

Week 18

IGCSE Biology

Homework bundle for this week

本周作业合集

exercises.lol

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14. Coordination and response

Starter Quiz · 课前小测

IGCSE Biology

Name: _____ Score: _____

- The central nervous system (CNS) consists of the:
 - ☐ brain and spinal cord
 - ☐ heart and lungs
 - ☐ muscles and glands
 - ☐ eyes and ears
- A synapse is:
 - ☐ the gap between two neurones
 - ☐ a type of muscle
 - ☐ a part of the brain
 - ☐ a blood vessel
- The part that controls the size of the pupil is the:
 - ☐ iris
 - ☐ lens
 - ☐ retina
 - ☐ cornea
- To focus on a NEAR object, the lens becomes:
 - ☐ fatter (more curved)
 - ☐ thinner (flatter)
 - ☐ larger overall
 - ☐ opaque
- A hormone is a chemical messenger carried in the:
 - ☐ blood
 - ☐ nerves
 - ☐ air
 - ☐ lymph only
- A reflex action is fast and automatic, not consciously controlled.
 - ☐ True ☐ False

7. The neurone carrying impulses from a receptor to the CNS is the _____ neurone.

8. Synapses allow impulses to travel in one direction only.

☐ True ☐ False

9. The image formed on the retina is upside down.

☐ True ☐ False

10. Cones detect colour and work best in bright light.

☐ True ☐ False

14. Coordination and response

Answers · 答案

IGCSE Biology

1. brain and spinal cord

The CNS is the brain and spinal cord.

2. the gap between two neurones

A synapse is the junction between neurones.

3. iris

The iris adjusts the pupil size.

4. fatter (more curved)

A fatter lens bends light more for near objects.

5. blood

Hormones travel in the blood to target organs.

6. True

Reflexes protect the body before conscious thought.

7. sensory

Sensory neurones carry signals into the CNS.

8. True

Neurotransmitter is released on one side only.

9. True

The brain interprets it the right way up.

10. True

Cones need bright light; rods handle dim light.

14.1 Coordination and response

Name: _____ Class: _____ Date: _____

Total: 28 marks

KEY WORDS synapse 突触 • receptor 感受器 • reflex 反射 • neurones 神经元
• reflex arc 反射弧

Objective

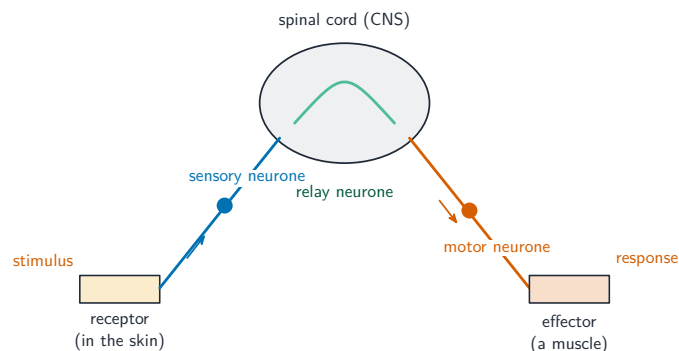
Build the skills to answer exam questions on **coordination and response** 协调与反应 — the **nervous system** 神经系统, the **reflex arc** 反射弧, and **synapses** 突触.

You must be able to:

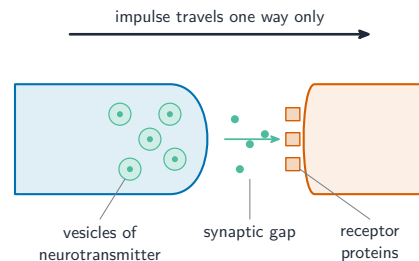
- name the parts of the nervous system and the three neurones
- describe a reflex arc in order
- describe how a synapse works and why impulses go one way

1 Worked examples

■ Reflex arc and synapse



Reflex arc: receptor → sensory neurone → relay neurone → motor neurone → effector



Neurotransmitter diffuses across the gap and binds receptors — impulses go one way only

- **CNS** = brain + spinal cord; **PNS** = the nerves.

■ The reflex arc, named in order, and what a synapse does

The **nervous system** 神经系统 splits into the **central nervous system (CNS)** 中枢神经系统 — the brain and the spinal cord — and the **peripheral nervous system**, the nerves that connect the CNS to the rest of the body.

Three kinds of neurone 神经元, learned as a chain: a **sensory neurone** 感觉神经元 carries the impulse from a receptor to the CNS; a **relay neurone** 中继神经元 passes it across inside the CNS; a **motor neurone** 运动神经元 carries it from the CNS to an effector.

The reflex arc, in the order the marks are given:

stimulus → receptor → sensory neurone → relay neurone → motor neurone → effector → response

A **reflex action** 反射作用 is fast and automatic because the impulse does not travel to the conscious part of the brain — the relay neurone in the spinal cord completes the circuit — which is what protects the body from damage in time.

A **synapse** 突触 is the junction between two neurones, with a tiny gap. The impulse arrives at the end of the first neurone; **neurotransmitter** 神经递质 molecules are released into the gap; they **diffuse** across and bind to **receptor proteins** on the next neurone's membrane; that starts a new impulse in the second neurone. The transmitter is released on one side only, so a synapse makes the impulse travel in **one direction only** — a mark in itself.

Worked example. Describe what happens between touching a hot plate and pulling the hand away. A temperature (pain) receptor in the skin detects the stimulus; a sensory neurone carries the impulse to the spinal cord; a relay neurone passes it to a motor neurone; the motor neurone carries it to the biceps muscle, the effector; the muscle contracts and pulls the hand away. The impulse does not go to the brain first, which is why the response is so fast.

2 Practice

2.1 Name the two parts of the central nervous system. [2]

2.2 State the job of a motor neurone. [1]

2.3 Name the three types of neurone in a reflex arc, in the order the impulse travels. [3]

2.4 Explain why an impulse can travel across a synapse in one direction only. [2]

2.5 State what is meant by an effector, and give one example. [2]

3 Exam-style questions

3.1 The correct order of a reflex arc is: [1]

- A receptor → motor → relay → sensory → effector
- B receptor → sensory → relay → motor → effector
- C effector → motor → relay → sensory → receptor
- D receptor → relay → sensory → motor → effector

3.2 A synapse joins two neurones.

(a) Describe how an impulse crosses a synapse. [3]

(b) Explain why a synapse makes impulses travel in one direction only. [1]

3.3 A person steps on a sharp stone and pulls the foot away before feeling any pain.

(a) Complete the sequence of the reflex arc. [3]

stimulus → **receptor** → _____ → _____ → _____ → effector → response

(b) Name the effector in this reflex and state the response it produces. [2]

(c) Explain why the foot is pulled away before the pain is felt. [2]

(d) Describe how the impulse crosses a synapse. [4]

(e) Explain the advantage of reflex actions to the body. [2]

Solutions

2.1 the brain; the spinal cord.

2.2 to carry impulses from the CNS to an effector.

2.3 Sensory neurone, relay neurone, motor neurone.

2.4 The neurotransmitter is released from one side of the synapse only, and the receptor proteins that it binds to are on the other side, so an impulse cannot start in the reverse direction.

2.5 An effector is a muscle or a gland that carries out the response; for example the biceps muscle, or a gland that secretes a hormone.

3.1 B. receptor → sensory → relay → motor → effector.

3.2 (a) the impulse makes vesicles release neurotransmitter into the gap; the neurotransmitter diffuses across; it binds receptors on the next neurone, starting a new impulse.

(b) only the first neurone releases neurotransmitter and only the second has receptors.

3.3 (a) sensory neurone → relay neurone → motor neurone.

(b) The effector is a muscle in the leg; it contracts and lifts the foot away from the stone.

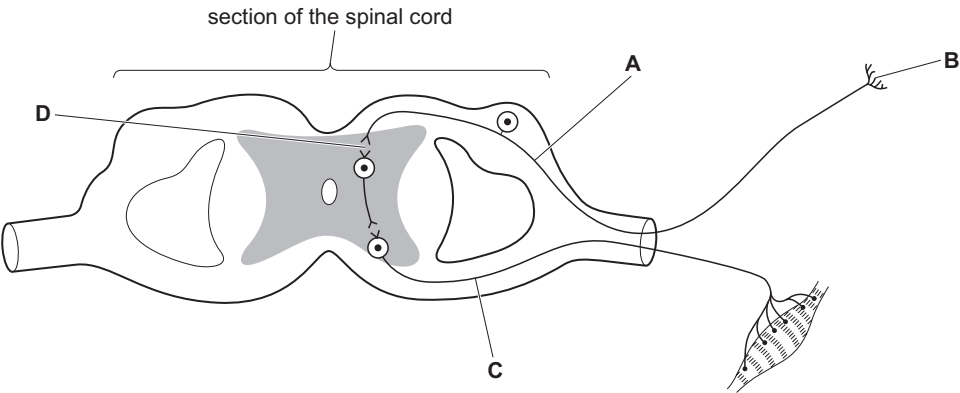
(c) The reflex is completed through the spinal cord, without the impulse first travelling to the conscious part of the brain; that pathway is much shorter, so the response happens before the brain has processed the pain.

(d) The impulse arrives at the end of the first neurone; neurotransmitter molecules are released into the gap; they diffuse across the synapse; they bind to receptor proteins on the next neurone's membrane and start a new impulse in it.

(e) They are fast and automatic, so the body is protected from damage before conscious thought could act.

18 The diagram shows the parts of the nervous system involved in a reflex arc.

Which letter identifies a synapse?



21 Events that occur at a synapse are listed.

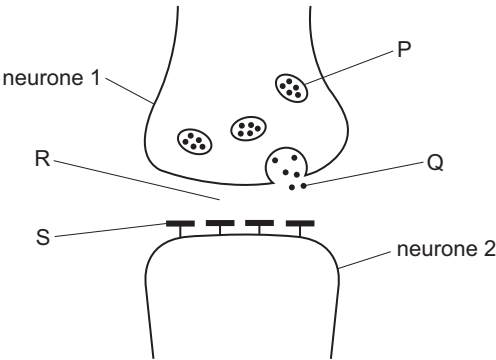
They are **not** in the correct order.

- 1 An impulse is stimulated in the next neurone.
- 2 An impulse stimulates the release of neurotransmitter molecules from vesicles into the synaptic gap.
- 3 Neurotransmitter molecules bind with receptor proteins on the next neurone.
- 4 The neurotransmitter molecules diffuse across the gap.

What is the actual sequence of events?

- A 2 → 4 → 1 → 3
- B 2 → 4 → 3 → 1
- C 4 → 2 → 1 → 3
- D 4 → 2 → 3 → 1

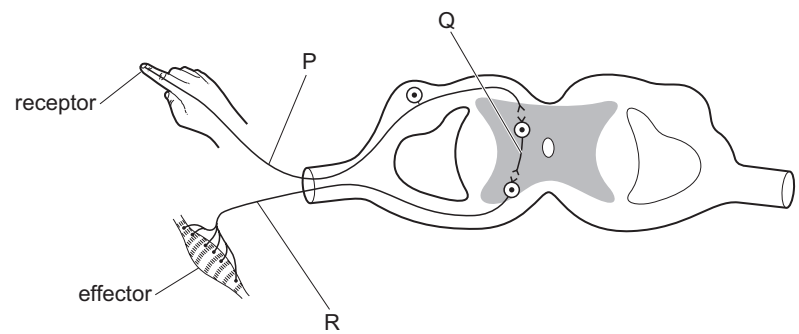
21 The diagram shows a synapse.



What are the labelled parts?

	P	Q	R	S
A	synaptic gap	neurotransmitter	vesicle	receptor
B	synaptic gap	receptor	vesicle	neurotransmitter
C	vesicle	neurotransmitter	synaptic gap	receptor
D	vesicle	receptor	synaptic gap	neurotransmitter

23 The diagram shows a simple reflex arc.



What are the names of the structures labelled P, Q and R?

	P	Q	R
A	motor neurone	relay neurone	sensory neurone
B	motor neurone	sensory neurone	relay neurone
C	sensory neurone	motor neurone	relay neurone
D	sensory neurone	relay neurone	motor neurone

2 (a) The human retina contains receptor cells called rods and cones.

Fig. 2.1 shows the distribution of receptor cells in a human retina.

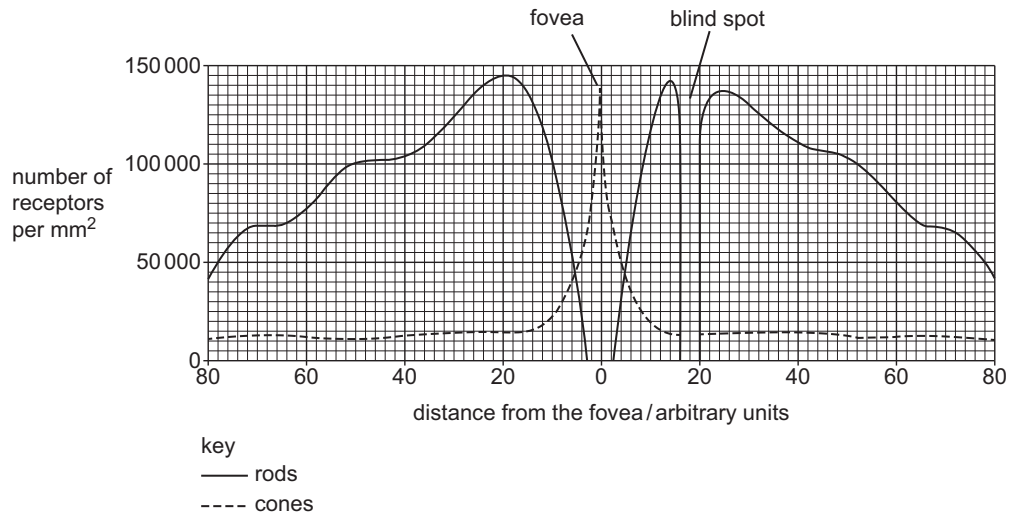


Fig. 2.1

Using the information in Fig. 2.1, describe the differences in the distribution of rods and cones.

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..... [4]

(b) Nocturnal animals are active at night.

Suggest how the number of receptor cells in the retina of a nocturnal animal differs from those in the retina of an animal that is active in the day.

Explain your suggestion.

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.....

..... [2]

(c) In humans, the size of the iris increases in bright light conditions.

During this response one effector in the iris contracts and one effector relaxes.

(i) State the name of this response.

..... [1]

(ii) State the name of the effector that contracts in this response.

..... [1]

(iii) State the name of the type of action shown by the paired effectors during this response.

..... [1]

(d) The optic nerve contains many neurones.

Fig. 2.2 shows a synapse between two neurones.

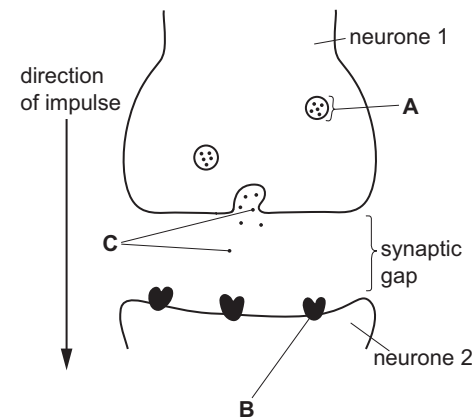


Fig. 2.2

(i) State the names of the parts labelled **A**, **B** and **C** in Fig. 2.2.

A

B

C

[3]

(ii) Explain how part **C** in Fig. 2.2 moves across the synaptic gap.

.....

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.....

.....

..... [2]

[Total: 14]

14.2 Sense organs

Name: _____ Class: _____ Date: _____ **Total: 25 marks**

KEY WORDS eye 眼 • cones 视锥细胞 • rods 视杆细胞 • retina 视网膜 • iris 虹膜

Objective

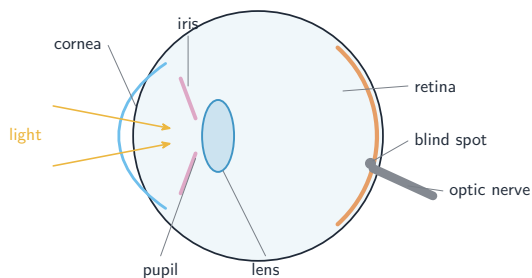
Build the skills to answer exam questions on **sense organs** 感觉器官 — the parts of the **eye** 眼, the **pupil reflex** 瞳孔反射, **accommodation** 视觉调节, and rods and cones.

You must be able to:

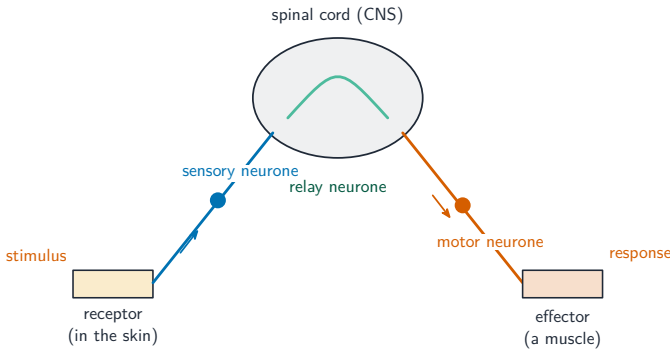
- name the parts of the eye and their functions
- explain the pupil reflex (antagonistic muscles)
- describe accommodation and the roles of rods and cones

1 Worked examples

■ The eye



Cornea and lens refract light onto the retina; impulses leave by the optic nerve



Sense organs feed the reflex arc

- **pupil reflex:** bright light → circular muscles contract → pupil narrows.
- **accommodation:** near object → ciliary muscles contract → lens fatter.
- **rods:** dim light (no colour); **cones:** colour, bright light.

■ The eye: which part does what, and the two reflexes

Part	What it does
cornea 角膜	transparent front; does MOST of the focusing (refracting)
iris 虹膜	coloured ring of muscle; controls the size of the pupil
pupil 瞳孔	the hole light passes through — not a structure but a gap
lens 晶状体	fine-focuses light onto the retina; changes shape
retina 视网膜	contains the light receptors (rods and cones)
optic nerve 视神经	carries impulses from the retina to the brain
ciliary muscle 睫状肌 and suspensory ligaments 悬韧带	change the shape of the lens

The pupil reflex. In **BRIGHT** light the **circular muscles** of the iris contract and the **radial muscles** relax, so the pupil gets smaller and less light enters — protecting the retina from damage. In **DIM** light the radial muscles contract and the circular muscles relax, so the pupil widens and more light enters. Naming which set of muscles contracts is the mark; “the pupil gets smaller” alone is not.

Accommodation 调节 — focusing on near and far:

	ciliary muscle	suspensory ligaments	lens
near object	contracts	slacken	fatter, more curved, refracts more
distant object	relaxes	pull tight	thinner, refracts less

Worked example. Explain what happens in the eye when a reader looks up from a book to a distant tree. The ciliary muscle relaxes; the suspensory ligaments are pulled tight; the lens is pulled thinner; it refracts the light less, which is what brings the distant object into focus on the retina.

△ The commonest error is to say the ciliary muscle *contracts* for a distant object. Learn the pair together: **near = contract = fat lens**.

2 Practice

2.1 State the function of the retina. [1]

2.2 State what happens to the pupil in bright light. [1]

2.3 Name the part of the eye that does most of the focusing. [1]

2.4 State which muscles of the iris contract in dim light, and the effect on the pupil. [2]

2.5 State what happens to the lens when the eye focuses on a near object. [2]

3 Exam-style questions

3.1 The part of the eye that focuses light onto the retina is the: [1]

- **A** iris
- **B** cornea only
- **C** lens
- **D** optic nerve

3.2 The pupil changes size in different light.

(a) Explain how the pupil narrows in bright light. [2]

(b) State the difference between rods and cones. [2]

3.3 A student walks from a dark room into bright sunlight and then reads a sign in the distance.

(a) Complete the table by naming the part of the eye that performs each function. [4]

Function	Part
contains the light receptors	
controls how much light enters	
carries impulses to the brain	
changes shape to fine-focus the light	

(b) Describe the pupil reflex that occurs as the student enters the sunlight, naming the muscles involved. [3]

(c) Explain the advantage of this reflex. [1]

(d) Describe the changes in the ciliary muscle, the suspensory ligaments and the lens as the student focuses on the distant sign. [3]

(e) The student then looks down at a book. State how the lens changes and explain why that change is needed. [2]

Solutions

2.1 it contains light receptors that detect light.

2.2 it gets smaller (narrows).

2.3 The cornea.

2.4 The radial muscles contract, and the circular muscles relax; the pupil becomes wider, so more light enters.

2.5 The lens becomes fatter, or more curved, so it refracts the light more.

3.1 C. The lens focuses light onto the retina.

3.2 (a) the circular muscles of the iris contract; the radial muscles relax, so the pupil narrows.

(b) rods are sensitive in dim light but detect no colour; cones give colour vision and work best in bright light.

3.3 (a) Retina; iris; optic nerve; lens.

(b) The circular muscles of the iris contract and the radial muscles relax; the pupil becomes smaller, so less light enters the eye.

(c) It protects the retina from being damaged by very bright light.

(d) The ciliary muscle relaxes; the suspensory ligaments are pulled tight; the lens is pulled thinner, so it refracts the light less.

(e) The lens becomes fatter or more curved; a near object needs the light refracted more to bring it to a focus on the retina.

- 21** When moving from an area with low light intensity to an area with high light intensity, how do the circular and radial muscles of the iris react?

	circular muscles	radial muscles
A	contract	no change
B	contract	relax
C	relax	contract
D	relax	no change

- 19** A person looks at a distant object in a dark area. The person then moves to a bright area and looks at a near object.

Which statement describes some of the changes that take place in the person's eyes?

- A** The circular muscles of the iris contract, the pupil constricts, the ciliary muscles relax and the lens gets thicker.
- B** The radial muscles of the iris relax, the circular muscles of the iris contract, the pupil constricts and the lens gets thinner.
- C** The radial muscles of the iris relax, the pupil constricts, the ciliary muscles contract and the lens gets thicker.
- D** The radial muscles of the iris relax, the pupil dilates, the ciliary muscles relax and the lens gets thicker.

- 20** Which row shows the state of the ciliary muscles and suspensory ligaments when the eye is focusing on a near object?

	ciliary muscles	suspensory ligaments
A	contracted	slack
B	contracted	tense
C	relaxed	slack
D	relaxed	tense

- 22** Which row shows the function of rod cells?

	night vision	colour vision
A	yes	yes
B	yes	no
C	no	yes
D	no	no

- 24** The diagram shows a vertical section through part of a human eye. A fly is coming nearer to the eye. The eye begins to focus the image of the fly on the retina.



How do the labelled parts of the diagram change?

	Q	R	S
A	contracts	becomes thinner	becomes tighter
B	relaxes	becomes fatter	becomes slacker
C	contracts	becomes fatter	becomes slacker
D	relaxes	becomes thinner	becomes tighter

(b) Nocturnal animals are active at night.

Suggest how the number of receptor cells in the retina of a nocturnal animal differs from those in the retina of an animal that is active in the day.

Explain your suggestion.

.....

.....

.....

.....

..... [2]

(c) In humans, the size of the iris increases in bright light conditions.

During this response one effector in the iris contracts and one effector relaxes.

(i) State the name of this response.

..... [1]

(ii) State the name of the effector that contracts in this response.

..... [1]

(iii) State the name of the type of action shown by the paired effectors during this response.

..... [1]

(d) The optic nerve contains many neurones.

Fig. 2.2 shows a synapse between two neurones.

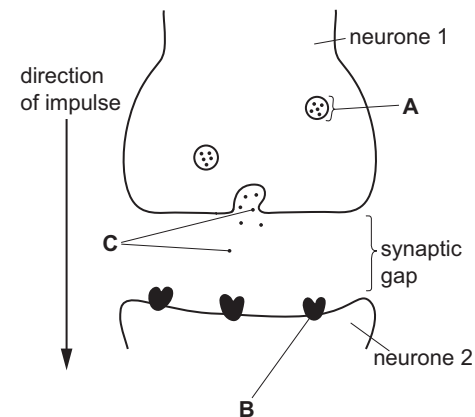


Fig. 2.2

(i) State the names of the parts labelled **A**, **B** and **C** in Fig. 2.2.

A

B

C

[3]

(ii) Explain how part **C** in Fig. 2.2 moves across the synaptic gap.

.....

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.....

.....

..... [2]

[Total: 14]

14.3 Hormones

Name: _____ Class: _____ Date: _____ **Total: 19 marks**

KEY WORDS hormone 激素 • glucose 葡萄糖 • adrenaline 肾上腺素 • insulin 胰岛素
• target organs 靶器官

Objective

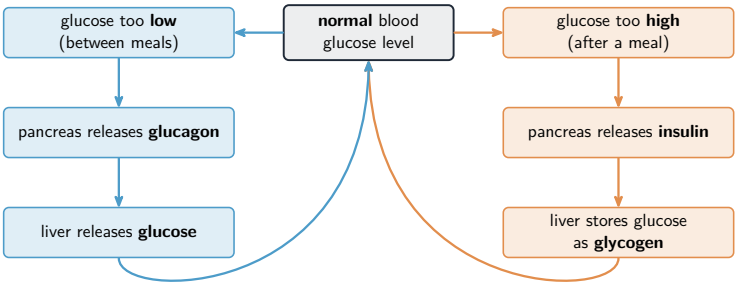
Build the skills to answer exam questions on **hormones** 激素 — what they are, the main glands and hormones, **adrenaline** 肾上腺素, and nervous vs hormonal control.

You must be able to:

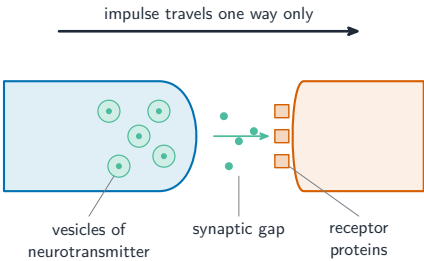
- define a hormone and name the main glands and their hormones
- describe the effects of adrenaline
- compare nervous and hormonal control

1 Worked examples

■ Hormones



Hormones are chemicals made by glands, carried in the blood, acting on target organs



Hormonal control compared with nervous (synapse) control

Gland	Hormone
adrenal	adrenaline
pancreas	insulin (and glucagon)
ovaries / testes	oestrogen / testosterone

2 Practice

2.1 Define a hormone. [2]

2.2 Name the gland that releases adrenaline. [1]

3 Exam-style questions

3.1 Compared with nervous control, hormonal control is: [1]

- A faster and shorter-lived
- B slower and longer-lasting
- C electrical
- D instant

3.2 Adrenaline is released in 'fight or flight' situations.

(a) State two effects of adrenaline on the body. [2]

(b) State how a hormone travels to its target organ. [1]

3.3 A person walking alone at night hears a sudden loud noise. Adrenaline is released.

(a) State what a hormone is, and name the type of gland that makes one. [2]

(b) Name the gland that releases adrenaline and describe **three** effects it has on the body. [4]

(c) Explain how each of the three effects helps the person deal with danger. [3]

(d) Compare nervous and hormonal control under **three** headings: how the message travels, how fast it acts, and how long the effect lasts. [3]

Solutions

2.1 a chemical made by a gland, carried in the blood, that changes the activity of a target organ.

2.2 the adrenal gland.

3.1 B. Hormonal control is slower but longer-lasting.

3.2 (a) any two of: increases heart rate; increases breathing rate; raises blood glucose; widens the pupils.

(b) in the blood.

3.3 (a) A hormone is a chemical messenger, made in one place and carried in the **blood** to act on target organs elsewhere; it is made by an **endocrine** (ductless) gland.

(b) The **adrenal glands**, just above the kidneys. Any three of: heart rate and breathing rate increase; the pupils widen; blood is diverted from the gut to the muscles, and stored glycogen is converted to glucose.

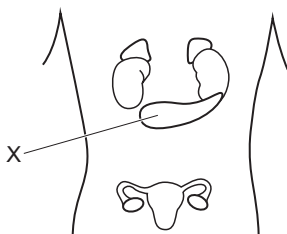
(c) A faster heart and breathing rate deliver more oxygen and glucose to the muscles; wider pupils let in more light so more can be seen; more blood and more glucose reaching the muscles means more respiration and so more energy for running or fighting.

(d) Nervous messages travel as **electrical impulses along neurones**, hormonal messages as **chemicals in the blood**; nervous is very fast (a fraction of a second), hormonal is slower (seconds to minutes); nervous effects are short-lived, hormonal effects last much longer.

20 Which effect does adrenaline have on blood glucose concentration and pulse rate?

	blood glucose concentration	pulse rate
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

23 The diagram shows the position of some of the human endocrine glands.



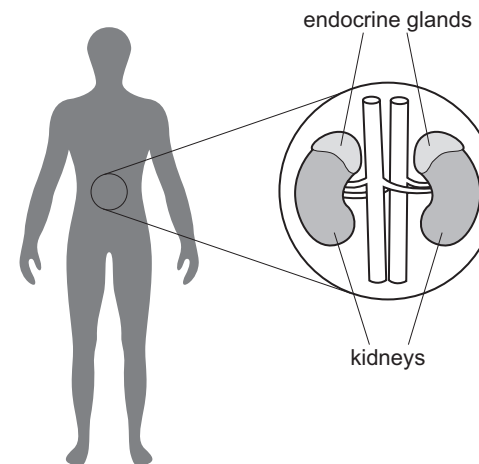
Which hormone is secreted by X?

- A adrenaline
- B insulin
- C oestrogen
- D testosterone

24 Which row shows the correct speed and duration for the type of control?

	type of control	speed of action	duration of effect
A	hormonal	fast	short
B	hormonal	slow	long
C	nervous	fast	long
D	nervous	slow	short

23 The diagram shows the positions of two endocrine glands in the human body.



What is a response of the body to the hormone released from these glands?

- A a decrease in heart rate
- B a decrease in blood glucose concentration
- C an increase in pupil diameter
- D the development of secondary sexual characteristics

25 Which organ produces glucagon?

- A adrenal gland
- B liver
- C ovary
- D pancreas

25 Which hormones increase the blood glucose concentration in humans?

- A adrenaline and glucagon
- B adrenaline and insulin
- C glucagon only
- D insulin only

3 (a) Complete the sentences about the control of blood glucose concentration.

Blood glucose concentration increases after a person eats a meal containing carbohydrates.

This causes the to release insulin. Insulin causes the to remove glucose from the blood and convert it into

The control of blood glucose concentration is an example of [4]

(b) Outline the treatment of type 1 diabetes.

.....

 [2]

(c) A scientist investigated the effect of an injection of glucose solution on blood glucose concentration in healthy people. The injection was given at 0 minutes.

Fig. 3.1 shows the results.

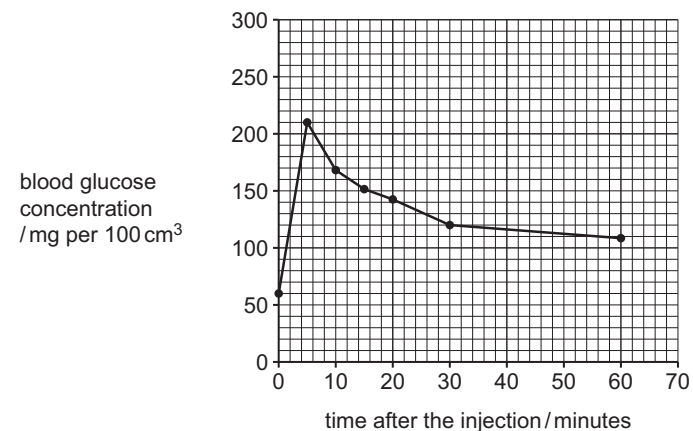


Fig. 3.1

Calculate the percentage change in the blood glucose concentration from 5 minutes after the injection to 30 minutes after the injection.

Give your answer to **two** significant figures.

Space for working.

..... % [3]

(d) Adrenaline also affects blood glucose concentration.

Suggest how this is an advantage for the "fight or flight" response.

.....

 [3]

14.4 Homeostasis

Name: _____ Class: _____ Date: _____ Total: 29 marks

KEY WORDS blood glucose 血糖 • set point 设定点 • environment 环境 • diabetes 糖尿病
• blood vessels 血管

Objective

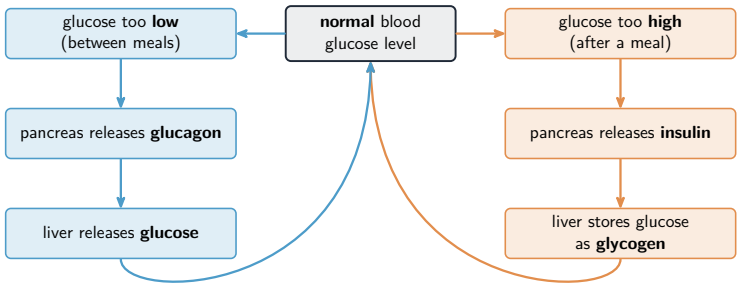
Build the skills to answer exam questions on **homeostasis** 稳态 — **negative feedback** 负反馈, controlling **blood glucose** 血糖, **diabetes** 糖尿病, and temperature control.

You must be able to:

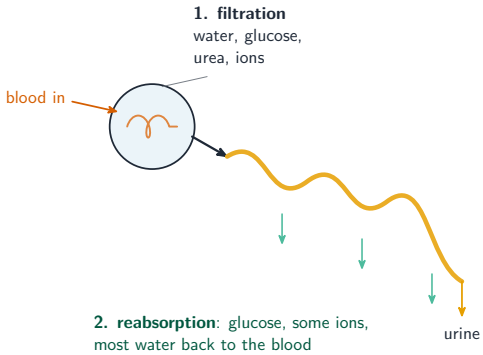
- define homeostasis and explain negative feedback
- describe how insulin and glucagon control blood glucose
- describe how the skin controls body temperature

1 Worked examples

■ Blood glucose control



Negative feedback keeps blood glucose near a set point



The kidney is a key homeostatic organ

- **insulin**: after a meal, liver stores glucose as glycogen (lowers glucose).
- **glucagon**: between meals, liver releases glucose (raises glucose).
- **too hot**: sweating + vasodilation; **too cold**: shivering + vasoconstriction.

■ One loop, three examples

Homeostasis 稳态 is the maintenance of a constant internal environment. Every example follows the same **negative feedback** 负反馈 loop, and writing it in this order earns the marks:

a change from the set point → receptor detects it → coordinator → effector acts → the change is RE

The word that makes it *negative* feedback is **reversed**: the response acts in the opposite direction to the change.

Temperature.

Too HOT	Too COLD
more sweat; its water evaporates , taking heat from the skin	little sweat
vasodilation 血管舒张 — surface arterioles widen, more blood flows near the surface, more heat lost by radiation hairs lie flat	vasoconstriction 血管收缩 — arterioles narrow, less blood near the surface, less heat lost hairs stand up, trapping insulating air; shivering , whose respiration releases heat

△ The arterioles **widen or narrow**; blood vessels do not move up and down in the skin, and saying they “rise to the surface” is specifically penalised.

Blood glucose. Too high → the **pancreas** releases **insulin** → the liver converts glucose to **glycogen** and cells take up more glucose → the level falls. Too low → the pancreas releases **glucagon** → the liver converts glycogen back to glucose → the level rises. **Type 1 diabetes** is a failure to produce enough insulin, treated by injection with diet and exercise control.

Water. Too little water in the blood → the pituitary releases more **ADH** → the kidney tubules become more permeable → more water is reabsorbed → a small volume of concentrated urine. Too much water → less ADH → less reabsorption → a large volume of dilute urine.

Worked example. Explain what happens in the body during 20 minutes of hard exercise on a hot day.

1. Respiration in the muscles releases heat, so core temperature rises above the set point.
2. The hypothalamus detects the rise; sweat glands produce more sweat and the surface arterioles vasodilate.
3. Evaporation and radiation remove heat, so the temperature falls back — negative feedback.
4. Meanwhile water is lost in sweat, so the blood becomes more concentrated; more ADH is released and the kidney reabsorbs more water, producing a small volume of concentrated urine.

2 Practice

2.1 Define homeostasis. [1]

2.2 Name the hormone that lowers blood glucose. [1]

2.3 State what is meant by negative feedback. [2]

2.4 Name the hormone released when blood glucose falls, and state its effect on the liver. [2]

2.5 Explain the effect of ADH on the kidney when a person is dehydrated. [2]

3 Exam-style questions

3.1 When you are too hot, the blood vessels near the skin surface: [1]

- **A** narrow (vasoconstriction)
- **B** widen (vasodilation)
- **C** disappear
- **D** stop carrying blood

3.2 Blood glucose is kept steady by negative feedback.

(a) Describe what happens after a meal raises blood glucose. [3]

(b) State what causes Type 1 diabetes. [1]

3.3 Explain how sweating helps cool the body. [2]

3.4 A student runs for 20 minutes on a hot day.

(a) Describe two changes in the skin that help lower body temperature, explaining how each works. [4]

(b) Explain why the student's urine is a smaller volume and more concentrated afterwards, naming the hormone involved. [4]

(c) After the run the student drinks a sugary sports drink and blood glucose rises. Describe the response that returns it to normal, naming the organ, the hormone and the storage compound. [4]

(d) Explain why all three of these responses are described as negative feedback. [2]

Solutions

2.1 keeping a constant internal environment inside the body.

2.2 insulin.

2.3 A change away from the set point is detected, and the response acts to reverse that change and restore the set point.

2.4 Glucagon; it makes the liver convert stored glycogen back into glucose.

2.5 More ADH makes the kidney tubules more permeable to water, so more water is reabsorbed into the blood and a smaller volume of more concentrated urine is produced.

3.1 B. When too hot, the vessels widen (vasodilation) to lose more heat.

3.2 (a) the pancreas releases insulin; the liver takes up glucose and stores it as glycogen; so blood glucose falls back to normal.

(b) the pancreas cannot make insulin.

3.3 sweat evaporates from the skin; evaporation takes heat from the body, cooling it.

3.4 (a) Any two, each for two marks: more sweat is produced, and its evaporation takes heat energy from the skin; vasodilation widens the surface arterioles so more blood flows near the surface and more heat is lost by radiation; the hairs lie flat so no insulating layer of air is trapped.

(b) Water is lost in sweat, so the blood becomes more concentrated; this is detected and the pituitary releases more ADH; ADH makes the kidney tubules more permeable to water, so more water is reabsorbed and less is lost as urine.

(c) The pancreas detects the rise in blood glucose; it releases insulin; insulin makes the liver convert glucose into glycogen for storage; body cells also take up more glucose, so the blood glucose level falls back to normal.

(d) In each case a change away from the norm is detected, and the response acts in the opposite direction, reversing the change and restoring the norm.

22 Which actions can prevent a mammal's internal body temperature falling too low?

- A** shivering and vasoconstriction
- B** shivering and vasodilation
- C** sweating and vasoconstriction
- D** sweating and vasodilation

IGCSE Biology: **s25 21**

24 What is a response of the human body to overheating?

- A** vasoconstriction of arterioles
- B** vasoconstriction of veins
- C** vasodilation of arterioles
- D** vasodilation of veins

IGCSE Biology: **s25 43**

3 (a) Complete the sentences about the control of blood glucose concentration.

Blood glucose concentration increases after a person eats a meal containing carbohydrates.

This causes the to release insulin. Insulin causes the to remove glucose from the blood and convert it into

The control of blood glucose concentration is an example of [4]

(b) Outline the treatment of type 1 diabetes.

.....

 [2]

(c) A scientist investigated the effect of an injection of glucose solution on blood glucose concentration in healthy people. The injection was given at 0 minutes.

Fig. 3.1 shows the results.

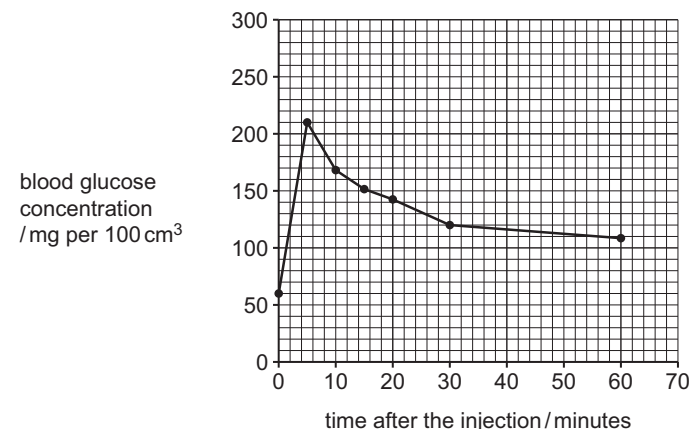


Fig. 3.1

Calculate the percentage change in the blood glucose concentration from 5 minutes after the injection to 30 minutes after the injection.

Give your answer to **two** significant figures.

Space for working.

..... % [3]

(d) Adrenaline also affects blood glucose concentration.

Suggest how this is an advantage for the "fight or flight" response.

.....

 [3]

22 The liver and the pancreas work together to control the concentration of glucose in the blood.

Which statement is correct?

- A** The liver converts the small molecule glucose into the large molecule glucagon.
- B** The liver releases the hormone insulin when blood glucose concentration is too high.
- C** The pancreas does **not** respond to an increase in blood glucose concentration.
- D** The pancreas responds to a fall in the blood glucose concentration by increasing the release of the hormone glucagon.

2 (a) The internal body temperature of a person was recorded.

Fig. 2.1 shows the results.

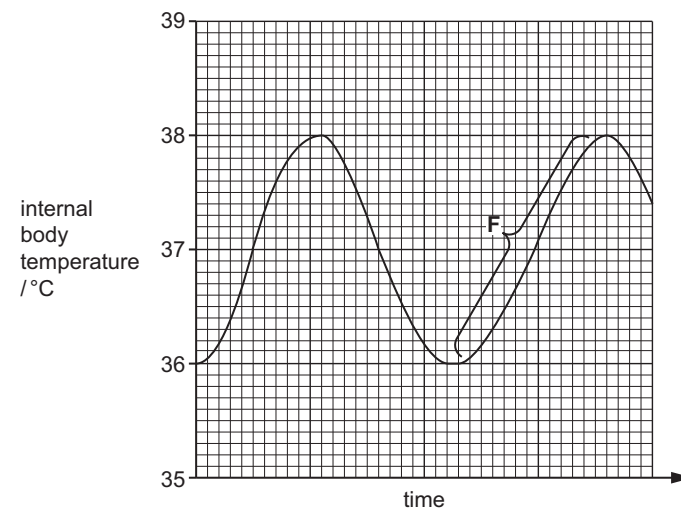


Fig. 2.1

- (i)** Using the information in Fig. 2.1, calculate the temperature range for the internal body temperature of the person.

State the units.

..... [1]

- (ii)** On Fig. 2.1, draw a line to show the set point for the internal body temperature of the person. [1]

- (iii)** The maintenance of internal body temperature is an example of homeostatic control.

State the name of the mechanism for homeostatic control.

..... [1]

(iv) On Fig. 2.1, region **F** shows a change in body temperature.

Explain how the body causes the change in body temperature shown.

..... [5]

(b) Fig. 2.2 shows a cross-section of human skin.

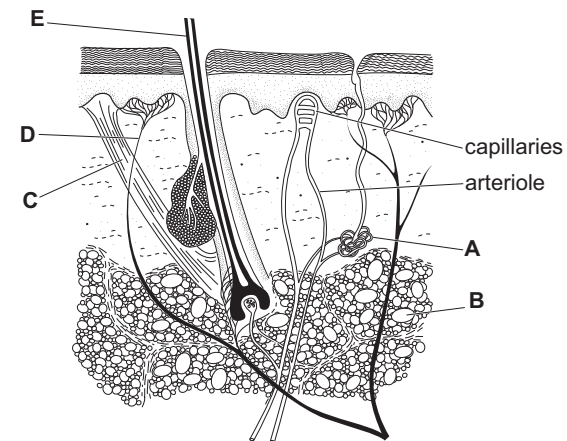


Fig. 2.2

- (i) State the letter of the structure shown in Fig. 2.2 that produces sweat.

..... [1]

- (ii) State the names of structures **C** and **D** shown in Fig. 2.2.

C

D

[2]

[Total: 11]

14.5 Tropic responses

Name: _____ Class: _____ Date: _____

Total: 19 marks

KEY WORDS shoot 嫩枝 • auxin 生长素 • tropism 向性 • phototropism 向光性
• gravitropism 向地性

Objective

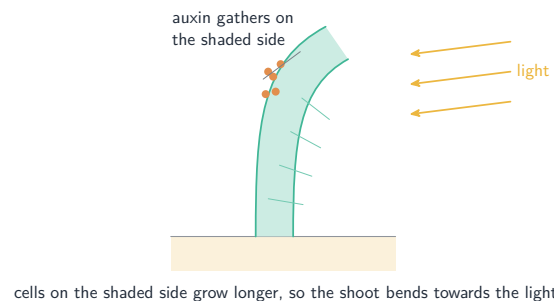
Build the skills to answer exam questions on **tropic responses** 向性反应 — **phototropism** 向光性 and **gravitropism** 向地性, and the role of **auxin** 生长素.

You must be able to:

- define phototropism and gravitropism
- describe how auxin controls a shoot's response to light
- predict the direction of growth

1 Worked examples

■ Phototropism and auxin



Auxin from the tip gathers on the shaded side; those cells grow longer, so the shoot bends to the light

- **phototropism:** growth towards light (shoots positive). **gravitropism:** roots down, shoots up.
- auxin made in the shoot tip; it makes cells elongate.

2 Practice

2.1 Define phototropism. [1]

2.2 State the direction a root grows in response to gravity. [1]

3 Exam-style questions

3.1 A shoot lit from one side bends towards the light because auxin: [1]

- **A** is destroyed by light
- **B** gathers on the shaded side and makes those cells grow longer
- **C** stops the shoot growing
- **D** gathers on the lit side

3.2 Auxin controls phototropism.

(a) State where auxin is made. [1]

(b) Explain how unequal auxin makes a shoot bend towards the light. [3]

3.3 A seedling was left in a box with a hole in one side, so light reached it from one direction only. After three days the shoot had bent towards the light and the root had grown straight down.

(a) Name the response shown by the shoot and the response shown by the root, and state whether each is positive or negative. [4]

(b) Explain, using auxin, why the shoot bends towards the light. [4]

(c) Explain how each response helps the seedling survive. [2]

(d) The tip of a second shoot was cut off before the experiment. Predict what happened to that shoot, and explain why. [2]

Solutions

2.1 a plant's growth response towards (or away from) the direction of light.

2.2 downwards (towards gravity).

3.1 B. Auxin gathers on the shaded side and makes those cells grow longer.

3.2 (a) in the shoot tip.

(b) light makes auxin spread to the shaded side; auxin makes those cells elongate (grow longer); so the shaded side grows faster and the shoot bends towards the light.

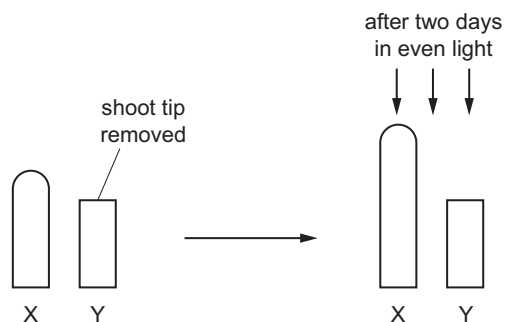
3.3 (a) The shoot shows **positive phototropism** — growth towards light; the root shows **positive gravitropism** — growth towards gravity. (Accept “negative phototropism” for the root only if the answer makes clear it is growing away from light.)

(b) Auxin is made in the shoot tip; it moves to the **shaded** side of the shoot, so more auxin collects there; auxin makes cells **elongate**, so the cells on the shaded side grow longer than those on the lit side; the uneven growth makes the shoot bend towards the light.

(c) Growing towards light means the leaves get more light for photosynthesis; growing downwards anchors the plant and reaches water and minerals in the soil.

(d) It grew straight up without bending; the tip is where auxin is made, so with the tip removed there is no auxin to build up on one side and no uneven growth.

21 The diagram shows an experiment using two wheat shoot tips, X and Y.



Which statement is supported by the evidence provided by this experiment?

- A** Auxin moves through the plant by osmosis.
- B** Auxin is made in the shoot tip.
- C** Auxin is unequally distributed in response to light.
- D** Auxin inhibits cell elongation.

25 A student writes four statements about auxin.

- 1 Auxin becomes more concentrated on the lower side of a horizontal stem.
- 2 Auxin becomes more concentrated on the side of the shoot that has more light.
- 3 Auxin is made in the shoot tip.
- 4 Auxin prevents cell elongation in the shoot.

Which statements describe what happens during chemical control of plant growth?

- A** 1, 2 and 4
- B** 1 and 2 only
- C** 1 and 3
- D** 2, 3 and 4

25 What is an example of phototropism?

- A** the growth of a root in the direction of gravity
- B** the growth of a shoot towards light
- C** the release of energy from glucose using light
- D** the synthesis of glucose using light

26 A young seedling is growing underground.

The shoot grows towards the surface of the ground.

The root grows away from the surface of the ground.

Which row describes the responses involved?

	gravitropism		phototropism	
	root	shoot	root	shoot
A	yes	yes	no	no
B	yes	no	no	yes
C	no	yes	yes	no
D	no	no	yes	yes

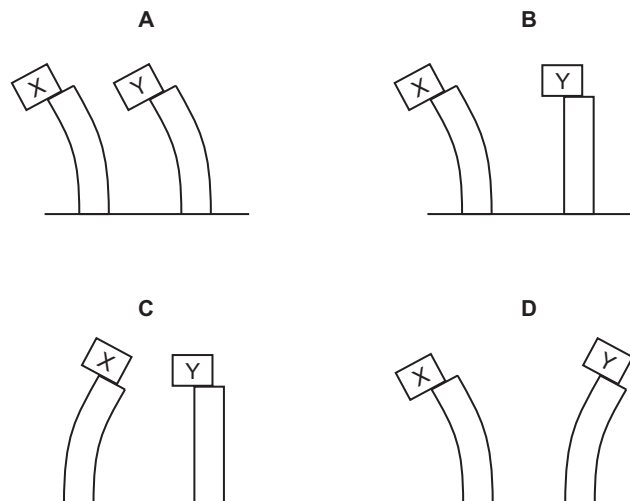
26 A shoot tip was placed on an agar block. Substances can diffuse through agar.

Light was shone on the shoot tip from one direction.



After three days, the agar was cut in half to form blocks X and Y. Blocks X and Y were placed on the stems of shoots that had the tips cut off. The agar blocks were kept on the shoot stems for one week.

Which set of shoots represents the results after one week?



6 (a) Some maize seeds were pinned on a board and provided with light from all directions.

The board was placed in a clinostat that rotated the board.

The board was rotated continuously as the seeds germinated and the roots grew.

Fig. 6.1 shows the apparatus and results after 5 days.

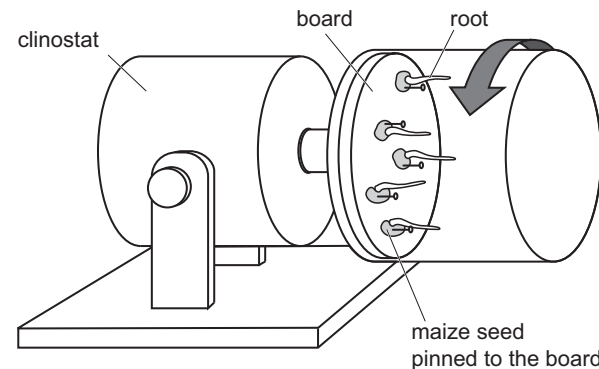


Fig. 6.1

(i) Complete the sentences to explain the root growth in Fig. 6.1.

Auxin is produced in shoot and root The auxin travels down the root by the process of

As the clinostat rotates, the effect of on all sides of the root is equal.

This causes the distribution of auxin in the root to be

Auxin stimulates cell causing the roots to grow horizontally. [5]

(ii) The rotation of the clinostat was stopped.

Predict the change in growth that will occur in the germinating maize seeds in Fig. 6.1.

.....

 [1]

(iii) State the name of the tropic response to light.

..... [1]

(b) A student observed cells from a plant that had wilted.

State **and** explain the expected appearance of the cells.

[3]

[Total: 10]

23 In the dark, plant shoots grow upwards and roots grow downwards.

What causes these responses?

	gravitropism	phototropism
A	no	no
B	no	yes
C	yes	no
D	yes	yes