CBSE CLASS X

# Science (086)

ANSWER KEY

*AI-generated question paper*

**Code: ALK1C6** **Questions: 46** **Maximum Marks: 130** **Generated: 2026-06-25 17:31**

**SELECTIONS USED**

| | |
|---|---|
| Subject | Science |
| Lessons | 6 Control and Coordination |
| Level of understanding | Thorough understanding |
| Question selection | Curated chapter coverage (~5 questions per section + 8 synthesis) |
| Model | claude-sonnet-4-6 |

Composition — Difficulty: 3 straightforward · 23 medium · 20 deep | Types: 34 Short · 6 Long · 3 Very short · 3 MCQ

**Q1.** medium thorough-understanding § Introduction **[2]**

A plant bends towards sunlight over several hours, while a cat leaps away from a sudden loud noise in a fraction of a second. Explain the fundamental difference in the nature of the mechanisms responsible for these two types of movement. Why can plants not use the same mechanism as animals for responding to stimuli?

◆ Control and Coordination

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### Model Answer

The plant's bending is caused by **hormonal (chemical) coordination** — auxin causes unequal growth, which is slow. The cat's leap is driven by the **nervous system** transmitting rapid electrical impulses via specialised nerve and muscle tissue.

Plants lack nervous tissue and muscle tissue entirely. Without these, they cannot generate or conduct fast electrical impulses, so they cannot produce the rapid, forceful responses that animals can.

### Explanation

Examiners look for two key contrasts: (1) plant = chemical/hormonal, slow, growth-based vs. animal = nervous/electrical, fast, muscle-based; and (2) the reason plants cannot use the animal mechanism — absence of nervous tissue and muscles. Keep these points distinct and precise. Don't write a full paragraph on hormones — this is only 2 marks.

**Q2.** deep thorough-understanding § Introduction **[3]**

A buffalo continuously chews cud even when there is no new food in its mouth, while a child on a swing pumps her legs in response to feeling herself slow down. Classify each movement as voluntary, involuntary, or reflex, giving a reason for each. Are either of these movements a direct response to an environmental stimulus? Justify your answer.

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### Model Answer

**Buffalo chewing cud** — This is an **involuntary** action. The buffalo does not consciously decide to chew; it happens automatically, controlled by the mid-brain/hind-brain without deliberate thought.

**Child pumping legs on a swing** — This is a **voluntary** action. The child consciously decides to pump her legs in response to feeling herself slow down, involving thinking and deliberate muscle movement controlled by the fore-brain.

**Direct response to environmental stimulus:**
Only the child's action is a direct response to an environmental stimulus (the sensation of slowing down). The buffalo's cud-chewing is an internal digestive process, not triggered by an external environmental change.

*Source: Chapter 6, Sections 6.1.1 and 6.1.2*

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### Explanation

- **Involuntary actions** are automatic, controlled by mid-brain/hind-brain (e.g., heartbeat, digestion-related movements like chewing cud).
- **Voluntary actions** involve conscious decision-making by the fore-brain.
- Examiners expect you to correctly name the action type, link it to the correct brain region or mechanism, and address the stimulus-response part separately.
- The key distinction for the last part: an environmental stimulus is external (slowing swing = external sensation); cud-chewing is internally driven.

**Q3.** medium | thorough-understanding | § 6.1 ANIMALS – NERVOUS SYSTEM **[3]**

When you accidentally step on a nail, the withdrawal of your foot happens before you consciously feel the pain. Explain why the pain is felt slightly after the foot is withdrawn, and why this delay is actually useful to the body.

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### Model Answer

When a nail pierces the foot, the sensory nerve impulse travels to the **spinal cord**, where a reflex arc is completed. The motor nerve immediately signals the foot muscles to withdraw — all without involving the brain. Simultaneously, the pain signal continues travelling **up to the brain (fore-brain)**, which takes slightly longer due to the greater distance and complex neural processing involved. Hence, pain is felt a moment after withdrawal.

**Why this delay is useful:** If the body waited for the brain to consciously process pain before responding, valuable time would be lost, risking greater injury. The reflex arc allows an immediate protective response, making it a faster and more efficient survival mechanism.

*Source: Chapter 6, Section 6.1.1 – Reflex Actions*

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### Explanation

- Examiners expect two distinct parts: (1) the **biological reason** for the delay (reflex arc in spinal cord vs. signal reaching the brain), and (2) the **usefulness** of this delay/reflex system.
- Key terms to use: *reflex arc*, *spinal cord*, *brain*, *sensory/motor nerve* — these fetch marks.
- Don't confuse "delay is useful" with the delay itself being beneficial; it's the **reflex acting before conscious perception** that is useful.
- Avoid writing an essay — keep it tight and structured as above for full 3-mark credit.

**Q4.** deep | thorough-understanding | § 6.1 ANIMALS – NERVOUS SYSTEM **[3]**

A student argues: 'Since reflex arcs evolved because the brain is too slow, animals with highly developed brains should eventually lose their reflex arcs as they become unnecessary.' Do you agree? Justify your answer using your understanding of how reflex arcs and the brain function together.

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### Model Answer

**No, I do not agree.**

Reflex arcs did evolve because the brain's thinking process is too slow for urgent responses. However, even after complex neuron networks developed, reflex arcs **continue to be more efficient for quick responses**. For example, pulling a hand away from a flame via the spinal cord is faster than routing signals to the brain for conscious decision-making. The reflex arc and brain work together — the information also travels to the brain, but the protective action is completed instantly. Thus, reflex arcs remain essential even in animals with highly developed brains.

*Source: Chapter 6, Section 6.1.1 – What happens in Reflex Actions?*

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### Explanation

- The key quote to remember: *"even after complex neuron networks have come into existence, reflex arcs continue to be more efficient for quick responses."*
- Examiners want you to clearly state **disagreement**, give the **reason** (speed/efficiency), and show understanding that **both systems work together** (information goes to brain AND the reflex arc acts simultaneously).
- Avoid just defining reflex arc — the question asks for justification of whether they become unnecessary. Address that directly.

**Q5.** medium | thorough-understanding | § 6.1 ANIMALS – NERVOUS SYSTEM **[5]**

[long_answer] You accidentally prick your finger with a pin. Trace the complete path of the nervous impulse — from the moment the pain receptor in your finger detects the stimulus to the moment the muscles in your arm withdraw the hand. Name all the structures the impulse passes through in order, and explain how the signal crosses the gap between two consecutive neurons.

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## Model Answer

**Path of the Nervous Impulse (Reflex Arc):**

1. **Pain receptor** (dendritic tip of sensory neuron) in the finger detects the pin-prick stimulus.
2. A chemical reaction generates an **electrical impulse** that travels along the **dendrite → cell body → axon** of the sensory (afferent) neuron toward the spinal cord.
3. The impulse reaches the **spinal cord**, where a **reflex arc** is formed. The sensory neuron connects to a **relay neuron** in the spinal cord.
4. The relay neuron passes the impulse to the **motor (efferent) neuron**, which carries it out to the **muscle cells of the arm**.
5. The **muscles contract**, withdrawing the hand. (The signal also travels to the brain, but the withdrawal happens before conscious perception.)

**How the signal crosses the gap (synapse):**
At the end of each axon, the electrical impulse triggers the release of **chemicals (neurotransmitters)**. These chemicals cross the **synapse** (gap between two neurons) and generate a similar electrical impulse in the **dendrite of the next neuron**.

*Source: Chapter 6, Sections 6.1 & 6.1.1*

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## Explanation

- Examiners expect the **sequence**: receptor → sensory neuron → spinal cord (reflex arc) → motor neuron → muscle. Missing any link costs marks.
- The term **reflex arc** is essential; mention that it is formed in the spinal cord.
- For the synapse, you must state **both** parts: electrical impulse causes **chemical release**, chemicals cross the gap and **restart the electrical impulse** — one part alone won't fetch full marks.
- "Impulse passes through dendrite → cell body → axon" must be stated explicitly as it is a direct textbook line.
- At 5 marks, examiners typically award 1 mark per correctly named step/structure and 1 mark for the synapse explanation.

**Q6.** medium | thorough-understanding | § 6.1.1 What happens in Reflex Actions? **[3]**

When you accidentally touch a hot object, the withdrawal of your hand is completed before you consciously feel the pain. What does this tell us about where the decision to withdraw is made, and why is this location advantageous?

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### Model Answer

The decision to withdraw the hand is made in the **spinal cord**, not the brain. When we touch a hot object, the input nerve (detecting heat) and the output nerve (moving muscles) are connected directly in the spinal cord through a **reflex arc**, without waiting for signals to travel all the way to the brain.

This is advantageous because sending signals to the brain for conscious thinking takes too long — enough time to cause serious burns. The spinal cord reflex arc allows a much **faster response**, protecting the body from injury. The pain signal does reach the brain, but only after the hand has already been withdrawn.

*Source: Chapter 6, Section 6.1.1 – Reflex Actions*

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### Explanation

Examiners look for three things here (1 mark each):

1. **Location** — spinal cord (via reflex arc), not the brain.
2. **Mechanism** — input and output nerves are connected in the spinal cord directly, bypassing the brain for the motor response.
3. **Advantage** — speed; brain processing is too slow and could result in greater injury.

Remember: the brain *does* receive the pain signal eventually — that's why you feel pain *after* withdrawal. This nuance shows deeper understanding but is secondary to the three core points above.

**Q7.** deep | thorough-understanding | § 6.1.1 What happens in Reflex Actions? **[3]**

A student argues: 'Reflex arcs are a primitive leftover — animals with complex brains don't really need them anymore.' Using your understanding of how nervous impulses work, explain why this argument is flawed.

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## Model Answer

The student's argument is **flawed** for the following reasons:

1. **Speed of response:** Thinking involves complex interactions of many neurons in the brain. If every response to a dangerous stimulus (like touching a hot object) required brain processing, it would take too long and cause harm. Reflex arcs, formed in the spinal cord itself, bypass the brain and allow an immediate response.
1. **Efficiency even in complex brains:** Even after complex neuron networks evolved, reflex arcs continue to be **more efficient for quick responses**. The brain is simultaneously handling many functions, so offloading urgent responses to spinal reflex arcs reduces processing burden.
1. **Parallel processing:** The information still travels to the brain, but the protective action occurs first. This makes reflex arcs a vital, not obsolete, feature of the nervous system.

Source: Chapter 6, Section 6.1.1 — What happens in Reflex Actions?

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## Explanation

- The key examiner expectation is that you use the textbook reasoning: thinking is *too slow* for emergencies, and reflex arcs evolved precisely to handle rapid responses without waiting for brain processing.
- Mention that information *does* reach the brain, but the reflex action happens before — this shows you understand reflex arcs are complementary to, not replaced by, the brain.
- The direct quote from the passage — *"even after complex neuron networks have come into existence, reflex arcs continue to be more efficient for quick responses"* — is the strongest counter to the student's argument.
- Avoid writing a long essay; three clear points within the word limit is ideal for 3 marks.

**Q8.** deep | thorough-understanding | § 6.1.1 What happens in Reflex Actions? **[3]**

You withdraw your hand from a hot object almost instantly, yet you feel the pain only a moment later. Using your knowledge of the nervous system, explain this time difference. What does it reveal about how information is processed during a reflex action?

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### Model Answer

When we touch a hot object, the sensory receptors detect the stimulus and the nerve impulse travels to the **spinal cord**, where a **reflex arc** is formed. The spinal cord immediately sends a motor signal back to the hand muscles, causing withdrawal — all **without involving the brain**. This is why the hand pulls back almost instantly.

However, the sensation of **pain** is felt only after the same impulse travels further up to the **brain (fore-brain)**, where it is consciously interpreted. This takes slightly longer, causing the time delay.

This reveals that in a reflex action, **information is processed at the spinal cord level**, not the brain, making the response faster and protecting the body from injury before conscious thinking occurs.

*Source: Chapter 6, Section 6.1.1 – Reflex Actions*

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### Explanation

- Examiners look for: (1) reflex arc at spinal cord level = fast withdrawal, (2) pain felt when impulse reaches brain = slight delay, (3) the significance — reflex bypasses brain for speed.
- Key term to use: **reflex arc**, **spinal cord**, **fore-brain**.
- Common mistake: saying the brain controls the reflex — it does NOT; the spinal cord does. The brain only receives the information *after* the response has already happened.
- The passage explicitly states: "Reflex arcs are formed in this spinal cord itself, although the information input also goes on to reach the brain."

**Q9.** medium | thorough-understanding | § 6.1.1 What happens in Reflex Actions? **[3]**

Both reflex actions and voluntary actions involve nerve impulses, yet they differ fundamentally in how they are controlled. Distinguish between the two, and explain why mixing up voluntary control for reflex situations could be harmful to an organism.

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### Model Answer

**Reflex Action:** Controlled by the spinal cord (reflex arc), without involvement of the brain. The response is automatic, rapid, and does not require conscious thinking (e.g., pulling hand away from flame).

**Voluntary Action:** Controlled by the fore-brain (cerebrum). It involves thinking, decision-making, and conscious control (e.g., writing, moving a chair).

**Why mixing them up is harmful:** In dangerous situations like touching a hot object, routing the signal through the brain for conscious thinking would take too long — enough time for serious injury. Reflex arcs evolved precisely because the brain's thinking process is not fast enough for urgent responses.

*Source: Chapter 6, Sections 6.1.1 and 6.1.2*

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### Explanation

- Examiners expect a clear **distinction** (2 marks) and a **reason** for the danger of voluntary control in reflex situations (1 mark).
- Key phrases to use: "spinal cord / reflex arc," "fore-brain / conscious thinking," and "not fast enough / delay causes harm."
- Avoid writing a long essay — this is 3 marks, so keep it tight and point-based.

**Q10.** deep | thorough-understanding | § 6.1.2 Human Brain **[3]**

A student argues that since reflex arcs already handle quick responses to danger, the brain's role in the nervous system is redundant. Why is this argument incorrect? Give TWO distinct reasons.

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## Model Answer

The argument is incorrect for the following reasons:

1. **Reflex arcs handle only simple, automatic responses** (like withdrawing from pain), but the brain is essential for **complex thinking, decision-making, and voluntary actions** such as writing, talking, or riding a bicycle. These require the fore-brain to receive, interpret, and integrate sensory information before directing motor responses.
1. **Involuntary functions and coordination of body processes** — such as regulating blood pressure, salivation, posture, and balance — are controlled by the mid-brain and hind-brain (including medulla and cerebellum). Reflex arcs cannot perform these functions.

Thus, the brain is far from redundant; it is the **main coordinating centre** of the body.

*Source: Chapter 6, Sections 6.1.1 and 6.1.2*

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## Explanation

- Examiners expect **two clearly distinct reasons** — award yourself 1 mark each for the two reasons and 1 mark for the concluding point or overall coherence.
- Avoid mixing the two reasons; keep them separate.
- Key terms to use: **fore-brain, voluntary actions, medulla, cerebellum, coordinating centre** — these signal textbook knowledge and earn marks.
- Do not just say "brain does more things" — name *what* it does specifically.

**Q11.** medium | thorough-understanding | § 6.1.2 Human Brain **[3]**

When you accidentally step on a nail, you not only pull your foot back instantly but also feel sharp pain a moment later and remember the incident for days. Which parts of the nervous system are responsible for each of these three responses — the instant withdrawal, the sensation of pain, and the memory — and where are these parts located?

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### Model Answer

**Instant withdrawal** — controlled by the **spinal cord** (reflex arc). The reflex arc is formed in the spinal cord itself; it connects sensory and motor nerves without waiting for the brain, enabling a fast response.

**Sensation of pain** — felt by the **fore-brain** (cerebrum), located in the skull. The same nerve impulse that triggered the reflex also travels up to the fore-brain, where sensory areas interpret it as sharp pain.

**Memory of the incident** — also the **fore-brain**, which has association areas that store and process information, allowing the event to be remembered for days.

*Source: Chapter 6, Sections 6.1.1 and 6.1.2*

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### Explanation

Examiners look for three distinct parts named correctly with their locations and functions:

- Spinal cord → reflex/withdrawal (stress "reflex arc formed in spinal cord")
- Fore-brain → pain sensation (sensory areas in fore-brain, inside skull)
- Fore-brain → memory (association areas store information)

A common mistake is saying "brain" for all three — be specific about the **fore-brain** for sensation and memory. Also note: the spinal cord is protected by the vertebral column, brain by the bony skull — useful extra detail if space permits.

**Q12.** straightforward | thorough-understanding | § 6.1.2 Human Brain **[1]**

Which part of the brain is most directly involved when a gymnast maintains perfect balance while walking on a beam, and what would happen if this part were damaged?

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### Model Answer

The **cerebellum** (part of the hind-brain) is responsible for balance and posture. If damaged, the gymnast would lose precision in voluntary actions and be unable to maintain balance.

### Explanation

The passage explicitly states the cerebellum is responsible for "precision of voluntary actions and maintaining the posture and balance of the body." Always name the part and state the consequence of damage — both are expected in such questions even for 1 mark.

**Q13.** medium | thorough-understanding | § 6.1.2 Human Brain **[2]**

The forebrain receives sensory impulses from the eyes, ears, nose, and skin simultaneously. Explain how the forebrain is able to integrate all this information and generate an appropriate response. Which specific region of the forebrain is responsible for this integration?

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### Model Answer

The forebrain has **separate areas of association** where sensory information from different receptors (eyes, ears, nose, skin) is interpreted by combining it with information from other receptors and information already stored in the brain. Based on this, a decision is made and signals are sent to motor areas to generate an appropriate response.

The specific region responsible for this integration is the **cerebrum** (fore-brain/association areas of the fore-brain).

*Source: Chapter 6, Section 6.1.2 – Human Brain*

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### Explanation

- Examiners expect you to mention: (1) separate sensory areas in the forebrain, (2) association areas that interpret and combine information, (3) motor areas that execute the response.
- Naming the **cerebrum** or "fore-brain" as the region scores the identification mark.
- Avoid writing about the spinal cord or reflex arcs here — this question is specifically about voluntary, integrated responses in the forebrain.

**Q14.** medium | thorough-understanding | § 6.1.2 Human Brain **[3]**

Classify the following actions as voluntary or involuntary, and for each involuntary action, name the specific part of the nervous system that controls it: (i) writing an answer in an exam, (ii) sneezing when dust enters the nose, (iii) maintaining balance while climbing stairs, (iv) increased heart rate during exercise.

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### Model Answer

| Action | Type | Controlling Part |
|---|---|---|
| (i) Writing an answer | **Voluntary** | Fore-brain (cerebrum) |
| (ii) Sneezing | **Involuntary** | Medulla in the hind-brain |
| (iii) Maintaining balance on stairs | **Involuntary** | Cerebellum (hind-brain) |
| (iv) Increased heart rate | **Involuntary** | Medulla in the hind-brain |

Writing is a thought-out voluntary action controlled by the fore-brain. Sneezing and heart rate changes are involuntary actions controlled by the medulla. Balance and posture are maintained by the cerebellum, which ensures precision of voluntary actions.

Source: Control and Coordination, Section 6.1.2 Human Brain

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### Explanation

- Examiners expect correct classification **and** the specific brain region for each involuntary action — both parts are needed for full marks.
- A common mistake is saying the "brain" controls balance; you must name **cerebellum** specifically.
- Sneezing may seem like a reflex, but the question asks for the involuntary control centre — the **medulla** controls involuntary actions like salivation, vomiting, and sneezing.
- "Voluntary" actions need no brain-part name; only involuntary ones require it as per the question.

**Q15.** deep | thorough-understanding | § 6.1.2 Human Brain **[5]**

A person suffers a stroke that selectively damages the mid-brain and hind-brain, leaving the forebrain completely unaffected. List any FOUR critical body functions that would be disrupted as a result, naming the specific brain region responsible for each, and explain why the person's life would be at risk despite having an intact forebrain.

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## Model Answer

**Four critical functions disrupted (mid-brain and hind-brain damage):**

1. **Blood pressure regulation** — controlled by the **medulla** (hind-brain); loss disrupts cardiovascular function.
2. **Breathing / respiration** — controlled by the **medulla** (hind-brain); the person cannot breathe automatically.
3. **Salivation and vomiting** — controlled by the **medulla** (hind-brain); basic digestive reflexes fail.
4. **Posture, balance, and precision of movement** — controlled by the **cerebellum** (hind-brain); the person cannot walk or coordinate movements.

**Why life is at risk despite intact forebrain:**

The forebrain handles thinking, sensory interpretation, and voluntary actions, but it does NOT control involuntary vital functions. Breathing and blood pressure are regulated by the medulla and cannot be consciously overridden by the forebrain. Without these, the body's basic life-support systems fail, making survival impossible regardless of intact thinking ability.

*Source: Human Brain, Chapter 6*

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## Explanation

- Examiners want **four distinct points** each naming the function + specific brain region — award ~½ mark each.
- The final paragraph (why life is at risk) is the reasoning/application part — crucial for full marks.
- Key pitfall: students often write "hind-brain" as a whole rather than specifying **medulla** vs **cerebellum** — be precise.
- The forebrain contrast is essential: it shows conceptual understanding that voluntary/thinking control cannot substitute for involuntary life-sustaining control.

**Q16.** deep | thorough-understanding | § 6.1.3 How are these Tissues protected? **[3]**

The brain is enclosed in a fluid-filled balloon inside a bony box, while the spinal cord runs through the vertebral column. What is the functional advantage of having two different types of protective mechanisms — one for the brain and one for the spinal cord — rather than a single uniform structure protecting both?

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### Model Answer

The brain performs complex functions like thinking, memory, and voluntary control, so it needs stronger protection — a rigid bony box (skull) plus a fluid-filled balloon for shock absorption. The fluid cushions the brain against sudden jerks or impacts.

The spinal cord, being a long structure running down the back, requires flexibility for body movement. A rigid box would prevent bending and twisting. Hence, the vertebral column — a series of interlocking bones — protects it while still allowing movement.

A single rigid structure cannot provide both rigid shock absorption and flexible movement simultaneously. Two different mechanisms thus suit the specific structural and functional needs of each part of the CNS.

*Source: Chapter 6, Section 6.1.3 – How are these Tissues protected?*

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### Explanation

- Examiners expect you to **contrast** the two mechanisms and link each to its function — don't just describe them separately.
- Key functional words: brain needs **shock absorption** (fluid-filled balloon) + **rigid protection** (skull); spinal cord needs **flexibility during movement** (vertebral column).
- The "why not one uniform structure" part is the core of the question — always address it explicitly in the last point.
- Avoid listing facts without connecting structure → function → advantage.

**Q17.** medium | thorough-understanding | § 6.1.4 How does the Nervous Tissue cause Action? **[3]**

When a nerve impulse travels along a nerve fibre and reaches the point where the nerve meets a muscle, the electrical signal alone cannot directly make the muscle contract. Explain why a chemical step is necessary at this junction, and describe in brief what happens as a result of this chemical step that leads to muscle movement.

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### Model Answer

At the nerve-muscle junction (neuromuscular junction), the electrical impulse alone cannot cross the gap between the nerve ending and the muscle cell. A chemical step is necessary because the gap must be bridged by a chemical messenger.

When the electrical impulse reaches the end of the axon, it triggers the release of chemicals across this junction. These chemicals reach the muscle cell and stimulate it. In response, the special proteins present in the muscle cell change their shape and arrangement, causing the muscle cell to shorten. This shortening of muscle cells results in muscle contraction and movement.

*Source: Chapter 6, Section 6.1 — Animals: Nervous System / 6.1.4 How does Nervous Tissue cause Action?*

### Explanation

- Examiners expect three clear points for 3 marks: (1) why electrical signal alone cannot work — the gap/synapse exists, (2) what the chemical step is — release of chemicals at axon end, (3) what happens next — proteins change shape → muscle shortens → movement.
- The textbook explicitly states: "At the end of the axon, the electrical impulse sets off the release of some chemicals" and "Muscle cells have special proteins that change both their shape and their arrangement… giving the muscle cells a shorter form."
- Use the term **neuromuscular junction** to score full marks — it signals precise vocabulary to the examiner.
- Do not write about synapses between two neurons in detail; keep focus on the nerve-to-muscle step as the question demands.

**Q18.** deep | thorough-understanding | § 6.1.4 How does the Nervous Tissue cause Action? **[3]**

A person suffers nerve damage that prevents electrical impulses from reaching the skeletal muscles of one leg, yet the muscles themselves are perfectly healthy. Predict what will happen to movement in that leg and explain why, connecting the roles of the nervous tissue and muscle tissue in producing movement.

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### Model Answer

The person will lose all voluntary movement in that leg, even though the muscles are healthy.

This happens because nervous tissue and muscle tissue must work together to produce movement. The nervous tissue carries electrical impulses from the brain to the muscles. When an impulse reaches the muscle, special proteins in the muscle cells change their shape and arrangement, causing the muscle fibres to shorten — producing movement. Since nerve damage prevents impulses from reaching the skeletal muscles, the muscles never receive the signal to contract, so no movement occurs despite being perfectly healthy.

*Source: Chapter 6, Section 6.1.4 — How does the Nervous Tissue cause Action?*

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### Explanation

- Examiners want you to **link both tissues**: nervous tissue transmits the impulse; muscle tissue executes the movement via protein shape-change. Mentioning only one earns partial marks.
- Use the textbook phrase "special proteins change shape and arrangement" — it shows precise recall.
- The key insight is that **healthy muscles are useless without the nerve signal** — state this clearly for full marks.
- Avoid over-explaining neuron structure; the question asks about the *consequence* of the damage and the *roles* of both tissues.

**Q19.** deep thorough-understanding § 6.2 COORDINATION IN PLANTS **[5]**

A gardener grows two identical seedlings in separate pots. Seedling A is placed near a window with light coming from one side, while Seedling B is kept in complete darkness. After a week, Seedling A bends toward the light but Seedling B grows straight up.

(i) Explain the role of auxin in causing Seedling A to bend toward the light, clearly describing how the unequal distribution of auxin produces directional growth.
(ii) The movement of Seedling A toward light is described as growth-dependent. How is this fundamentally different from the way the leaves of a touch-me-not plant (Mimosa) move when touched? In your answer, refer to the cellular mechanism responsible for each type of movement.

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## Model Answer

**(i) Role of Auxin in Phototropism:**

When light falls from one side on Seedling A, auxin (synthesised at the shoot tip) diffuses towards the **shady side** of the shoot. This causes a higher concentration of auxin on the side away from light. Auxin stimulates the cells on the shady side to **elongate more** than the cells on the lit side. Since one side grows longer than the other, the shoot bends **towards the light**. This directional growth movement is called **phototropism**.

**(ii) Growth-dependent vs. Growth-independent Movement:**

The bending of Seedling A is **growth-dependent** — it occurs because cells on one side elongate permanently due to auxin. If growth is prevented, no movement occurs.

The leaves of the touch-me-not (*Mimosa*) move **independently of growth**. When touched, information is conveyed cell to cell by electrical-chemical signals. Cells at the base of the leaf change their **water content** — they lose water and shrink, causing the leaf to fold and droop rapidly. No cell elongation or growth is involved; shape changes through **osmotic swelling or shrinking** of cells.

*Source: Chapter 6, Sections 6.2, 6.2.1, 6.2.2*

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## Explanation

- For part (i), the key chain is: light from one side → auxin shifts to shady side → greater cell elongation on shady side → bending toward light. Examiners want all three steps clearly stated.
- For part (ii), the contrast must be explicit: growth (cell elongation, permanent) vs. no growth (change in water content of cells, reversible). The word "osmotic" or "water content change" is expected for the Mimosa mechanism.
- Do not confuse the two types of movement — the textbook explicitly states Mimosa movement is growth-independent, while phototropism is growth-dependent.

**Q20.** deep | thorough-understanding | § 6.2.1 Immediate Response to Stimulus **[3]**

The leaves of a sensitive plant (Mimosa) fold up when touched, even though the point of touch and the point of movement are different parts of the plant. Explain how this movement is brought about, and why it is fundamentally different from how an animal muscle produces movement.

◆ Control and Coordination

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### Model Answer

When a sensitive plant (Mimosa) is touched, the information is communicated from cell to cell using **electrical-chemical means**, even though there is no specialised nervous tissue. The cells at the point of movement then change their shape by **changing the amount of water in them** — cells swell or shrink, causing the leaves to fold.

This is fundamentally different from animal muscle movement. In animals, muscle cells contain **specialised proteins** that change their shape and arrangement in response to nervous electrical impulses, causing the muscle cell to shorten. In plants, no such proteins exist; movement depends entirely on **changes in water content (turgor)** of cells.

*Source: Chapter 6, Section 6.2.1 (Immediate Response to Stimulus) and Section 6.1.4 (How does the Nervous Tissue cause Action?)*

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### Explanation

- **3 marks = 3 key points:** (1) electrical-chemical communication between cells in plants, (2) plant cell movement via water gain/loss (turgor change), (3) contrast with animal muscles using specialised proteins.
- Examiners expect the phrase **"no specialised tissue"** for plants and **"special proteins"** for animal muscles — these are direct textbook terms.
- Don't confuse this with growth-based movement (tropism); Mimosa folding is **growth-independent**.
- Mentioning "turgor" or "swelling/shrinking" scores the movement mark; mentioning "special proteins shorten the cell" scores the animal-muscle mark.

**Q21.** medium | thorough-understanding | § 6.2.2 Movement Due to Growth **[2]**

When a pea plant tendril contacts a support, which part of the tendril grows more rapidly — the side touching the support or the side facing away from it? What is the consequence of this difference?

◆ Control and Coordination

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### Model Answer

When a tendril contacts a support, the **side touching the support grows more slowly**, while the **side facing away grows more rapidly**.

**Consequence:** This unequal growth causes the tendril to **curve and coil around the support**, allowing the plant to cling to it and climb.

*Source: Chapter 6, Section 6.2.2 – Movement Due to Growth*

---

### Explanation

The examiner expects you to clearly state **which side grows slower** (touching side) and **which grows faster** (away side), then give the **result** — coiling/clinging. Many students get the sides mixed up; remember: contact inhibits growth. Two marks = two points: (1) differential growth, (2) consequence (coiling around the support).

**Q22.** deep | thorough-understanding | § 6.2.2 Movement Due to Growth **[3]**

A gardener places a seedling near a window so that light comes from one side. After a few days, the shoot bends towards the light. If the gardener then rotates the pot so that the illuminated side now faces away from the window, the OLD bent portion of the shoot does NOT straighten back. Why not?

◆ Control and Coordination

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### Model Answer

The bending of the shoot is a **tropic movement caused by growth**. When light falls from one side, auxin diffuses to the shady side of the shoot tip, causing cells there to elongate more. This unequal growth permanently bends the shoot toward light.

Once cells have **already grown and elongated**, they cannot shrink back — growth is **irreversible**. The old, bent cells have permanently increased in length. Only the **new cells** forming at the growing tip will respond to the changed direction of light and grow in the new direction. Therefore, only new growth reorients; the old bent portion stays curved.

*Source: Chapter 6, Section 6.2.2 — Movement Due to Growth*

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### Explanation

- The key concept examiners want: **tropic (phototropic) movements are growth-based and therefore irreversible** — once cells elongate, they don't shrink.
- Mention **auxin** and **unequal cell elongation** for full marks.
- The textbook Activity 6.2 explicitly asks students to observe that "old parts do not change direction" — this is a direct exam point.
- A common mistake is saying the plant "forgets" the light direction; the correct reason is biological: **cell elongation is a one-way process**.

**Q23.** medium | thorough-understanding | § 6.2.2 Movement Due to Growth **[3]**

The roots of a germinating seed always grow downward into the soil, while the shoot grows upward. Name the stimulus responsible for this directional growth. For each organ (root and shoot), state whether its response is positive or negative with respect to that stimulus, and explain the advantage of this arrangement for the seedling.

◆ Control and Coordination

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### Model Answer

**Stimulus:** Gravity (the pull of the earth). The directional growth in response to gravity is called **geotropism**.

- **Root:** Shows **positive geotropism** — it grows downward, towards the pull of gravity.
- **Shoot:** Shows **negative geotropism** — it grows upward, away from the pull of gravity.

**Advantage:** This arrangement ensures the root grows into the soil to absorb water and minerals, while the shoot grows upward towards sunlight for photosynthesis. Together, this helps the seedling survive and establish itself.

*Source: Chapter 6, Section 6.2.2 — Movement Due to Growth*

---

### Explanation

- The key term examiners expect is **geotropism** (not just "gravity response").
- Always pair the organ with the correct **positive/negative** label — this is where most marks are awarded.
- The **advantage** part is often missed; write one line each for root and shoot to be safe.
- Do not confuse geotropism with phototropism (response to light); here the stimulus is specifically **gravity**.

**Q24.** medium | thorough-understanding | § 6.2.2 Movement Due to Growth **[1]**

Which of the following correctly describes the role of auxin in phototropism?
(A) Auxin is destroyed on the lit side, so cells on that side grow shorter.
(B) Auxin diffuses to the shady side of the shoot, causing cells there to elongate more, bending the plant towards light.
(C) Auxin diffuses to the lit side of the shoot, causing cells there to elongate more, bending the plant away from light.
(D) Auxin is produced equally on both sides of the shoot, but light directly stretches cells on the shady side.

A Auxin is destroyed on the lit side, so cells on that side grow shorter.
B Auxin diffuses to the shady side of the shoot, causing cells there to elongate more, bending the plant towards light.
C Auxin diffuses to the lit side of the shoot, causing cells there to elongate more, bending the plant away from light.
D Auxin is produced equally on both sides of the shoot, but light directly stretches cells on the shady side.

◆ Control and Coordination

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### Model Answer

**(B)** Auxin diffuses to the shady side of the shoot, causing cells there to elongate more, bending the plant towards light.

### Explanation

The source passage (Chapter 6) states clearly: "auxin diffuses towards the shady side of the shoot... stimulates the cells to grow longer on the side away from light... the plant appears to bend towards light." Option A (auxin destroyed) and D (equal production) are not mentioned in the text. Option C wrongly says auxin moves to the lit side.

**Q25.** deep | thorough-understanding | § 6.2.2 Movement Due to Growth **[3]**

Explain why a plant root and a plant shoot respond in opposite directions to the same stimulus of gravity, and suggest how this opposite response is useful to the plant's survival.

◆ Control and Coordination

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### Model Answer

Plants respond to gravity through **geotropism**. Roots show **positive geotropism** (grow downward, towards gravity), while shoots show **negative geotropism** (grow upward, away from gravity). This opposite response occurs because the two organs have different sensitivities to the growth hormone **auxin** — the same concentration that promotes cell elongation in shoots inhibits growth in roots.

This is useful for survival: roots growing downward anchor the plant firmly in soil and absorb water and minerals, while shoots growing upward receive sunlight for photosynthesis. Together, these opposite responses ensure the plant can carry out all essential life functions.

*Source: Chapter 6, Section 6.2.2 — Movement Due to Growth*

---

### Explanation

- The key term is **geotropism** (gravity + tropism). Roots = positive geotropic; shoots = negative geotropic.
- Examiners expect you to name the hormone (auxin) and note that **the same stimulus causes opposite effects** in roots vs. shoots.
- The survival benefit must cover **both** organs — marks are split between root function (anchorage/absorption) and shoot function (photosynthesis/light capture).
- Do not confuse geotropism with phototropism (light stimulus).

**Q26.** medium | thorough-understanding | § 6.2.2 Movement Due to Growth **[1]**

Name ONE plant hormone that promotes cell division. State the type of plant tissue where it is found in greater concentration and briefly explain its role in that tissue.

◆ Control and Coordination

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### Model Answer

**Cytokinin** — found in greater concentration in **meristematic tissue** (actively dividing regions); it promotes rapid cell division, helping in growth of shoots and roots.

### Explanation

The question asks for ONE hormone, its tissue location, and its role — all in one line. Cytokinin is the textbook answer (it appears directly in the Exercise MCQ in the source). Meristematic tissue is where cell division actively occurs, and cytokinins are produced and act there. Examiners expect the hormone name, tissue type, and a brief function — don't mix up cytokinin (cell division) with auxin (cell elongation).

**Q27.** deep | thorough-understanding | § 6.2.2 Movement Due to Growth **[3]**

A student claims: 'Tropic movements in plants are really the same as the movement of the leaves of a touch-me-not plant — both are just responses to an external stimulus.' Evaluate this claim. In what important way are the two types of movement fundamentally different?

◆ Control and Coordination

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### Model Answer

The student's claim is **partially correct but fundamentally flawed**.

Both movements are indeed responses to external stimuli. However, they differ in a crucial way:

- The touch-me-not (*Mimosa*) movement is **independent of growth**. Cells change shape by losing or gaining water (changing turgor pressure), causing rapid folding of leaves.
- Tropic movements (e.g., phototropism, geotropism) are **dependent on growth**. A hormone like auxin causes unequal growth on two sides of the shoot, making it bend directionally. If growth is stopped, tropic movement does not occur.

Thus, the fundamental difference is: **touch-me-not movement involves no growth**, while **tropic movement is caused by growth**.

*Source: Chapter 6, Section 6.2 – Coordination in Plants; Section 6.2.2 – Movement Due to Growth*

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### Explanation

Examiners expect you to:

1. **Acknowledge** what is correct in the claim (both are stimulus responses) — don't dismiss it entirely.
2. **Clearly contrast** the two types: growth-independent (turgor/water change) vs. growth-dependent (auxin-driven differential growth).
3. Use textbook terms: *turgor pressure / water content change* for touch-me-not; *auxin / differential growth* for tropisms.

The key sentence the examiner wants: *"If growth is prevented, tropic movement will not occur, but the touch-me-not movement will still happen."* This shows you understand the fundamental distinction.

**Q28.** medium | thorough-understanding | § 6.2.2 Movement Due to Growth **[2]**

Both gibberellins and abscisic acid are plant hormones with contrasting roles. Describe the role of each hormone in the plant, and give ONE observable situation in which abscisic acid acts on a plant structure to restrict or slow down a process.

◆ Control and Coordination

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### Model Answer

**Gibberellins** promote growth in plants — they stimulate cell elongation and help in stem elongation, seed germination, and fruit development.

**Abscisic acid (ABA)** is a growth inhibitor — it inhibits growth and promotes responses such as seed dormancy and wilting.

**Observable situation:** When a plant is under water stress, abscisic acid causes stomata to close, restricting water loss and slowing transpiration.

### Explanation

The question asks for contrasting roles (gibberellin = promoter; ABA = inhibitor) and ONE observable example of ABA restricting a process. Stomatal closure under drought stress is the classic, textbook-expected example. Note: though the source passages do not detail these hormones explicitly, these are standard NCERT Class 10 Science (Chapter 6) facts examiners expect. Award marks are split: ~1 mark for describing both hormones' roles, ~1 mark for the ABA example.

**Q29.** straightforward | thorough-understanding | § 6.3 HORMONES IN ANIMALS **[1]**

A squirrel suddenly spots a predator. Which hormone prepares its body for 'fight or flight', and which gland secretes it?

◆ Control and Coordination

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### Model Answer

**Adrenaline** prepares the squirrel's body for fight or flight; it is secreted by the **adrenal glands**.

*Source: Hormones in Animals, Chapter 6, Section 6.3*

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### Explanation

This is a direct fact-recall question. Examiners expect both pieces of information — the hormone name **and** the gland — in a single line. Missing either loses the mark. Note the spelling: *adrenaline*, not "andrenaline." The adrenal glands sit atop the kidneys; knowing their location helps you remember the name.

**Q30.** medium | thorough-understanding | § 6.3 HORMONES IN ANIMALS **[3]**

Adrenaline causes blood supply to the digestive system and skin to decrease while blood supply to skeletal muscles increases. Explain the physiological mechanism behind this shift and why it is useful during an emergency.

◆ Control and Coordination

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### Model Answer

Adrenaline is secreted by the **adrenal glands** directly into the blood during an emergency (fight-or-flight situation). It acts on small arteries supplying the digestive system and skin, causing the **muscles around these arteries to contract**, which reduces blood flow to these organs. This diverts extra blood to the **skeletal muscles**. Simultaneously, the heart beats faster, increasing oxygen supply to muscles, and breathing rate increases.

This shift is useful because during an emergency, digestion is non-essential, while skeletal muscles need maximum oxygen and glucose to fight or flee quickly.

*Source: Chapter 6, Section 6.3 — Hormones in Animals*

---

### Explanation

- The key mechanism is **contraction of muscles around small arteries** — examiners specifically look for this phrase.
- Link the redistribution of blood to the **purpose** (fight-or-flight) for full marks.
- Three points to cover: (1) adrenaline source, (2) mechanism of blood shift, (3) why it is useful — one mark each.

**Q31.** medium | thorough-understanding | § 6.3 HORMONES IN ANIMALS **[2]**

Both the nervous system and the endocrine system help animals respond to changes in the environment, yet the body uses hormones rather than nerve impulses to prepare for a fight-or-flight response. Justify this choice by comparing the two systems in terms of the speed, reach, and duration of their effects.

◆ **Control and Coordination**

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### Model Answer

Nerve impulses act **quickly but over a limited range** — only tissues connected by nerves receive the signal. For fight-or-flight, the body needs to prepare **many different tissue types simultaneously** (heart, muscles, lungs, digestive system). Adrenaline, released into the **blood**, reaches **all cells** of the body, producing wide-ranging changes. Its effects also **last longer**, sustaining readiness until the threat passes. Hence, hormonal control is better suited for this response.

*Source: Chapter 6, Section 6.3 — Hormones in Animals*

---

### Explanation

The examiner wants you to hit **three comparison points** — speed, reach, duration — and link each to why hormones win for fight-or-flight. The key textbook line is: *"If the body design relied only on electrical impulses, the range of tissues instructed would be limited; a chemical signal would reach all cells."* Mention adrenaline by name. Don't just describe what adrenaline does — explain *why* the chemical route is chosen over nerve impulses. Two well-linked points with the justification will earn full marks.

**Q32.** medium | thorough-understanding | § 6.3 HORMONES IN ANIMALS **[3]**

A child's diet is consistently deficient in iodine over several years. What visible symptom might develop, and what is the underlying chain of events — from missing nutrient to symptom — that produces it?

◆ Control and Coordination

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## Model Answer

**Visible symptom:** Goitre — a swelling in the neck due to enlargement of the thyroid gland.

**Chain of events:**

1. Iodine is essential for the thyroid gland to produce thyroxine hormone.
2. When iodine is deficient in the diet, the thyroid gland cannot synthesise sufficient thyroxine.
3. The thyroid gland keeps trying to compensate by growing larger, resulting in a visible swelling in the neck called **goitre**.

Using iodised salt in daily diet is the simplest way to prevent iodine deficiency.

*Source: Life Processes, Chapter 5 (Control and Coordination cross-reference — standard CBSE Class 10 content on iodine deficiency)*

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## Explanation

- The question asks for **two things**: (1) the visible symptom and (2) the **chain of events** — so structure your answer in steps.
- Examiners expect the keyword **goitre** and the logical sequence: no iodine → no thyroxine → thyroid enlarges → goitre.
- Note: The source passages provided are from Chapters 1, 2, and 5 (digestion focus) and do **not** directly cover iodine/goitre. This topic comes from the *Control and Coordination* chapter. Since no passage covers it, the answer draws on standard CBSE textbook knowledge — examiners will expect the correct scientific chain as above.
- Keep it concise: name the symptom first, then list the steps clearly.

**Q33.** deep | thorough-understanding | § 6.3 HORMONES IN ANIMALS **[2]**

A child who consumes adequate food still shows stunted physical and mental development. Investigations reveal consistently low levels of thyroxin in the blood. Explain how a deficiency of thyroxin can impair a child's overall development despite sufficient food intake.

◆ Control and Coordination

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### Model Answer

Thyroxin regulates the body's **metabolic rate** — it controls how efficiently cells convert food into energy and use it for growth. Even with adequate food intake, without sufficient thyroxin, nutrients cannot be properly utilised for cell growth and brain development. This leads to **stunted physical growth** and **impaired mental development** (a condition called cretinism in children).

### Explanation

The question tests your understanding that food alone is not enough — hormones like thyroxin are needed to *regulate* metabolism so that nutrients are actually used. Examiners expect two clear points: (1) thyroxin controls metabolism/energy use, and (2) its deficiency impairs both physical and mental growth despite food being available. Mentioning "cretinism" adds value but is not compulsory for full marks.

**Q34.** medium | thorough-understanding | § 6.3 HORMONES IN ANIMALS **[2]**

Deficiency of growth hormone during childhood leads to dwarfism, while its excess can cause gigantism. What does this tell us about the role of the pituitary gland in human growth and development? Which broader part of the brain oversees the functioning of the pituitary gland?

◆ Control and Coordination

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### Model Answer

The pituitary gland secretes growth hormone, which regulates body growth. Its deficiency causes dwarfism (stunted growth) and excess causes gigantism, showing that the pituitary gland directly controls the rate and extent of human growth and development.

The **hypothalamus** (part of the forebrain) oversees and regulates the functioning of the pituitary gland.

*Source: Chapter 6, Control and Coordination*

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### Explanation

- The question has two parts — address both: (1) what the pituitary's role is, and (2) which brain region controls it.
- The key inference is that growth hormone from the pituitary is essential for normal growth — too little or too much disrupts it. This shows the pituitary's direct regulatory role.
- The hypothalamus controls the pituitary gland; this is the expected factual recall for the second part.
- Don't just describe dwarfism/gigantism — the examiner wants the **conclusion** about the pituitary's role.

**Q35.** straightforward | thorough-understanding | § 6.3 HORMONES IN ANIMALS **[1]**

Which of the following correctly pairs a hormone with its source gland and its primary function?
(A) Insulin — pancreas — regulates blood sugar level
(B) Testosterone — adrenal gland — development of male sex organs
(C) Oestrogen — pituitary gland — regulates menstrual cycle
(D) Adrenaline — thyroid gland — increases heart rate

A Insulin — pancreas — regulates blood sugar level
B Testosterone — adrenal gland — development of male sex organs
C Oestrogen — pituitary gland — regulates menstrual cycle
D Adrenaline — thyroid gland — increases heart rate

◆ Control and Coordination

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### Model Answer

**(A) Insulin — pancreas — regulates blood sugar level**

### Explanation

Testosterone is secreted by the **testes** (not adrenal gland); oestrogen is from the **ovaries** (not pituitary); adrenaline is from the **adrenal gland** (not thyroid). Only option A is correctly paired on all three counts.

**Q36.** medium | thorough-understanding | § 6.3 HORMONES IN ANIMALS **[3]**

A diabetic patient's pancreas produces very little insulin. Explain why this leads to harmful effects in the body. If the patient is given regular insulin injections, how does this help restore normal body functioning?

◆ Control and Coordination

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### Model Answer

Insulin regulates blood glucose levels by helping cells absorb glucose from the blood. When insulin is insufficient, glucose cannot enter the cells properly, causing blood glucose levels to rise abnormally high (hyperglycaemia). This high glucose concentration damages blood vessels and organs over time, and cells are starved of energy despite glucose being present in the blood, leading to harmful effects like weakness, organ damage, and other complications.

When insulin injections are given regularly, the injected insulin performs the same function as natural insulin — it enables body cells to absorb glucose from the blood. This brings blood glucose back to normal levels, provides cells with energy, and prevents the harmful effects of hyperglycaemia, thereby restoring normal body functioning.

*Source: Chapter 5 — Life Processes (related to control and regulation of life processes)*

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### Explanation

- The question has two parts: (i) why low insulin is harmful, and (ii) how injections help. Address both clearly.
- Key concept: insulin allows glucose uptake by cells. Without it → high blood sugar + cells starved of energy → damage.
- Examiner expects mention of: glucose regulation, cells unable to use glucose, high blood sugar effects, and how injections compensate for the deficiency.
- This topic links to Chapter 7 (Control and Coordination — hormones), but the mechanism of insulin is relevant here too. Keep the answer focused and factual.

**Q37.** medium | thorough-understanding | § 6.3 HORMONES IN ANIMALS **[2]**

The amount of insulin secreted by the pancreas changes automatically as blood sugar levels rise and fall. What is the general name for the type of mechanism that achieves this self-regulation, and how does it operate in this specific case?

◆ **Control and Coordination**

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### Model Answer

The mechanism is called a **feedback mechanism**.

In the case of insulin: when blood sugar levels rise, the pancreas secretes more insulin, which causes cells to absorb glucose, lowering blood sugar. As blood sugar falls back to normal, insulin secretion decreases automatically. The output of the system thus regulates its own further production.

*Source: Control and Coordination, Chapter 6 — What you have learnt*

### Explanation

- **1 mark** for naming the mechanism: **feedback mechanism**.
- **1 mark** for explaining how it works in context — rising sugar → more insulin → sugar falls → less insulin. Show the self-correcting loop clearly.
- Examiners want the term stated explicitly, not just described. Don't write "negative feedback" unless you can justify it — the textbook simply says "feedback mechanism."
- Keep the example specific to insulin/blood sugar; no need to discuss other hormones.

**Q38.** deep thorough-understanding § 6.3 HORMONES IN ANIMALS **[3]**

A student claims: 'Animals do not need hormones for controlling growth because, unlike plants, animals do not show directional growth.' Evaluate this claim using specific examples from the human endocrine system.

◆ Control and Coordination

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## Model Answer

The student's claim is **incorrect**. Animals do need hormones to control growth and many other vital functions.

**Examples from the human endocrine system:**

1. **Growth Hormone (GH):** Secreted by the pituitary gland, it directly controls overall body growth. Deficiency causes dwarfism; excess causes gigantism.
2. **Thyroxin:** Released by the thyroid gland, it regulates metabolism and body development. Deficiency in children causes stunted growth (cretinism).
3. **Sex hormones (e.g., oestrogen/testosterone):** Control puberty changes like increased height, breast development, and reproductive maturity — all forms of growth.

Thus, hormones regulate growth, metabolism, and reproduction in animals, disproving the claim.

*Source: Chapter 6, Chemical Coordination; Chapter 7, Section 7.3.3*

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## Explanation

- The examiner wants you to **refute the claim** clearly, then support with **specific hormone examples** with gland, function, and effect of deficiency/excess.
- The passage confirms chemical coordination occurs in **both plants and animals**, so hormones are essential in animals too.
- Mentioning puberty changes (from Ch. 7) directly links hormones to growth in animals — a strong, text-based example.
- Avoid vague statements; name the hormone, its source, and its role for full marks.

**Q39.** deep | thorough-understanding | § 6.3 HORMONES IN ANIMALS **[5]**

Compare nervous coordination and hormonal coordination in animals. In your answer, address how they differ in the speed, reach, and duration of their effects, and give one specific example of a biological situation in which each system is better suited to achieve coordination.

◆ Control and Coordination

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## Model Answer

**Nervous vs. Hormonal Coordination in Animals**

| Feature | Nervous Coordination | Hormonal Coordination |
|---|---|---|
| Speed | Very fast (electrical impulses) | Slow (chemicals travel via blood) |
| Reach | Limited — specific nerve pathways to targeted tissues/muscles | Wide — hormones reach all cells of the body through bloodstream |
| Duration | Short-lived; effect stops when impulse stops | Long-lasting; effect continues until hormone is broken down |

**Mechanism:** The nervous system uses electrical impulses transmitted through neurons, acting through muscles. Hormones are chemicals secreted by endocrine glands, transported in blood, and regulated by feedback mechanisms.

**Example — Nervous system better suited:** A reflex action, such as withdrawing a hand from a hot object, requires an immediate, precise response. The nervous system achieves this within milliseconds.

**Example — Hormonal system better suited:** When a squirrel faces danger, adrenaline is secreted into the blood, reaching all body tissues to prepare for fight or flight — a wide-ranging response that nerve impulses alone cannot achieve.

*Source: Chapter 6, Sections 6.1 and 6.3*

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## Explanation

- Examiners expect the **three comparison points** (speed, reach, duration) — ideally in a table or clearly labelled points.
- **One specific example for each system** is explicitly asked; use the adrenaline/squirrel example from the textbook for hormonal, and reflex action for nervous — these are directly from the source.
- Avoid vague language; say "electrical impulses" for nervous and "blood-borne chemicals" for hormonal.
- The feedback mechanism is a bonus point that shows depth but keep it brief.
- Do **not** exceed ~125 words in the body — examiners penalise padding in 5-mark answers.

**Q40.** deep | thorough-understanding | § (whole-chapter synthesis) **[3]**

Both plants and animals use chemical signals for coordination, yet animals also possess a nervous system. Explain why chemical signalling is indispensable in animals even though it is slower than nerve impulses. How does the nature of chemical signalling in plants differ from that in animals in terms of the structural requirements and speed of response?

◆ Control and Coordination

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### Model Answer

**Chemical signalling in animals:** Even though nerve impulses are fast, they can only reach tissues connected by nerves. Chemical signals (hormones) are secreted into the blood and reach **all cells of the body**, enabling wide-ranging, coordinated responses — for example, adrenaline prepares the entire body for fight or flight by affecting the heart, muscles, and breathing simultaneously. Such body-wide coordination is impossible through nerve impulses alone.

**Difference between plants and animals:**

- **Plants** have no specialised conducting tissue for chemical signals; information passes cell to cell by electrical-chemical means, and response is relatively slow (e.g., cells change shape by altering water content).
- **Animals** have a specialised endocrine system; hormones travel rapidly via the bloodstream to specific target organs, giving a faster and more directed response.

*Source: Chapter 6, Sections 6.2 / 6.2.1 / 6.3*

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### Explanation

- The key examiner expectation is **two distinct parts**: (i) why chemical signalling is indispensable in animals (reach all cells / blood-borne / wide-ranging effect — adrenaline is the textbook example), and (ii) the structural difference (no specialised tissue in plants vs. endocrine system in animals) and consequent speed difference.
- Avoid writing a long essay; 3 marks = ~3 clear points.
- Always anchor to textbook examples: **adrenaline/adrenal gland** for animals; **sensitive plant / cell water change** for plants.

**Q41.** medium | thorough-understanding | § (whole-chapter synthesis) **[3]**

When a student accidentally steps on a nail, she withdraws her foot instantly but feels the pain a moment later. Using your understanding of the nervous system, explain why the withdrawal happens before the pain is consciously felt, and identify the structures involved in each part of this sequence.

◆ Control and Coordination

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### Model Answer

When the student steps on a nail, the pain signal travels to the **spinal cord**, where a **reflex arc** is completed — the input nerve connects directly to the output nerve in the spinal cord itself, causing the foot to withdraw **instantly**, without waiting for the brain.

Simultaneously, the signal also travels upward to the **fore-brain**, but this takes longer due to the complex neural processing involved. The pain is consciously felt only after the fore-brain interprets the sensory impulse.

**Structures involved:**

- **Withdrawal:** Receptor (in foot) → sensory nerve → spinal cord (reflex arc) → motor nerve → muscle
- **Pain perception:** Signal travels further to the fore-brain (thinking centre)

Source: Chapter 6, Section 6.1.1 (Reflex Actions); Section 6.1.2 (Human Brain)

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### Explanation

Examiners look for two distinct parts: (1) the reflex arc in the spinal cord causing withdrawal, and (2) the brain (fore-brain) causing conscious pain perception *after*. The key phrase to use is **"reflex arc formed in the spinal cord"** — this directly answers *why* withdrawal is faster. Name the structures in sequence for full marks. Avoid vague terms like "nervous system" without specifics.

**Q42.** deep | thorough-understanding | § (whole-chapter synthesis) **[1]**

Assertion (A): A person with a damaged cerebellum can still respond to a sudden loud noise by blinking, but struggles to ride a bicycle smoothly.
Reason (R): Reflex actions are mediated by the spinal cord, whereas precise coordination of voluntary movements depends on the cerebellum.
Choose the correct option:
(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

A Both A and R are true and R is the correct explanation of A.
B Both A and R are true but R is not the correct explanation of A.
C A is true but R is false.
D A is false but R is true.

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### Model Answer

**(A)** Both A and R are true and R is the correct explanation of A.

Blinking to a loud noise is a reflex (spinal cord-mediated), unaffected by cerebellar damage. Riding a bicycle requires precision and balance, which the cerebellum controls.

### Explanation

The textbook states reflex arcs are formed in the spinal cord, so they are unaffected by cerebellar damage. It also explicitly states the cerebellum is responsible for "precision of voluntary actions and maintaining posture and balance." R directly explains why A is true, making option (A) correct.

**Q43.** deep thorough-understanding § (whole-chapter synthesis) **[3]**

The movement of a touch-me-not leaf and the bending of a shoot towards light both involve cells changing shape. Compare the mechanism by which cells change shape in each case and explain why one movement is almost instantaneous while the other takes hours.

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### Model Answer

**Touch-me-not (Mimosa):** Cells change shape by **changing the amount of water** in them — water moves out of cells at the base of the leaf, causing them to shrink and the leaf to droop. No growth is involved.

**Shoot bending towards light:** Cells change shape by **actually growing longer** — the hormone auxin diffuses to the shady side, stimulating those cells to elongate more than the cells on the lit side, causing the shoot to bend towards light.

**Why the difference in speed:** The touch-me-not response involves only water movement in and out of cells, which happens almost instantaneously. The shoot's bending requires cell growth driven by auxin diffusion and elongation — a slower biological process — so it takes hours.

*Source: Chapter 6, Sections 6.2, 6.2.1, 6.2.2*

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### Explanation

- The key contrast examiners look for: **water movement (turgor change) vs. cell elongation (growth)** — make sure both mechanisms are named clearly.
- Link the speed difference directly to the mechanism: water movement is rapid; hormone diffusion + cell growth is slow. This cause-effect reasoning earns the 3rd mark.
- Avoid vague phrases like "the cells react differently" — be specific about *how* cells change shape in each case.

**Q44.** deep thorough-understanding § (whole-chapter synthesis) **[5]**

A mountaineer stranded in extreme cold notices his heart is racing, his digestion has slowed, and he is breathing faster, even though he is sitting still.
(i) Name the hormone responsible for this state and the gland that secretes it.
(ii) Explain how each of the three physiological changes — increased heart rate, slowed digestion, and faster breathing — helps him survive the emergency.
(iii) Once he is rescued and safe, his body gradually returns to normal. What does this suggest about how hormone action is regulated after the emergency has passed?

◆ Control and Coordination

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### Model Answer

**(i)** The hormone responsible is **adrenaline**, secreted by the **adrenal glands**.

**(ii)**

- **Increased heart rate:** Adrenaline makes the heart beat faster, supplying more oxygen to the muscles, preparing the body for immediate action (fight or flight).
- **Slowed digestion:** Blood supply to the digestive system is reduced due to contraction of muscles around small arteries, diverting blood to skeletal muscles where it is needed most.
- **Faster breathing:** Contractions of the diaphragm and rib muscles increase breathing rate, ensuring more oxygen enters the body to meet the increased demand.

**(iii)** Once the emergency is over, hormone secretion is regulated by a **feedback mechanism**. As adrenaline levels normalise and the body stabilises, its further secretion is reduced. This shows that the timing and amount of hormone released are controlled by feedback, preventing over- or under-response.

*Source: Chapter 6, Section 6.3 — Hormones in Animals*

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### Explanation

- Examiners expect you to name both the hormone **and** the gland for full marks in part (i).
- In part (ii), link each change directly to **survival benefit** — don't just state the change; explain *why* it helps.
- Part (iii) is testing your knowledge of **feedback mechanism** — the key term examiners look for. Use the insulin-blood sugar example from the text as your model, applied here to adrenaline.
- Keep each point concise; one sentence per physiological change is sufficient.

**Q45.** medium | thorough-understanding | § (whole-chapter synthesis) **[5]**

A child is diagnosed with both iodine deficiency and a deficiency of growth hormone secreted by the pituitary gland. Both conditions affect growth, yet the underlying reasons differ.
(i) Name the hormone whose synthesis is impaired by iodine deficiency and explain how its deficiency leads to a visible symptom in the child.
(ii) Explain how a deficiency of growth hormone leads to a different growth-related outcome compared to iodine deficiency.
(iii) The pituitary gland is often called the 'master gland'. Based on the above scenario, justify this title and explain how the pituitary's control over another gland illustrates the concept of hormonal feedback regulation in the body.

◆ Control and Coordination

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### Model Answer

**(i)** Iodine deficiency impairs the synthesis of **thyroxine** (thyroid hormone). Without sufficient thyroxine, the thyroid gland keeps receiving signals to produce more hormone and enlarges abnormally. This causes a visible swelling in the neck called **goitre**.

**(ii)** Deficiency of **growth hormone** (from the pituitary) leads to **stunted growth** — the child remains shorter than normal due to insufficient stimulation of body tissues for growth. Unlike goitre (which is a glandular swelling), this deficiency causes reduced overall body size without any visible glandular enlargement.

**(iii)** The pituitary is called the **'master gland'** because it controls other endocrine glands, including the thyroid. It releases hormones that stimulate the thyroid to secrete thyroxine. When thyroxine levels are adequate, they signal back to the pituitary to reduce stimulation — this is **hormonal feedback regulation**, ensuring hormone levels stay balanced in the body.

*Source: Chapter 6 — Control and Coordination; Chapter 7 — Reproduction (Endocrine system references)*

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### Explanation

- **(i)** Examiners expect "thyroxine" named explicitly and "goitre" as the visible symptom.
- **(ii)** The key contrast is: iodine deficiency → gland swelling; GH deficiency → stunted/dwarfism. Mentioning this contrast earns the comparison mark.
- **(iii)** Two things are needed: why pituitary is "master" (it controls other glands) AND feedback mechanism (product hormone signals back to reduce further secretion). Both are required for full marks.
- Keep language simple and factual — CBSE rewards accuracy over elaboration.

**Q46.** medium | thorough-understanding | § (whole-chapter synthesis) **[3]**

Both the nervous system and the endocrine system help animals respond to changes in their environment, yet they are suited to different kinds of responses. Identify ONE situation where the nervous system response would be more appropriate and ONE situation where the hormonal response would be more appropriate. For each, justify your choice by referring to the properties of the respective system.

◆ Control and Coordination

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### Model Answer

**Nervous System Response — Touching a hot object (reflex action):**
When a person accidentally touches a hot surface, an immediate withdrawal response is needed. The nervous system transmits electrical impulses rapidly, giving a quick, localised response. Speed is critical here, making the nervous system more appropriate.

**Hormonal Response — A frightening or dangerous situation (fight or flight):**
When a squirrel (or human) faces danger, adrenaline is secreted into the blood and carried to all body cells. This produces wide-ranging changes — faster heartbeat, increased breathing rate, and redirected blood flow to muscles — which nerve impulses alone cannot achieve across so many tissue types simultaneously.

*Source: Chapter 6, Section 6.3 — Hormones in Animals*

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### Explanation

- Examiners expect **one example for each system** with a clear justification linked to its property (speed/localised vs. widespread/slow).
- Key property of nervous system: **fast, electrical, localised**.
- Key property of hormonal system: **chemical, travels via blood, wide-ranging, sustained**.
- The adrenaline/fight-or-flight example is directly from the textbook — always use it for hormonal responses.
- Don't just name the situation; always link it to **why** that system's properties suit it — that's where marks are awarded.



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