gland to make thyroxin, which controls metabolism of carbohydrates, proteins and fats. 1

Lack of iodine can cause goitre (swollen neck); iodised salt supplies iodine. 1

A19. How does our body respond when adrenaline is released into the blood? **[3]**

The heart beats faster, sending more oxygen to the muscles. 1

Blood supply to the digestive system and skin is reduced (small arteries there contract), so more blood goes to the skeletal muscles. 1

Breathing rate increases (diaphragm and rib muscles contract faster). The body is ready to deal with the emergency. 1

A20. Why are some patients of diabetes treated with insulin injections? **[2]**

Insulin, made by the pancreas, controls the level of sugar in the blood. 1

In these patients too little insulin is made, so blood sugar rises; injections supply the missing insulin. 1

A21. What is a feedback mechanism? Give an example. **[2]**

A mechanism that controls the timing and amount of a hormone according to the body's need. 1

When blood sugar rises, the pancreas releases more insulin; when it falls, insulin release is reduced. 1

A22. Compare nervous and hormonal coordination (three points). **[3]**

Nervous: electrical impulses along nerves; hormonal: chemicals carried by blood. 1

Nervous: very fast and short-lived; hormonal: slower but long-lasting. 1

Nervous: reaches only cells joined to nerves; hormonal: reaches all cells of the body. 1

B

PART B · ANSWERS

Exemplar Practice – Answers

Marking-scheme answers for every question in Part B of the chapter booklet.

Multiple choice

Q	Answer	Working / reason
B1	**(c)** Cytokinin	Cytokinins promote cell division in plants.
B2	**(b)** synapse	Chemicals cross the synapse to pass on the impulse.
B3	**(d)** all of these	Forebrain – thinking; medulla – involuntary actions; cerebellum – balance.
B4	**(b)** chemotropism	It is a response to chemicals.
B5	**(b)** thyroxin	Thyroxin contains iodine.
B6	**(a)** Growth hormone	Growth hormone is made by the pituitary.
B7	**(b)** wilting of leaves	It inhibits growth and causes wilting.
B8	**(b)** medulla	The medulla continues as the spinal cord.
B9	**(c)** Salivation when food is in the mouth	Salivation is controlled by the medulla without our will.
B10	**(b)** cerebellum	The cerebellum maintains posture and balance.

Short answer

B11. Name the hormones released by the testes and the ovaries, and state one function of each. **[2]**

Testes – testosterone: brings changes of puberty in boys (deep voice, facial hair) and development of male organs. 1

Ovaries – oestrogen: brings changes of puberty in girls and development of female organs. 1

B12. Why is a reflex action quicker than a voluntary action? **[2]**

In a reflex the impulse goes only to the spinal cord, which decides the response at once. 1

A voluntary action needs the brain to receive, think about and decide the response, which takes longer. 1

B13. The leaves of a touch-me-not plant droop when touched, but there is no growth. How does this happen? **[2]**

The touch is passed from cell to cell by electrical-chemical signals. 1

Cells at the base of the leaves lose water and change shape (shrink), so the leaves fold and droop. 1

B14. State one function each of gibberellins and cytokinins. **[2]**

Gibberellins – help growth of the stem. 1

Cytokinins – promote cell division (e.g. in fruits and seeds). 1

B15. What will happen if the nerve joining a leg muscle to the spinal cord is cut? [2]

Impulses from the spinal cord (and brain) can no longer reach the muscle. 1

The muscle cannot contract, so the leg cannot move (paralysis); reflexes of that muscle also stop. 1

PART C · ANSWERS

C Board Pattern Practice – Answers

Marking-scheme answers for every question in Part C of the chapter booklet.

The brain

Q	Answer	Working / reason
C1	**(b)** Cerebellum	The cerebellum controls precision of voluntary actions.
C2	**(c)** medulla	The medulla in the hindbrain controls these involuntary actions.
C3	**(a)** forebrain	The forebrain has a centre for hunger.
C4	**(a)**	Both true; R explains A.

C5. Name the two regions of the brain that control involuntary actions. Which part controls blood pressure and vomiting? [2]

Midbrain and hindbrain. 1

Medulla (in the hindbrain). 1

C6. Name the part of the brain responsible for (i) thinking and memory (ii) posture and balance. How is the brain protected? [3]

(i) Forebrain (cerebrum). 1

(ii) Cerebellum. 1

Bony skull (cranium) and a fluid-filled balloon that absorbs shocks. 1

Neurons, nerves and reflexes

Q	Answer	Working / reason
C7	**(b)** Dendrite → cell body → axon → nerve ending	Dendrites receive; the axon carries the impulse away.
C8	**(b)** motor nerve	Motor nerves carry orders to effectors.
C9	**(a)**	Both true; R explains A.
C10	**(a)**	Both true; R explains A.

C11. How does a muscle contract when it receives a nerve impulse? [2]

Muscle cells contain special proteins. 1

On receiving the impulse, these proteins change their shape and arrangement, so the muscle cells become shorter – the muscle contracts. 1

C12. You touch a hot iron and pull your hand back at once. Name this action and trace its path. Where is the decision taken? **[3]**

Reflex action. ½

Heat receptor in the skin → sensory neuron → relay neuron in the spinal cord → motor neuron → arm muscle (effector) → hand pulled back. 2

The decision is taken in the spinal cord. ½

C13. Distinguish between a sensory neuron and a motor neuron. **[2]**

Sensory neuron carries impulses from receptors (sense organs) to the brain or spinal cord. 1

Motor neuron carries impulses from the brain or spinal cord to effectors (muscles or glands). 1

Hormones in animals

Q	Answer	Working / reason
C14	**(c)** adrenal glands	Adrenal glands lie on top of the kidneys.
C15	**(b)** Pituitary	The pituitary (and hypothalamus) lie in the brain.
C16	**(c)** Iodine	Iodine is needed to make thyroxin.
C17	**(a)**	Both true; R explains A.

C18. State two limitations of using electrical impulses for communication in the body. How does chemical communication overcome them? **[3]**

(i) Electrical impulses reach only those cells that are connected by nervous tissue. 1

(ii) After making an impulse, a cell needs time to reset before it can make another, so impulses cannot be sent continuously. 1

Hormones released into the blood reach all cells of the body and can act steadily and for a long time. 1

C19. Name the gland that secretes each hormone and give one function: (i) thyroxin (ii) insulin (iii) growth hormone. **[3]**

(i) Thyroid – controls metabolism of carbohydrates, proteins and fats. 1

(ii) Pancreas – controls blood sugar level. 1

(iii) Pituitary – controls growth and development of the body. 1

C20. Which hormones bring about the changes of puberty in boys and girls? Give one change in each. **[2]**

Boys: testosterone (from the testes) – e.g. deepening of voice, growth of facial hair. 1

Girls: oestrogen (from the ovaries) – e.g. development of breasts, start of the menstrual cycle. 1

Coordination in plants

Q	Answer	Working / reason

C21	**(b)** auxin collects on the shaded side, making cells there grow longer	More growth on the shaded side bends the shoot towards light.
C22	**(b)** cells change shape by changing their water content	No growth is involved; cells swell or shrink with water.
C23	**(a)**	Both true; R explains A.

C24. Name the plant hormone that (i) promotes cell division (ii) causes wilting of leaves (iii) helps the stem grow (iv) is made at the shoot tip and makes cells grow longer. **[2]**

(i) Cytokinin (ii) abscisic acid — 1

(iii) Gibberellin (iv) auxin — 1

C25. Give three differences between the movement of touch-me-not leaves on touch and the movement of a shoot towards light. **[3]**

Touch-me-not: immediate; shoot: slow. — 1

Touch-me-not: not due to growth (change in water content of cells); shoot: due to growth (unequal growth caused by auxin). — 1

Touch-me-not: not directional (does not depend on the direction of the stimulus); shoot: directional, towards the light. — 1

Long answer

C26. (a) Name the three main regions of the human brain and give one function of each. (b) Give the functions of the medulla and the cerebellum. (c) How is the brain protected? **[5]**

(a) Forebrain – thinking, interpreting senses, voluntary actions; midbrain – involuntary actions; hindbrain – involuntary actions and balance. — 2

(b) Medulla – blood pressure, salivation, vomiting. — 1

Cerebellum – precision of voluntary actions; posture and balance. — 1

(c) Inside the skull, in a fluid-filled balloon that absorbs shocks. — 1

C27. (a) What are hormones? Why are endocrine glands called ductless? (b) Name the hormone and gland involved in (i) goitre (ii) diabetes (iii) a 'fight or flight' response. (c) Explain the feedback control of insulin. **[5]**

(a) Chemical messengers that coordinate body activities; endocrine glands pour hormones directly into the blood, not through ducts. — 1

(b) (i) Thyroxin – thyroid (ii) insulin – pancreas (iii) adrenaline – adrenal glands. — 1½

(c) When blood sugar rises, pancreas cells detect it and release more insulin. — 1½

As blood sugar falls, insulin release is reduced; so the level stays steady. — 1

C28. (a) What are tropic movements? Name the tropism shown by (i) roots growing down (ii) a pollen tube growing to the ovule (iii) roots growing towards water. (b) Explain the role of auxin in phototropism. (c) Name a plant hormone that inhibits growth. **[5]**

(a) Directional growth movements of plant parts in response to a stimulus. 1

(i) Geotropism (ii) chemotropism (iii) hydrotropism. 1½

(b) Auxin, made at the shoot tip, moves to the shaded side; cells there grow longer, so the shoot bends towards light. 1½

(c) Abscisic acid. 1

PART D · ANSWERS

D Case-Based Questions – Answers

Marking-scheme answers for every question in Part D of the chapter booklet.

D1. Case Study · The Hot Tava [4]

(i) Name the type of action shown by Kabir's hand. **[1]**

Reflex action. 1

(ii) Which part of the nervous system took the decision to pull the hand back? **[1]**

The spinal cord. 1

(iii) Write the path of the impulse in this action, from receptor to effector. **[2]**

Heat receptors in the skin → sensory neuron → relay neuron in the spinal cord. 1

→ motor neuron → muscles of the arm (effector) contract → hand pulled back. 1

OR

(iii) Why did Kabir feel the pain only after pulling his hand back? Why have such actions evolved? **[2]**

The message reached the brain a little later than the spinal cord's quick response, so awareness of pain came after. 1

The brain's thinking is too slow for danger; reflexes protect the body instantly. 1

D2. Case Study · The Bending Seedling [4]

(i) Name the response of the shoots to light. **[1]**

Phototropism (positive). 1

(ii) Name the hormone responsible for the bending. **[1]**

Auxin. 1

(iii) Explain how this hormone makes the shoot bend towards the hole. **[2]**

Auxin, made at the shoot tip, moves to the side away from light (shaded side). 1

It makes the cells on that side grow longer, so the shoot bends towards the light. 1

OR

(iii) Name the response of the roots, and the stimulus. How is this response different from the folding of touch-me-not leaves? **[2]**

Positive geotropism; the stimulus is gravity. 1

It is a slow growth movement in a fixed direction; touch-me-not folding is quick, involves no growth and is caused by change in water content of cells. 1

D3. Case Study · The Sugar Test [4]

(i) Name the hormone that the grandfather lacks. **[1]**

Insulin. 1

(ii) Name the disease that the classmate's mother has. **[1]**

Goitre. 1

(iii) How is the level of this hormone normally kept right in a healthy person? **[2]**

By a feedback mechanism: when blood sugar rises, the pancreas detects it and releases more insulin. 1

When sugar falls, insulin release is reduced, so the level stays steady. 1

OR

(iii) Why does lack of iodine cause the swelling? Name the gland and the hormone involved. **[2]**

The thyroid gland needs iodine to make the hormone thyroxin. 1

Without enough iodine the thyroid cannot make enough thyroxin and swells – goitre. 1