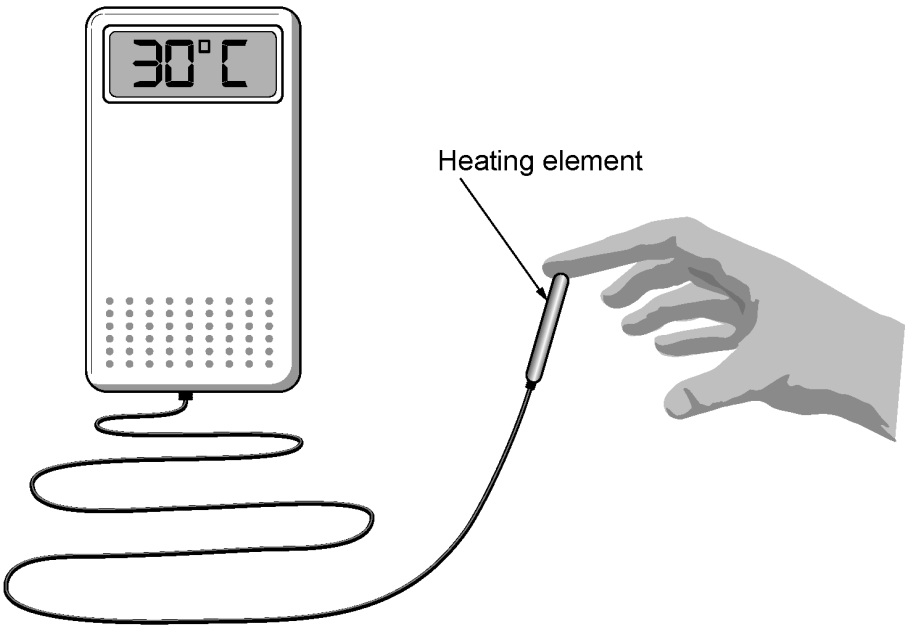
# WJEC (Wales) Biology GCSE Topic 2.5 Response and Regulation Questions by Topic

**1.** Harri used the apparatus shown below to investigate the sensitivity of the skin to changes in temperature.




This is Harri's method.

- He placed the heating element, set at 30°C, to a fingertip of one student.
- He increased the temperature of the heating element in 0.1°C steps.
- He noted the temperature at which the student said she could feel the increase in temperature.
- He called this temperature the **end temperature**.

He repeated this method on the lips, cheek and elbow.

*(a)* Harri then tested three other students in his class.
The results are shown in the table below.

| student | end temperature (°C) | | | |
|---|---|---|---|---|
| | finger tip | lips | cheek | elbow |
| 1 | 30.5 | 30.4 | 30.5 | 30.8 |
| 2 | 30.4 | 30.2 | 30.6 | 31.0 |
| 3 | 30.4 | 30.3 | 30.6 | 30.9 |
| 4 | 30.6 | 30.3 | 30.7 | 31.4 |
| mean | 30.5 | 30.3 | 30.6 | 31.0 |

Use the data from the table opposite to answer the following:

(i) Which skin part is the most sensitive to temperature change? [1]

.....

(ii) Which skin part has the widest range of readings? ..... [1]

*(b)* Harri then tested five of his teachers. The mean results are shown below.

| mean end temperature (°C) | | | |
|---|---|---|---|
| finger tip | lips | cheek | elbow |
| 30.6 | 30.3 | 31.3 | 32.0 |

Using only the results in the two tables, describe the effect of ageing on skin sensitivity. [2]

.....

.....

.....

*(c)* Complete the table below. [4]

| sense organ | stimuli detected |
|---|---|
| skin | temperature and ..... |
| eye | ..... |
| ..... | sound |
| tongue | ..... |

**2.** Jon stands at a pedestrian crossing.


*(a)* When it is safe to cross, the crossing makes a high pitch sound and a light flashes green.

Name the **two** stimuli that Jon detects **and** the sense organs involved. [2]

| stimulus | sense organ |
|---|---|
| | |
| | |

*(b)* Information from sense organs travels along neurones.

(i) In what form does information travel along neurones? [1]

.....

(ii) Which part of the nervous system processes information from neurones? [1]

.....

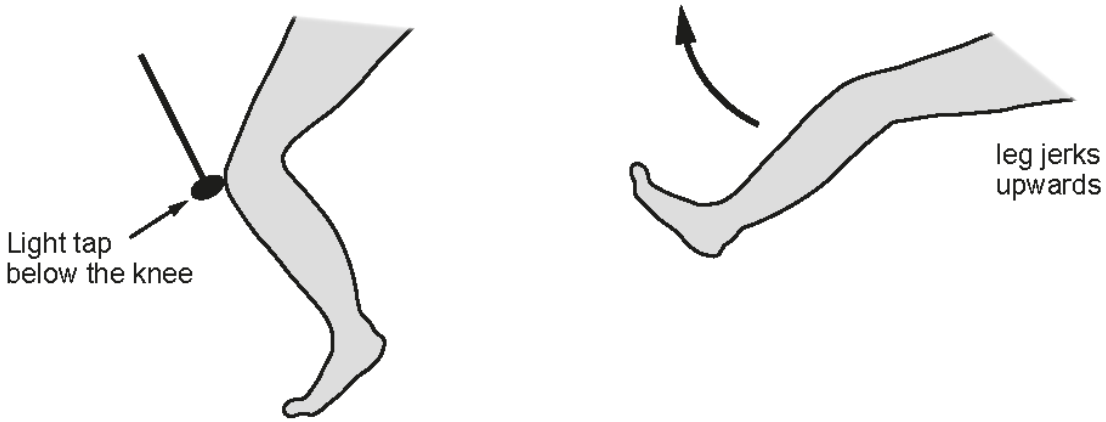
**3.**

*(a)* Complete the sentence about the human nervous system. [2]

The central nervous system consists of the ..... and

..... .

*(b)* The diagram below shows the knee jerk response, which is a reflex action.




(i) Apart from being very fast, state **one** *other* feature of **all** reflex actions. [1]

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(ii) Give **one** *other* reflex action which occurs in the human body and state its purpose. [2]

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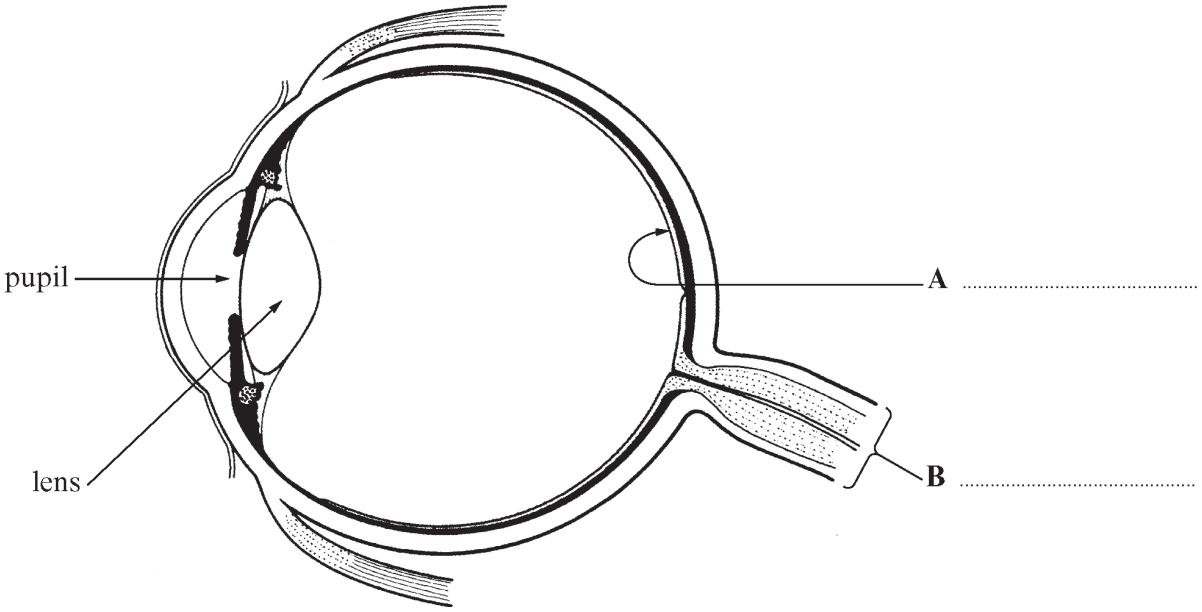
**4.**

*(a)* The diagram below shows the structure of the eye.
Complete labels **A** and **B**. [2]




*(b)* Scientists investigated how the diameter of the pupil of the eye changed in different light intensities. The results are shown below.

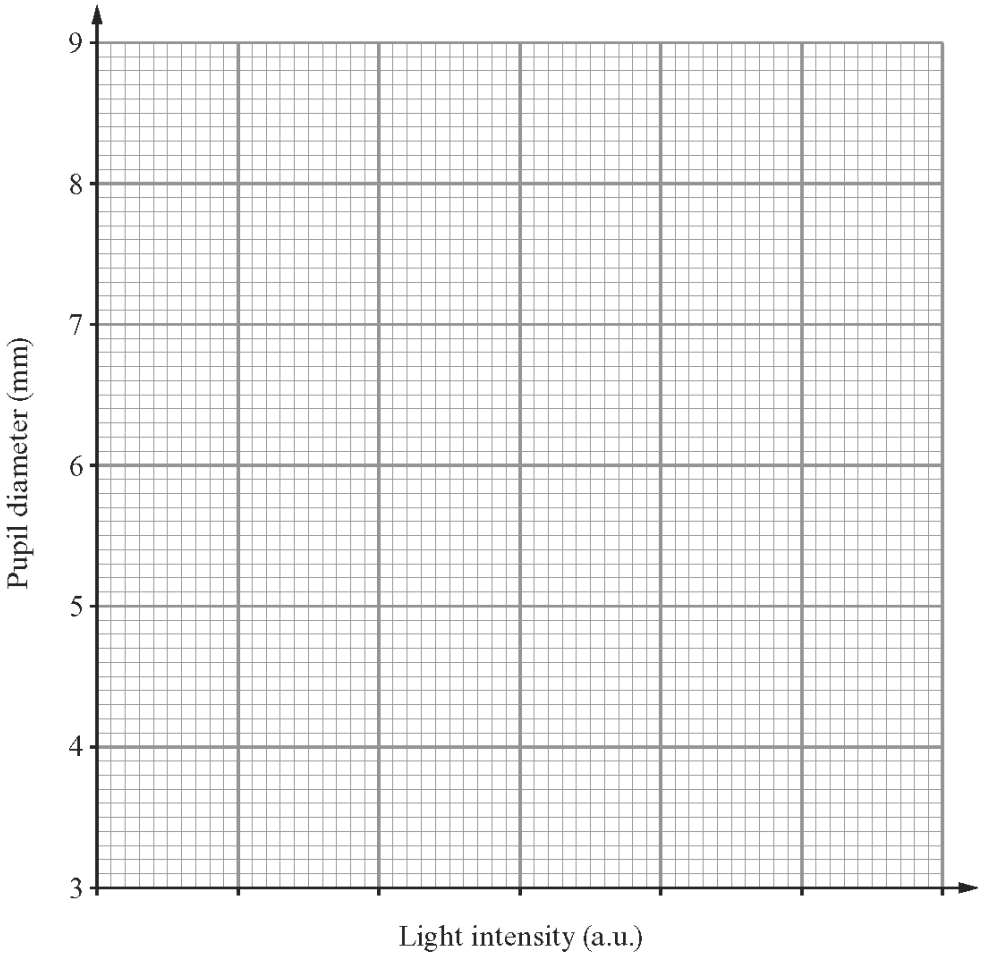
| light intensity (a.u.) | pupil diameter (mm) |
|---|---|
| 0 | 8.0 |
| 5 | 8.0 |
| 10 | 7.1 |
| 15 | 6.3 |
| 20 | 5.4 |
| 25 | 4.5 |

(i) Complete the line graph opposite for these results by:

I. choosing the scale on the axis for light intensity; [1]

II. plotting the points; [2]

III. drawing a line, with a ruler, to join the plots. [1]




(ii) From this graph

I. Describe what happens to the diameter of the pupil as the intensity of light increases. [1]

.....

II. State the pupil diameter at a light intensity of 17 units. [1]

..... mm

*(c)* The pupil changes in diameter because of a nervous response which happens very quickly and automatically.

(i) Name this type of response. [1]

.....

(ii) What is the purpose of this type of response? [1]

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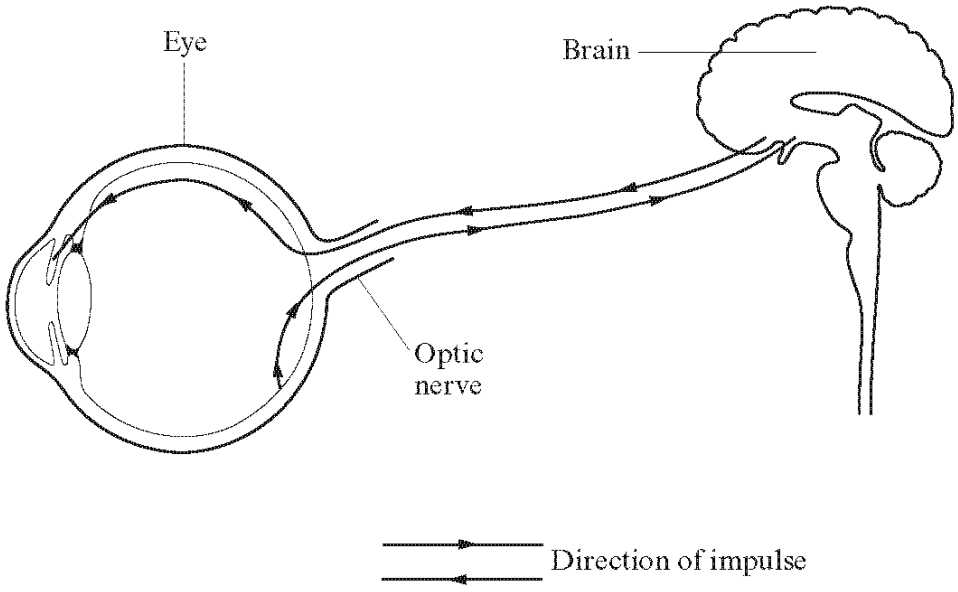
**5.** The diagram shows the pathway taken by nerve impulses which help to bring about changes in the diameter of the pupil.




*(a)* On the diagram above, use an arrow to label the motor neurone. [1]

*(b)* Name [3]

(i) the stimulus which causes a change in the diameter of the pupil,

.....

(ii) the receptor which receives the stimulus,

.....

(iii) the effector which causes the decrease in the diameter of the pupil.

.....

*(c)* Describe how the decrease in diameter of the pupil demonstrates the three most important features of a reflex action. [3]

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**6.**

*(a)* In the list below, which **two** letters represent pathways taken by nerve impulses in reflex actions? [2]

**A** motor neurone → brain → sensory neurone

**B** sensory neurone → spinal cord → motor neurone

**C** sensory neurone → spinal cord → receptor

**D** retina → brain → eyelid

Letters ..... and .....

*(b)* Name an example of each of the two reflex actions given as your answer to *(a)*. [2]

(i) Letter .....

Example .....

(ii) Letter .....

Example .....

4

**7.** Define a reflex action. Describe the reflex arc involved in the blinking response to a flashing light. (Diagrams will not be credited.) [6 QWC]

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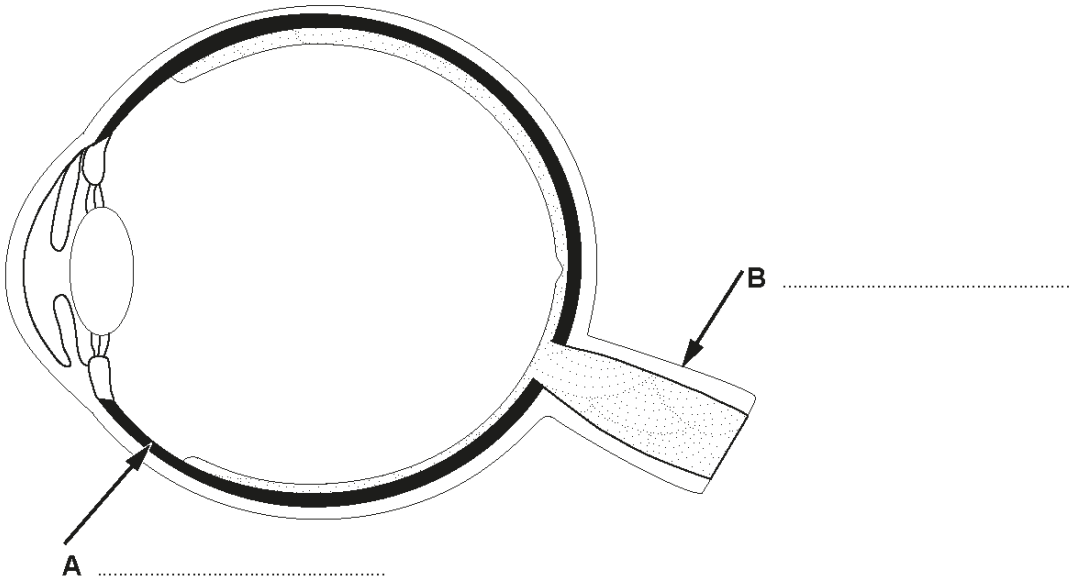
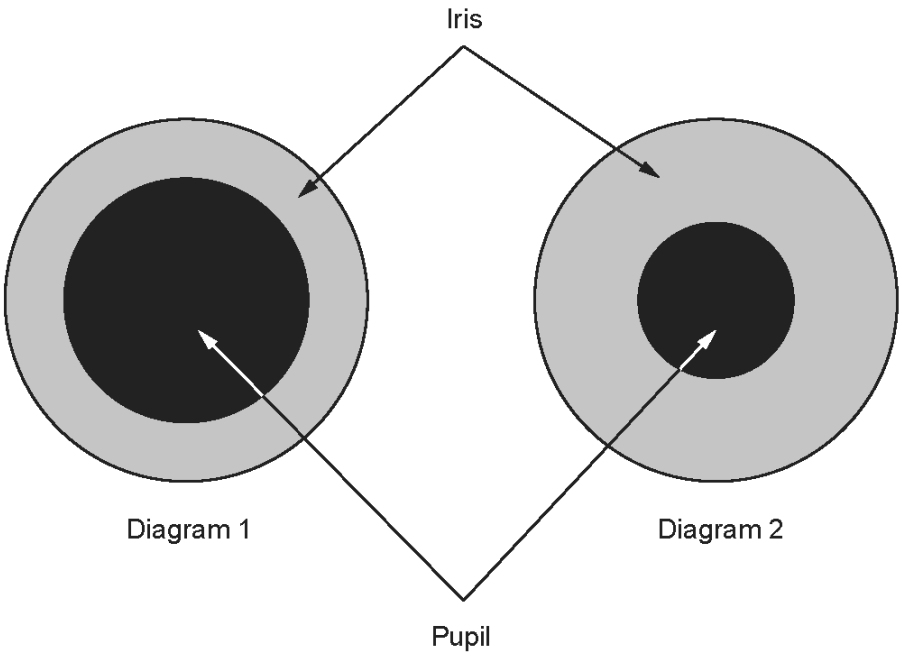
**8.** The diagram below shows a section through the eye.




*(a)* Label parts **A** and **B** on the diagram. [2]

*(b)* The diagrams below show a front view of the iris in different light intensities.




Explain how the appearance of the iris and pupil change in different light intensities. [4]

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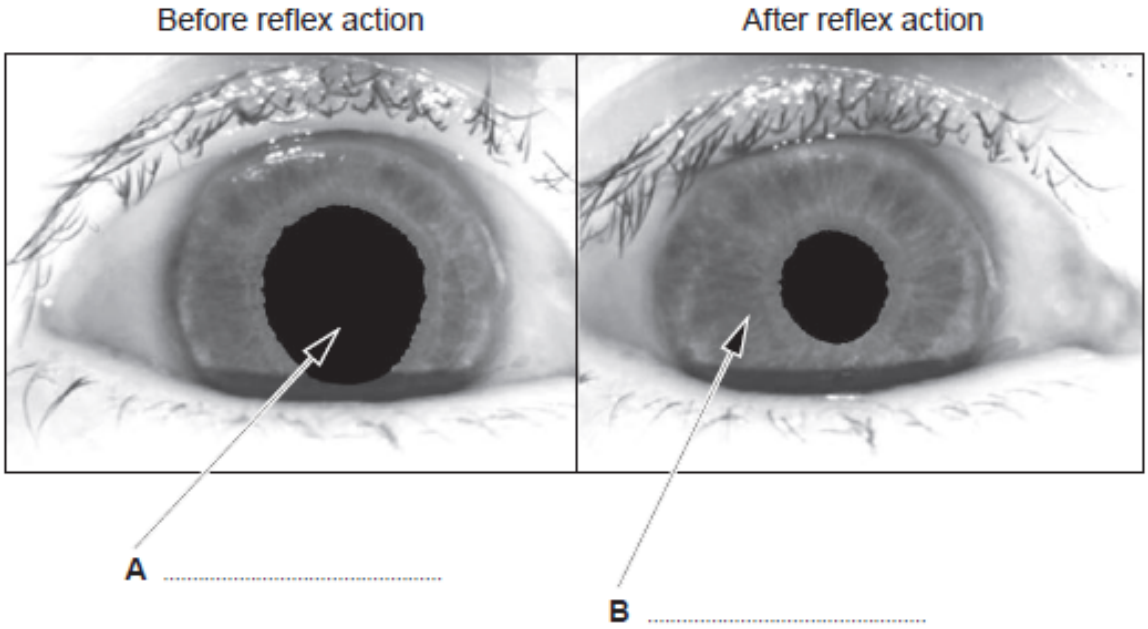
**9.** The photographs below show the appearance of an eye before and after a reflex action which occurs in response to a change in light intensity.




*(a)* (i) Label **A** and **B** on the diagram. [1]

(ii) From the photographs, describe how **and** why parts **A** and **B** of the eye alter when the light intensity changes. [3]

.....

.....

.....

.....

(iii) State **two** features of **all** reflex actions. [1]

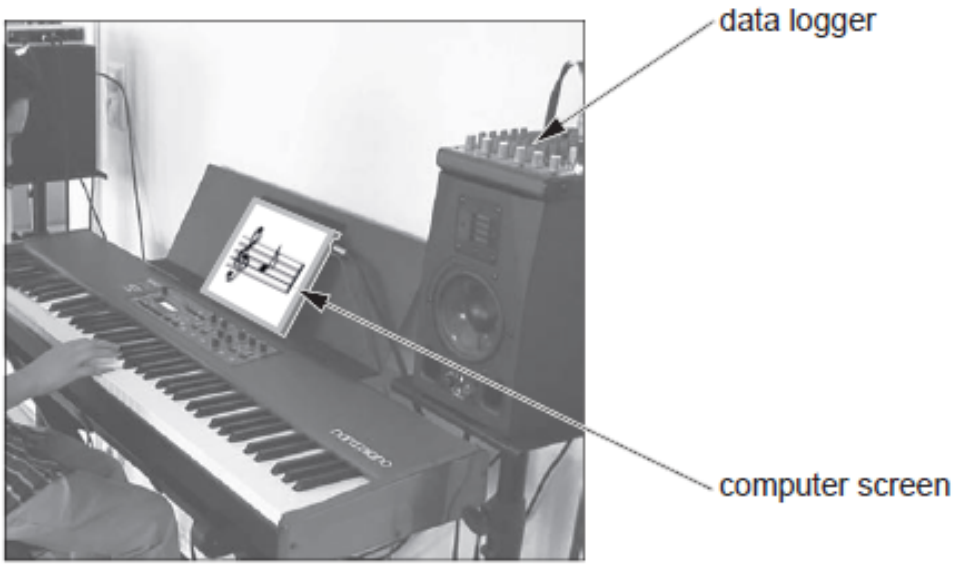
.....

*(b)* Josie investigated reaction time in humans.

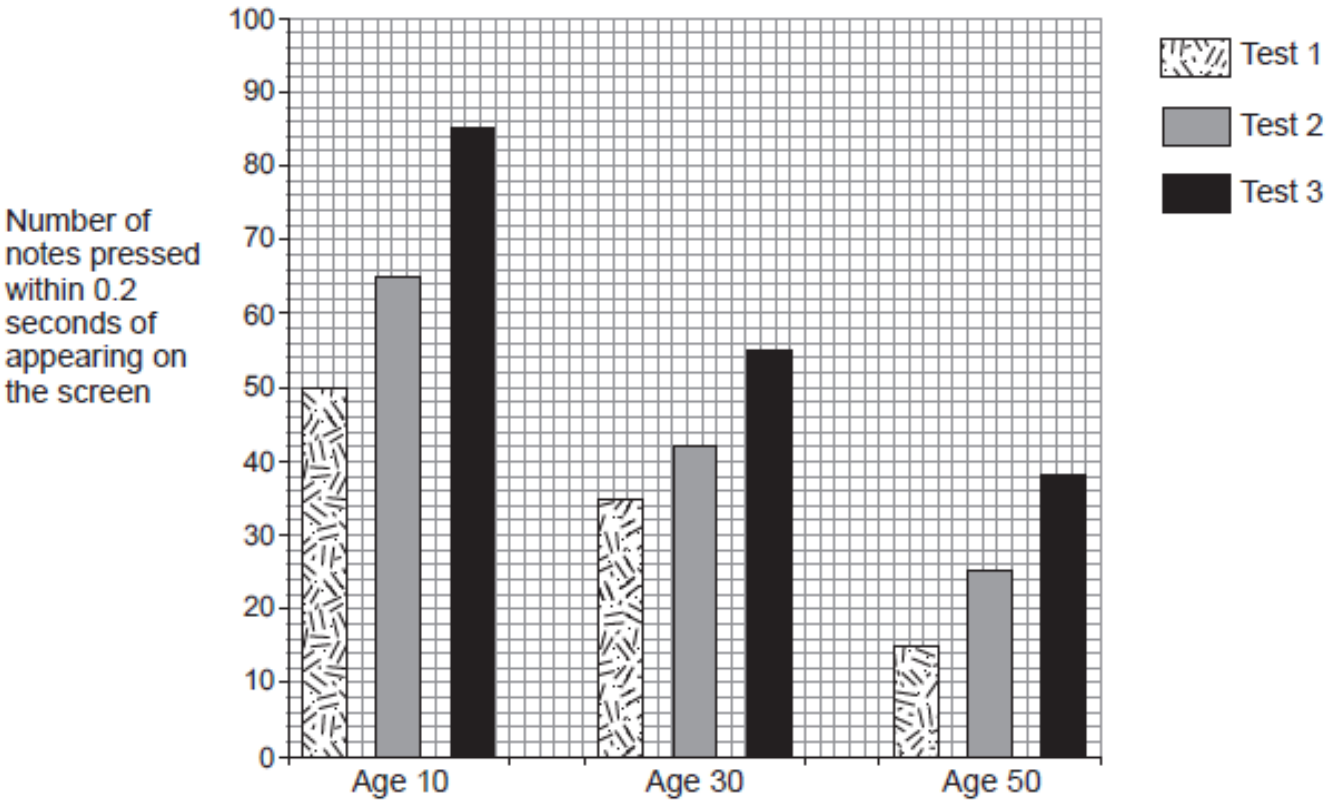
She tested three people, two males and one female of ages 10, 30 and 50 years old. They had between one and 20 years experience of playing the keyboard.

By means of a computer app, 90 random music notes flashed one by one onto a screen. The person being tested then instantly pressed each note on the keyboard as soon as it was seen. Each person did the test three times. No incorrect notes were pressed.

A data logger recorded the number of notes which were pressed within 0.2 seconds of appearing on the screen.




The bar chart shows the results of the investigation.



Use the bar chart to answer the questions.

(i) How does repeating the test affect reaction time? [1]

.....

(ii) Calculate the percentage change between tests 1 and 2 for age 50. Give your answer to one decimal place. [2]

Percentage change = ..... %

(iii) From the data, what **two** conclusions could you make about the effects of age on reaction time? [2]

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.....

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(iv) I. Josie decided to try the investigation again and make it a fairer test of the effects of age. State **two** variables which she should control. [2]

.....

.....

II. State **one** *other* way in which the investigation could be improved. [1]

.....

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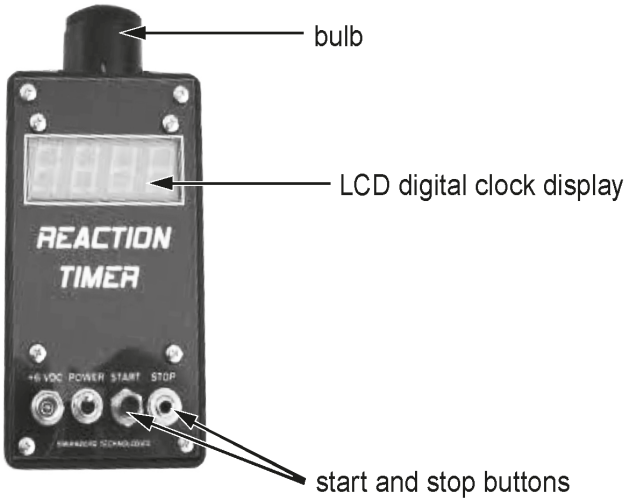
**10.** Megan wanted to know if playing music affected Bob's reaction time.

She used a reaction timer as shown in the photograph below.




Method

- The clock started timing as soon as the bulb lit up.
- When Bob saw the bulb light up, he pressed the stop button as fast as he could.
- Bob's reaction time with no music playing and then with music playing was recorded.

The results for five trials are shown below.

| trial number | reaction time with no music playing (s) | reaction time with music playing (s) |
|---|---|---|
| 1 | 0.20 | 0.53 |
| 2 | 0.20 | 0.44 |
| 3 | 0.20 | 0.40 |
| 4 | 0.20 | 0.38 |
| 5 | 0.20 | 0.25 |

*(b)* (i) State the name of the sense organ that detects light. [1]

.....

(ii) Describe how information gets from sense organs to the brain. [2]

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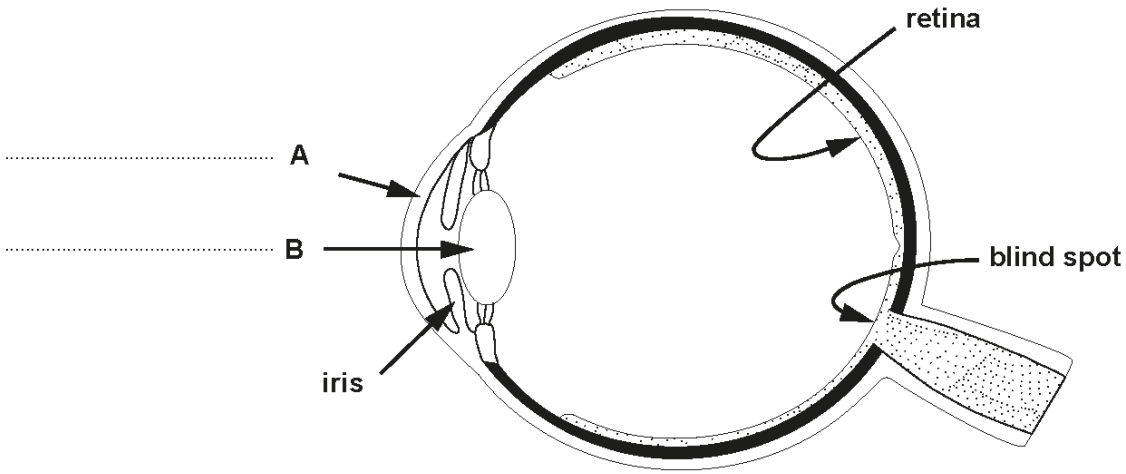
**11.** The diagram below shows a section through the human eye, with some parts labelled.




*(a)* (i) Label **A** and **B** on the diagram. [2]

(ii) The retina is the light sensitive layer of the eye where images are formed. Explain why no image is detected at the blind spot. [2]

.....

.....

*(b)* Name the parts of the eye described below. [2]

| Description | Part of the eye |
|---|---|
| tough, protective coating | ..... |
| layer containing blood vessels | ..... |

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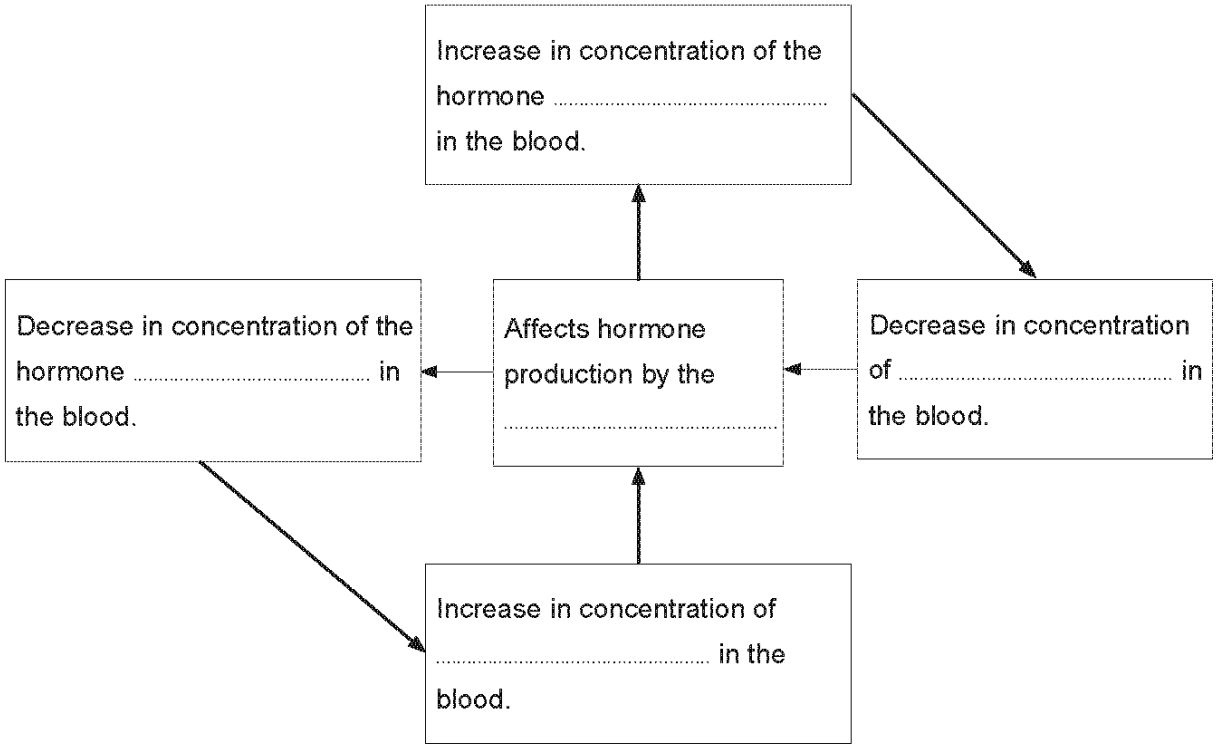
**12.**

The principles of negative feedback can be summarised by the flow chart shown below.

*(a)* Fill in the blank spaces to show how the source of energy in the blood is maintained at a constant concentration. [5]




*(b)* State **two** features of hormones shown in the flow chart. [2]

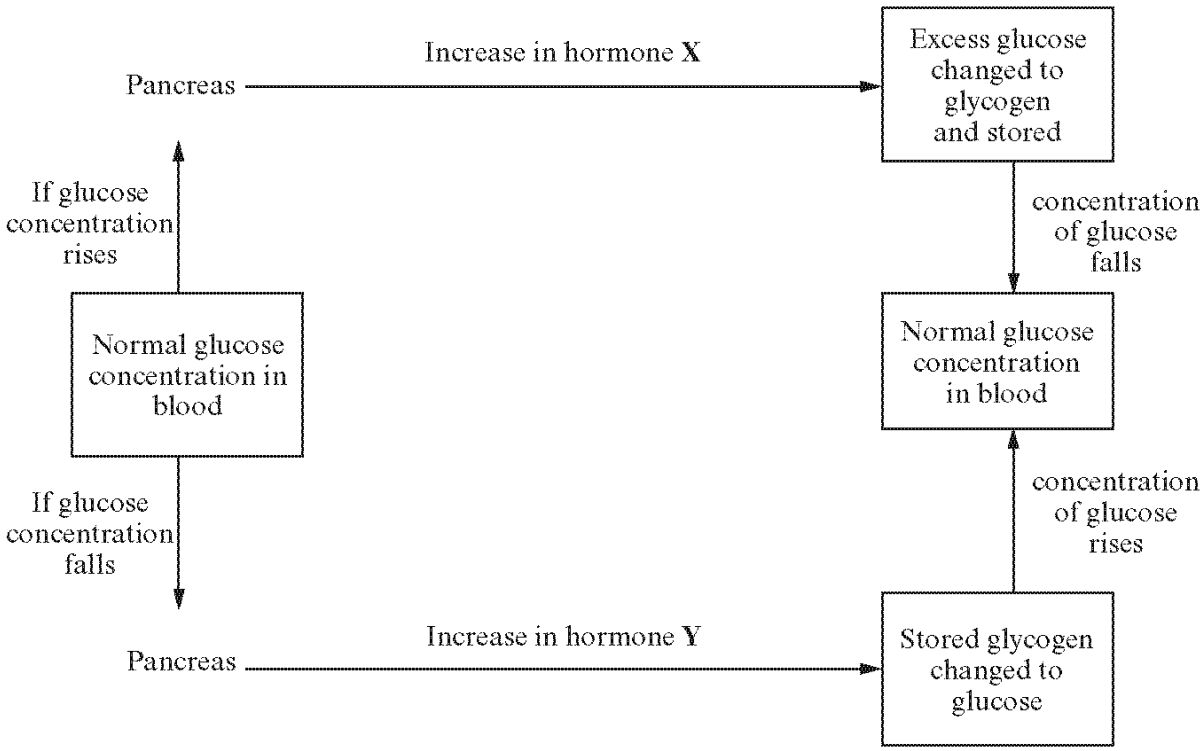
I .....

II .....

7

**13.**

It is important to keep the concentration of glucose in the blood constant. The flow diagram shows how this happens.




*(a)* What term would you use to describe the control mechanism shown in the diagram? [1]

.....

*(b)* Name the hormones, **X** and **Y**, shown in the diagram. [2]

(i) **X** .....

(ii) **Y** .....

*(c)* Name the organ of the body which stores glycogen. [1]

**14.**

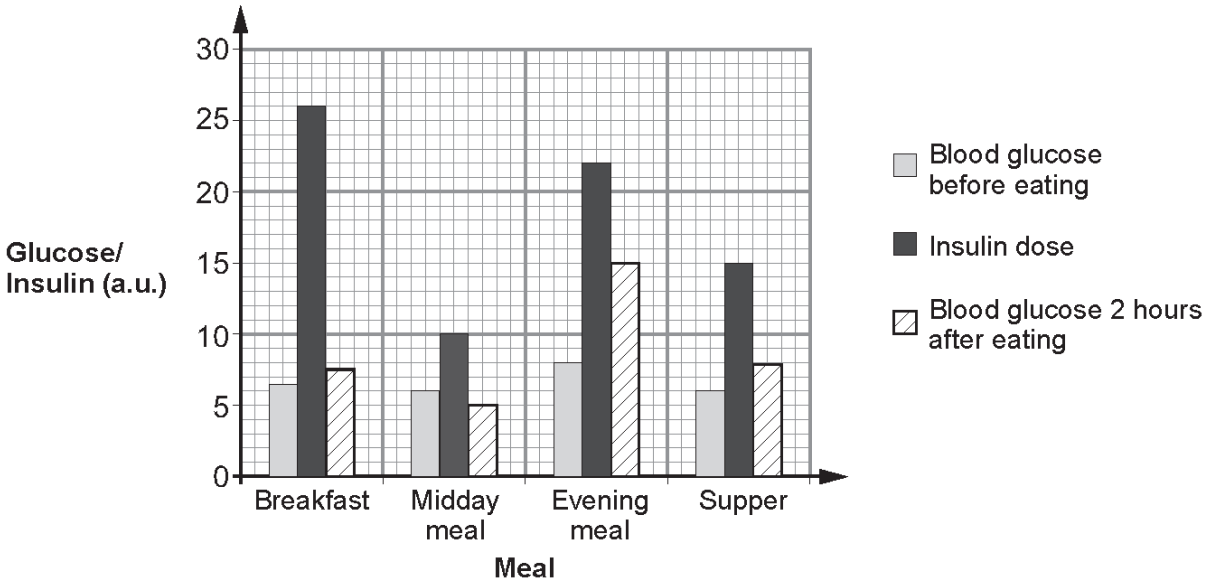
Anna has been a diabetic for 6 months. She injects herself with insulin before meals in order to control the level of glucose in her blood. Like all diabetics who have not been injecting insulin for very long she finds it difficult to get the dose correct.
Before every meal Anna carries out the following procedure.

1. Measures the concentration of glucose in her blood.
2. Estimates whether the meal she is about to eat has a high, medium or low level of glucose (sugar) in it.
3. Injects insulin, the dose of which depends on the level of glucose in the meal.

Two hours after the meal she measures the concentration of glucose in her blood again.

Anna records all this information on an App, called ***Glucose Buddy***, on her iPhone.

The chart below shows Anna's complete record for one day on ***Glucose Buddy***.




*(a)* (i) Which meal of the day did Anna estimate contained the lowest level of glucose? Give a reason for your answer. [2]

Meal .....

Reason .....

.....

(ii) Anna tries to keep her blood glucose level below 8 a.u. Using only the chart and the information opposite, suggest reasons why her blood glucose level was 15 a.u. two hours after she ate her evening meal. [2]

.....

.....

.....

*(b)* How does insulin lower the level of glucose in the blood? [2]

.....

.....

**15.** Insulin has an important role in the control of blood glucose.

*(a)* What type of substance is insulin? [1]

Underline the correct answer:

fat

hormone

nutrient

*(b)* Use your knowledge to complete the following sentences about the control of blood glucose. [3]

As blood glucose level rises, insulin is released from the

.....,

The insulin travels in the blood to the liver.

The liver then converts the excess ..... into an insoluble form

called .....

*(c)* Some people have a medical condition in which they cannot control their blood glucose. State the name of the condition and describe **one** method of treating it. [2]

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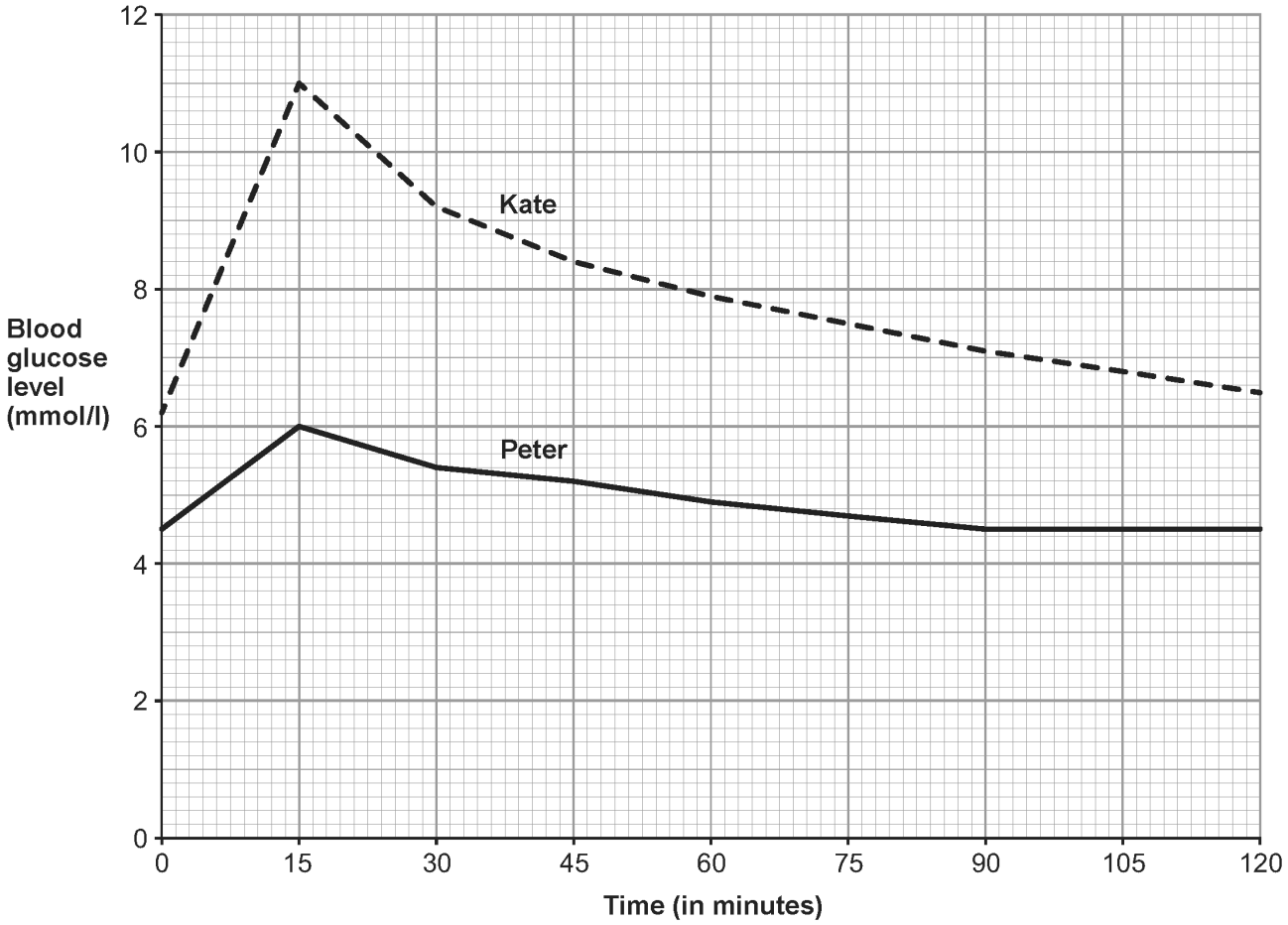
**16.** The graph below shows the blood glucose levels of Kate and Peter, after eating the same mass of sugary cereal at breakfast time. The normal blood glucose range before meals is 4.0 – 5.9 mmol/l.




*(a)* Explain why Peter's blood glucose level rises then falls. [3]

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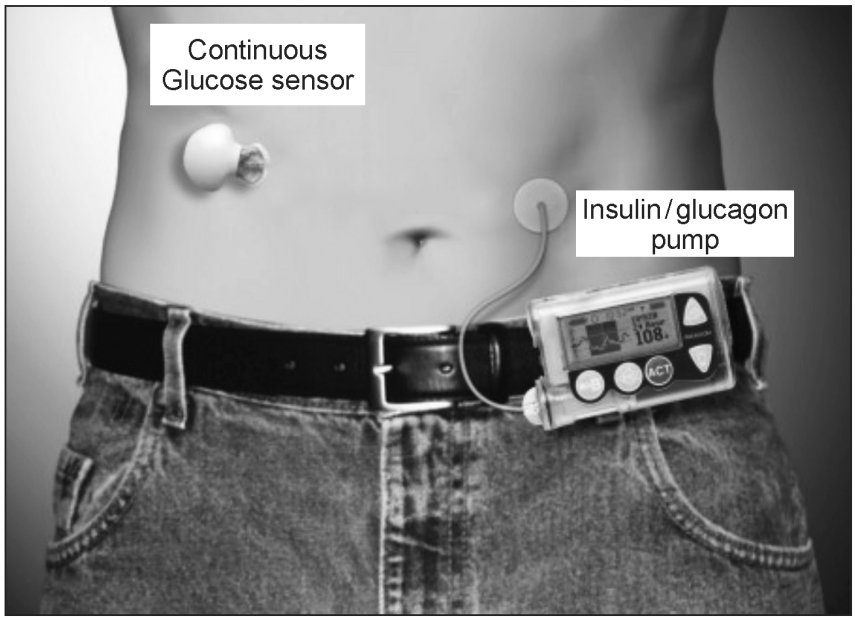
*(b)* State **two** pieces of evidence, shown in the graph, which indicate that Kate has diabetes. [2]

I. .....

II. .....

**17.** In 2014, scientists developed a new treatment for diabetes involving a smartphone app. Every five minutes, a wireless signal is sent from a glucose sensor under the user's skin to the app. The app then calculates the dose of insulin or glucagon needed to balance the blood glucose level. It then sends a signal to a hormone supply carried by the user to pump the required dose via a tube into the blood. This maintains the body's normal negative feedback mechanism.




*(a)* Which gland in the body is replaced by this treatment? [1]

.....

*(b)* Describe the function of glucagon when it reaches the liver and muscles. [1]

.....

.....

*(c)* State **two** ways in which the app could react if the blood glucose concentration became higher than normal. [2]

1. .....

2. .....

*(d)* A 55 year old man was newly diagnosed as having some symptoms of diabetes. A doctor recommended that the man should change his diet before trying any further treatment.

Suggest:

(i) the change of diet that would have been recommended; [1]

.....

(ii) the reason why the man was probably suffering from Type 2 diabetes rather than Type 1 diabetes. [2]

.....

.....

**18.** This question is about the control of blood glucose levels.

After eating a meal, the blood glucose level rises. Complete the description of how the blood glucose level is returned to normal.
Use **all** of the following words in your answer. [3]

**insulin** **glycogen** **liver**

When blood glucose levels rise, the pancreas .....

.....

.....

**19.** *(a)* When athletes prepare to run a marathon, they eat a lot of carbohydrate on the day before the race. During the marathon, the concentration of insulin in their blood decreases, while the concentration of glucagon increases.

(i) Describe what happens to the concentration of glucose in the blood when the concentration of insulin decreases and state the benefit to the athlete. [2]

.....

.....

.....

(ii) Explain how the concentration of glycogen in the liver and muscles changes when the concentration of glucagon increases. [2]

.....

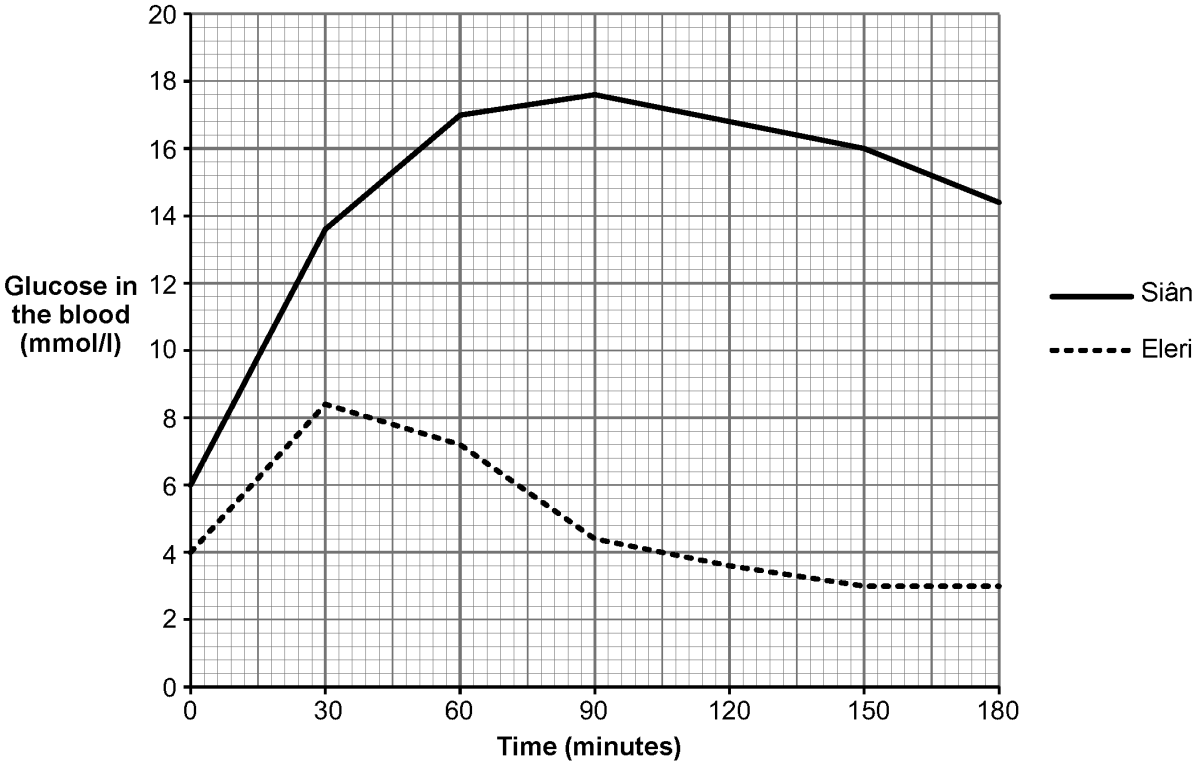
.....

.....

*(b)* What name is given to the mechanism which maintains the optimum concentration of glucose in the blood? [1]

.....

**20.** Eleri and Siân ate identical meals. After the meal the concentration of glucose in their blood was measured at regular intervals over the next 180 minutes. The graph below shows the results obtained.

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*(b)* It is important that the concentration of glucose in the blood remains between 3.5 and 7.5 mmol/l. Explain how the level of glucose in Eleri's blood is reduced after 30 minutes. [2]

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*(c)* What evidence, shown in the graph, suggests that Siân is suffering from diabetes? [1]

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.....

**21.** The list below describes processes involved in the control of blood glucose but they are in the wrong order.

1. the hormone enters the bloodstream
2. the pancreas detects the rise
3. blood glucose level rises
4. the glycogen is stored
5. the pancreas releases insulin
6. the liver turns excess glucose into glycogen

*(a)* Write down the numbers of the processes above in the right order to complete the sequence correctly. Two have been done for you. [3]

3 ..... ..... ..... 6 .....

*(b)* State the name of the substance in urine which shows a person may have diabetes. [1]

.....

*(c)* The table below shows the percentage of people in Wales with diabetes between 2006 and 2010.

| Year | Percentage of people in Wales with diabetes (%) |
|---|---|
| 2006 | 4.1 |
| 2007 | 4.2 |
| 2008 | 4.4 |
| 2009 | 4.6 |
| 2010 | 4.9 |

(i) Calculate the increase in diabetes between 2006 and 2010. [1]

.....%

(ii) Most of the increase in diabetes is due to a rise in Type 2 diabetes. One doctor working with diabetics in South Wales has called for a tax on chocolate.

How could a person's lifestyle possibly lead to Type 2 diabetes? [3]

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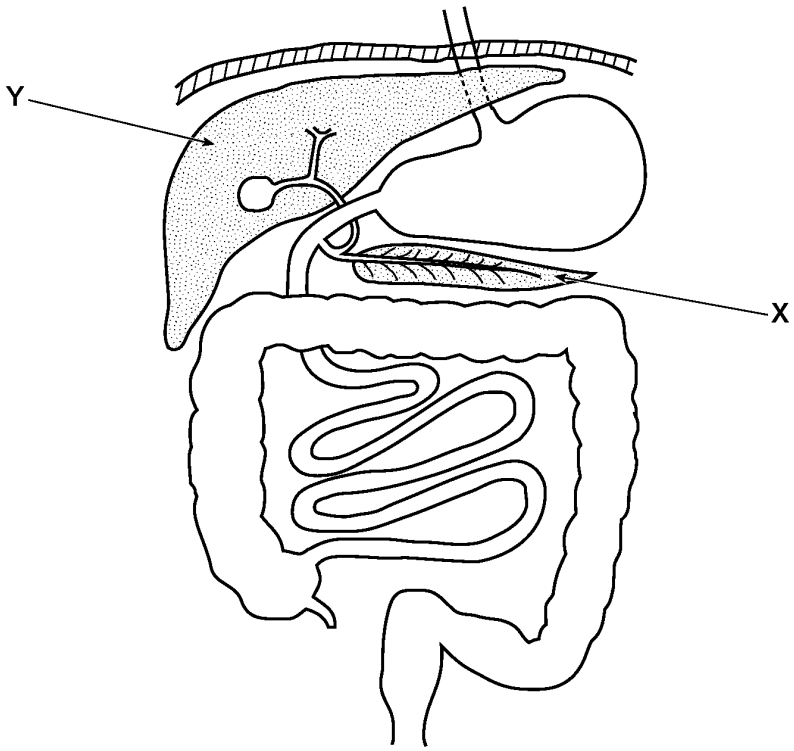
**22.** This question is about the control of blood sugar.

*(a)* The diagram shows part of the human body with two labelled organs, **X** and **Y**.




(i) Insulin is produced in organ **X**.

State the name of organ **X**. [1]

.....

(ii) Insulin has its effect in organ **Y**.

State the name of organ **Y**. [1]

.....

(iii) How does insulin travel from organ **X** to organ **Y**? [1]

.....

*(b)* In Wales, in 2010, the cost of treating diabetes was £500 million.

1. The percentage of the population with type 2 diabetes is increasing.
2. The percentage of the population who are obese is increasing.
3. The population is increasing.

Using the three statements above, which of the following (**A**, **B** or **C**) shows that the cost of treating diabetes will increase in the future? [1]

**A.** 1

**B.** 1 and 2

**C.** 1, 2 and 3

Answer .....

*(c)* Complete the following sentence. [1]

Diabetes may be diagnosed by testing a sample of urine for presence of

..... .

*(d)* Suggest **two** healthy lifestyle choices which might help prevent the development of type 2 diabetes. [2]

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**23.** The concentration of glucose in the blood is normally between 60 mg and 160 mg per 100 $cm^3$ of blood. Insulin reduces the concentration and prevents it from rising above the normal level.

*(a)* State the name of the organ which produces insulin. [1]

.....

*(b)* Doctors investigated the concentration of blood glucose in Kate and John.
They suspected that Kate had diabetes but they knew that John did not.

Their blood glucose was measured after taking a glucose drink.
The results for John are shown in the table below. Kate's results are shown on the graph.

| Time (hours) | John's blood glucose level (mg / 100 $cm^3$) |
|---|---|
| 0 | 80 |
| 0.5 | 115 |
| 1.0 | 134 |
| 1.5 | 110 |
| 2.0 | 95 |
| 2.5 | 84 |

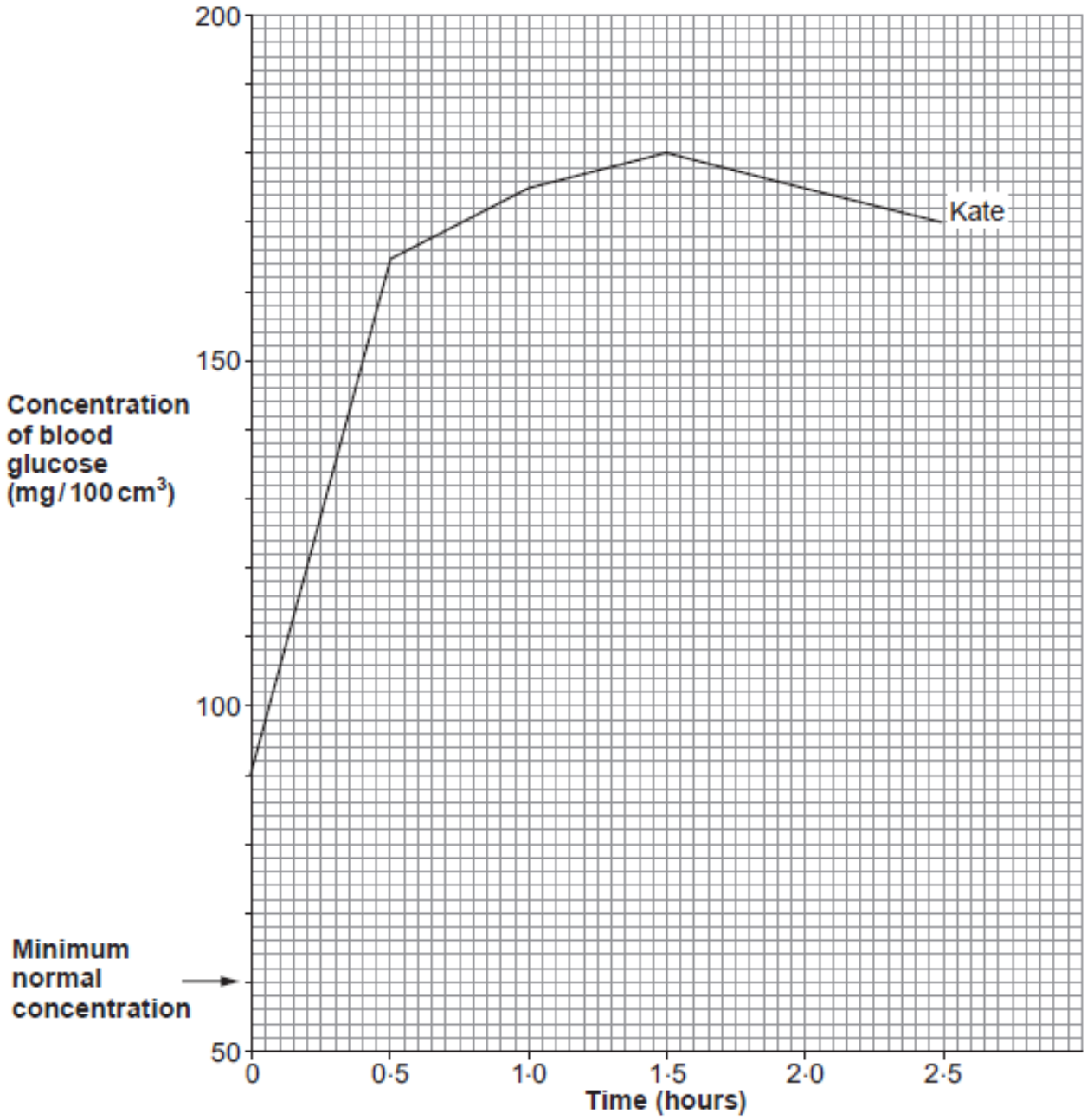
(i) Complete the graph of results by: [4]

I. drawing an arrow on the axis for glucose concentration to show the **maximum normal concentration** of blood glucose (the minimum has been done for you);

II. plotting the blood glucose results for John;

III. joining your plots with a ruler and labelling your line.

Graph of results




Use the graph to answer the questions.

(ii) At what time does insulin start to affect the concentration of glucose in John's blood? Give a reason for your answer. [2]

.....

.....

(iii) How do the results for Kate at 0.5 hours show that she has diabetes? [1]

.....

(iv) Describe how the results for Kate are different from those of John, between 0.5 and 2 hours. [3]

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.....

(v) The doctors concluded that Kate had diabetes. How could they increase the confidence they had in their results? [1]

.....

*(c)* (i) State **one** way in which Kate's diabetes could be treated. [1]

.....

(ii) Arthur is 70 years old. He produces insulin but his liver cells do not respond to it. State the precise name of this medical condition. [1]

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**24.** The diagram below shows the hairs on the surface of the skin of a cat at different air temperatures.

**Diagram A**

Mean air temperature 6.4°C

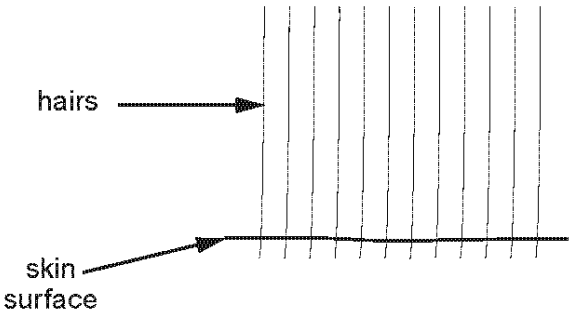
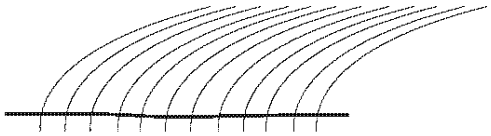



**Diagram B**

Mean air temperature 22.7°C



*(a)* Name the structures in the skin that raise each hair to the position shown in **Diagram A**. [1]

.....

*(b)* Explain why the skin in **Diagram A** loses less heat to the air than the skin in **Diagram B**. [3]

.....

.....

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.....

.....

.....

*(c)* State **two** *other* ways in which the skin reduces heat loss from the body. [2]

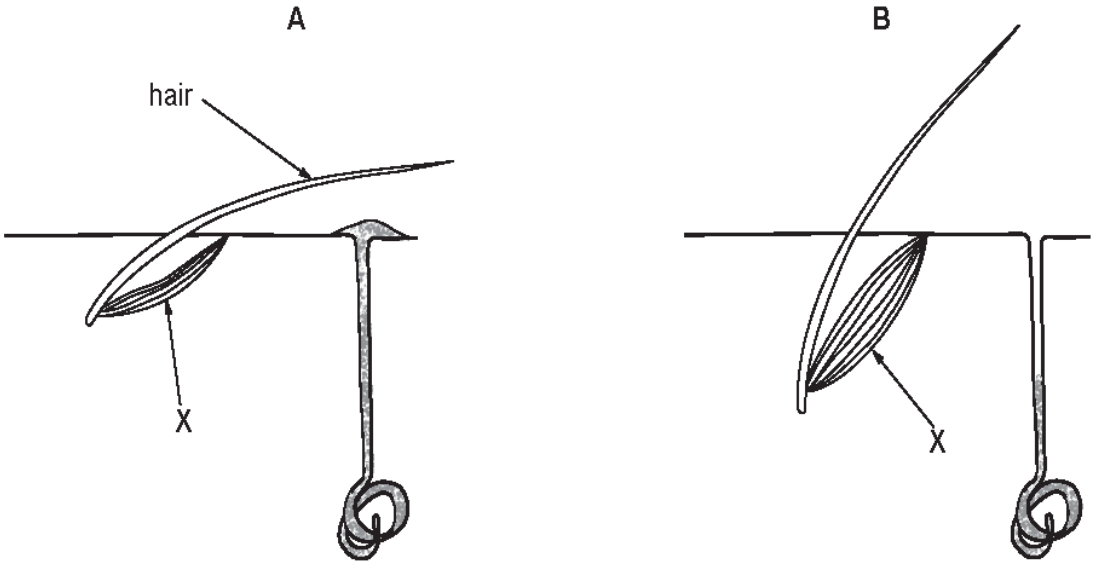
I .....

II .....

6

**25.**

Diagrams **A** and **B** below show the skin under two different environmental conditions.




*(a)* (i) Which of the diagrams shows the skin in hot conditions? ..... [1]

(ii) Give **two** reasons for your answer. [2]

I. .....

.....

.....

II. .....

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.....

*(b)* If blood vessels had been drawn on the diagrams, the blood vessels in the skin in diagram **B** would be narrower than in diagram **A**. Explain how this helps to control body temperature. [2]

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*(c)* State how structure **X** on the diagrams above causes the hair to appear as it does in diagram **B**. [1]

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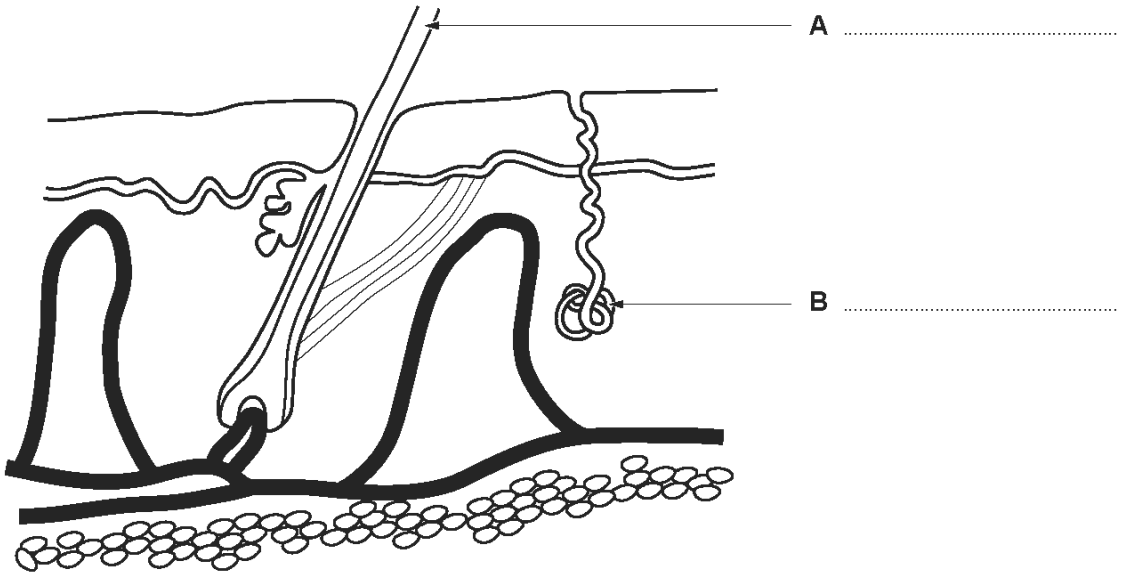
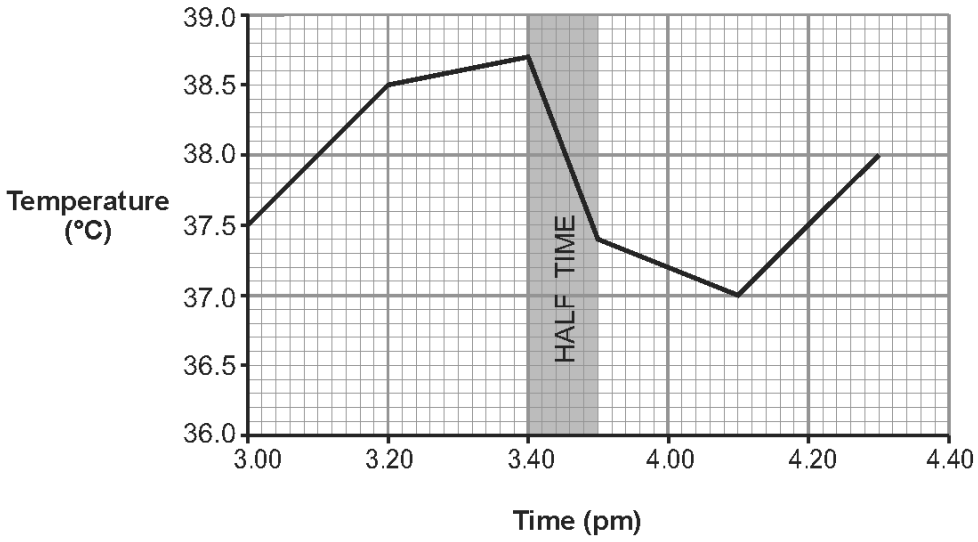
.....

**26.** The diagram shows a section through the skin.




*(a)* Label parts **A** and **B** on the diagram. [2]

*(b)* The graph shows the body temperature of a player during the course of a rugby match.




(i) State **two** responses made by the skin to cause the change in body temperature observed between 3.40pm and 4.10pm. [2]

I. .....

II. .....

(ii) Explain how the narrowing of blood vessels in the skin helps maintain body temperature in cold conditions. [2]

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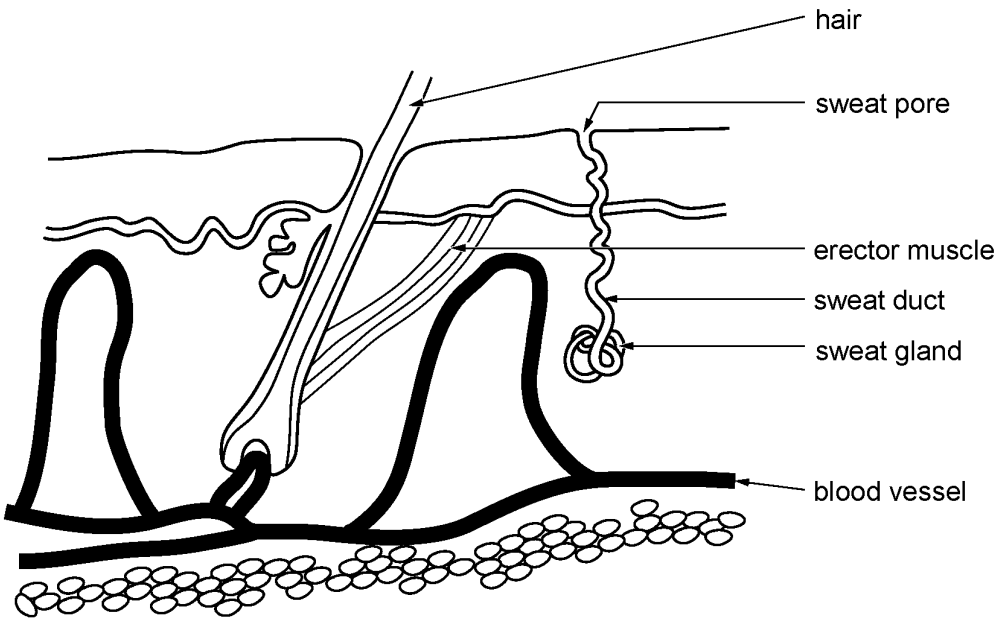
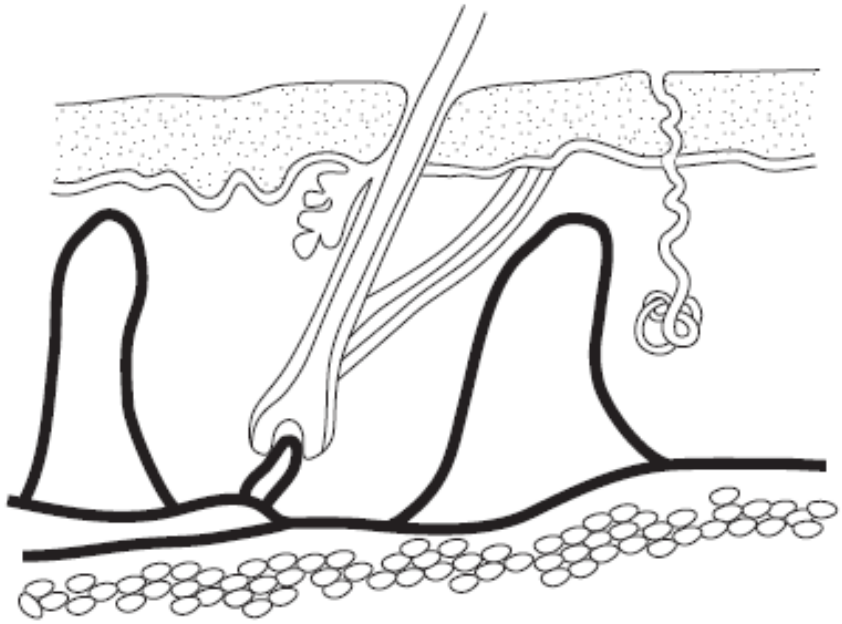
**27.**

Explain how human skin helps to control body temperature in hot conditions. Use the features labelled on the diagram below to help with your answer. [6 QWC]



**28.** The diagram shows a section through human skin.



*(a)* On the diagram, use arrows to label the: [2]

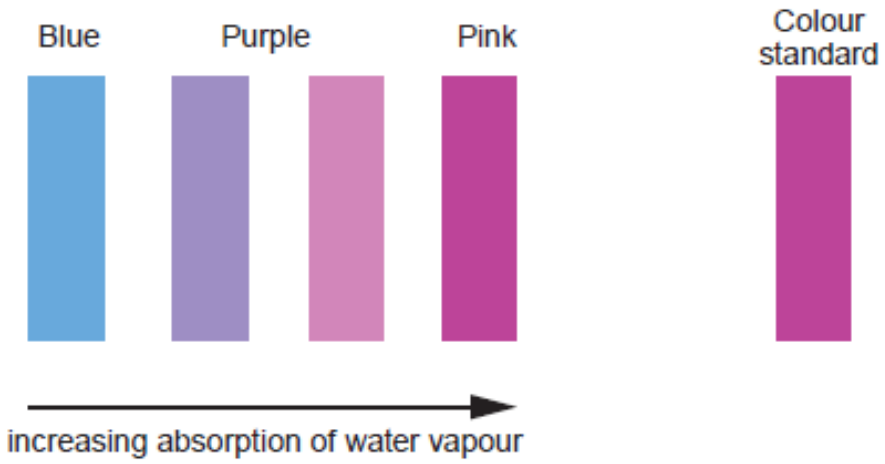
I. sweat gland;

II. erector muscle.

*(b)* Some GCSE students decided to investigate the effect of temperature on sweating.

This is their method.

Volunteers sat in a small room, the temperature of which could be finely controlled.
Strips of cobalt chloride paper were placed in small wire baskets which were held 2 mm above the surface of the skin of the arm of the volunteers.
Cobalt chloride paper turns from a blue to purple to pink colour in the presence of water vapour, as shown below.




The time taken for the cobalt chloride paper to change to the colour of the standard was recorded. The results are shown in the table below.

| | | Time taken for cobalt chloride paper to change to colour of standard (s) | | | |
|---|---|---|---|---|---|
| Volunteer No. | Room temp (°C) | Trial No. 1 | Trial No. 2 | Trial No. 3 | Mean |
| 1 | 15 | 363 | 387 | 376 | 375 |
| 2 | 20 | 321 | 304 | 309 | 311 |
| 3 | 25 | 287 | 289 | 265 | 280 |
| 4 | 30 | 221 | 230 | 202 | 218 |
| 5 | 35 | 187 | 176 | 167 | ..... |

(i) **Complete the table** by calculating the mean time for volunteer number **5**. [2]

(ii) Using these results only, what conclusion can be drawn about the effect of temperature on sweating? [1]

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(iii) Alun, one of the boys in the class, said that *'we can also conclude, from the results, that the effect of temperature differs in different people'*.
The rest of the class disagreed with this. State why they disagreed. [1]

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(iv) Explain why the final colour change of the cobalt chloride paper is compared with a standard. [1]

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*(c)* Explain the source of the water vapour which turned the cobalt chloride paper pink. [2]

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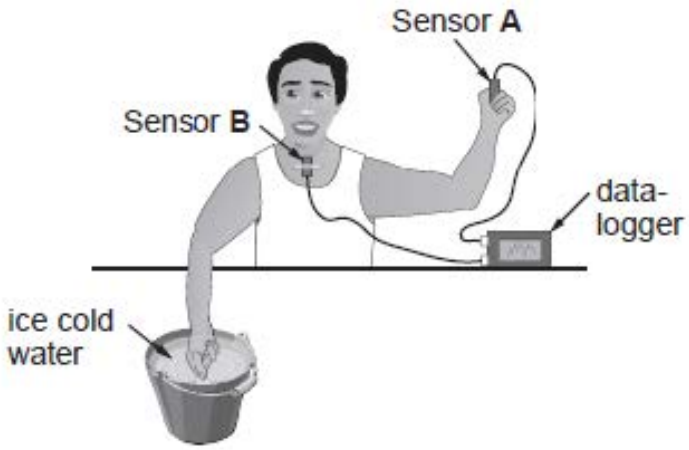
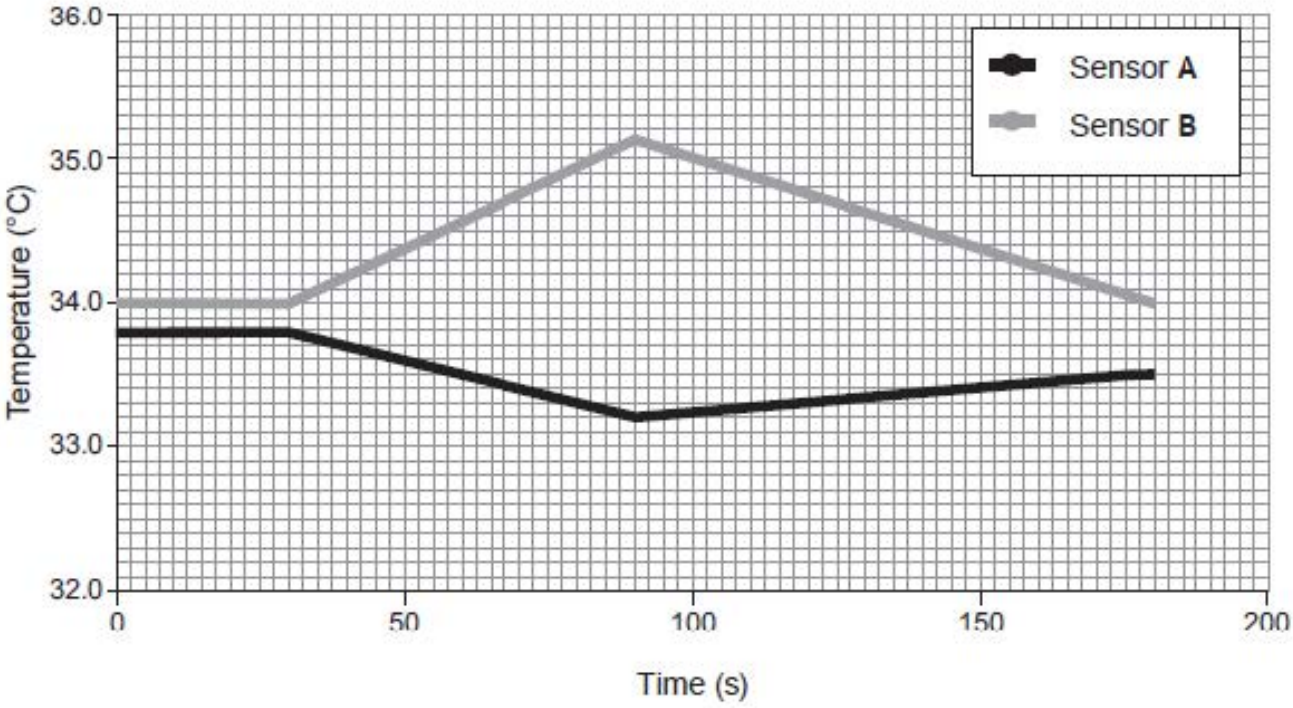
**29.** Dylan set up an experiment to study negative feedback mechanisms associated with rapid cooling of the hand.

A temperature sensor was held between the fingertips of a volunteer and another sensor was taped to the skin on the upper chest. The sensors were connected to a data logger that was set to record for three minutes.




The volunteer placed their right hand into ice cold water 30 seconds after the recording started. The hand was then removed from the ice cold water after a further 30 seconds.

The results from the data logger are shown below:



*(a)* State what is meant by a negative feedback mechanism. [2]

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.....

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*(b)* (i) Describe the results for sensor **A** after the hand was placed in the ice cold water. [1]

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(ii) Explain the change in temperature recorded by sensor **A** between 30 seconds and 90 seconds. [4]

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*(c)* Suggest the reason for the increase in the temperature recorded by sensor **B** between 30 seconds and 90 seconds. [1]

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*(d)* Suggest how the results of the experiment would differ if the volunteer had consumed an alcoholic drink 20 minutes before the start of the experiment. [1]

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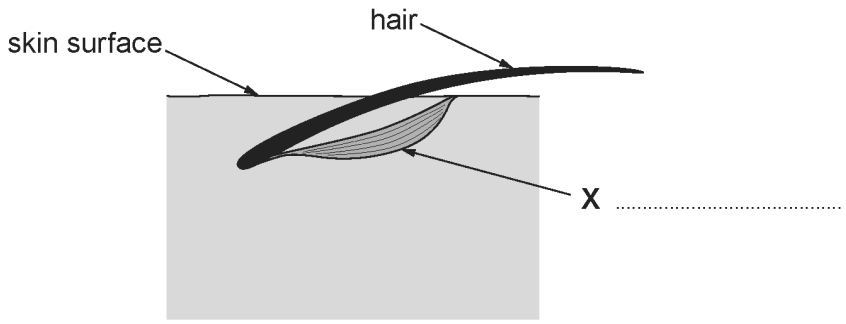
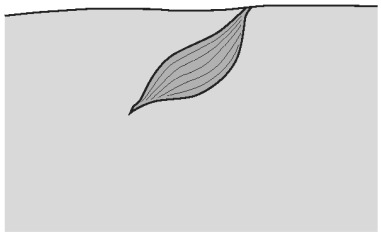
**30.** *(a)* The diagram below shows a section of skin with the position of a hair on a hot day.




(i) Label structure **X** on the diagram. [1]

(ii) Complete the diagram below by drawing in the position of the hair on a **cold** day. [1]



(iii) State how structure **X** causes the change in the position of the hair on a cold day. [1]

.....

(iv) Describe how hair reduces heat loss from the surface of the skin. [2]

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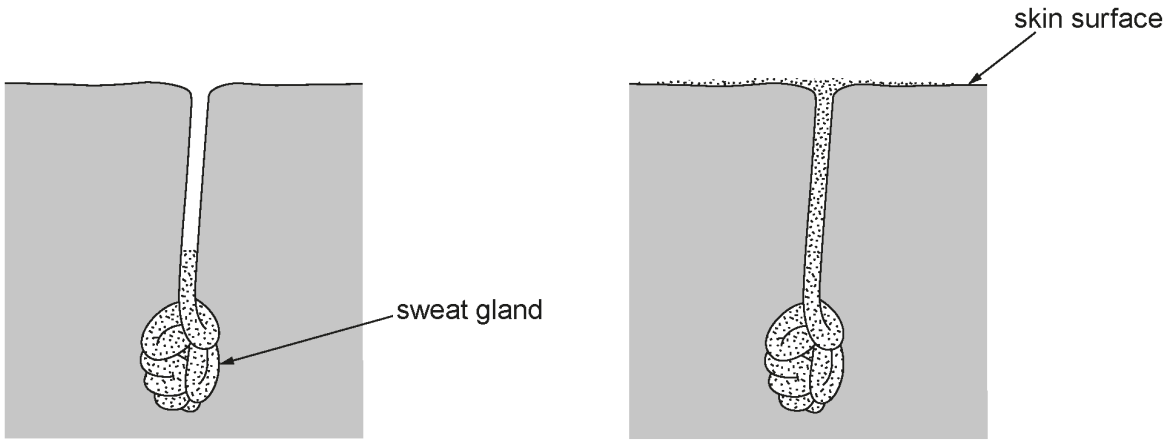
.....

*(b)* The diagram shows a section through the skin on a cold day and on a hot day.




Use the diagram to describe and explain how the processes taking place in the sweat gland **and on the skin surface** help to cool the body on a **hot** day. [3]

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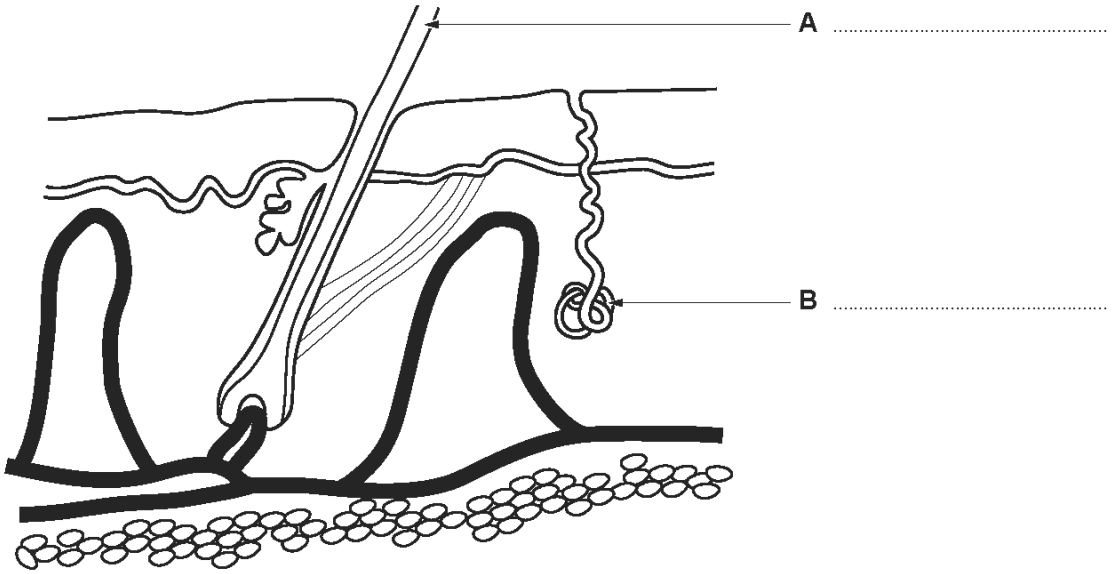
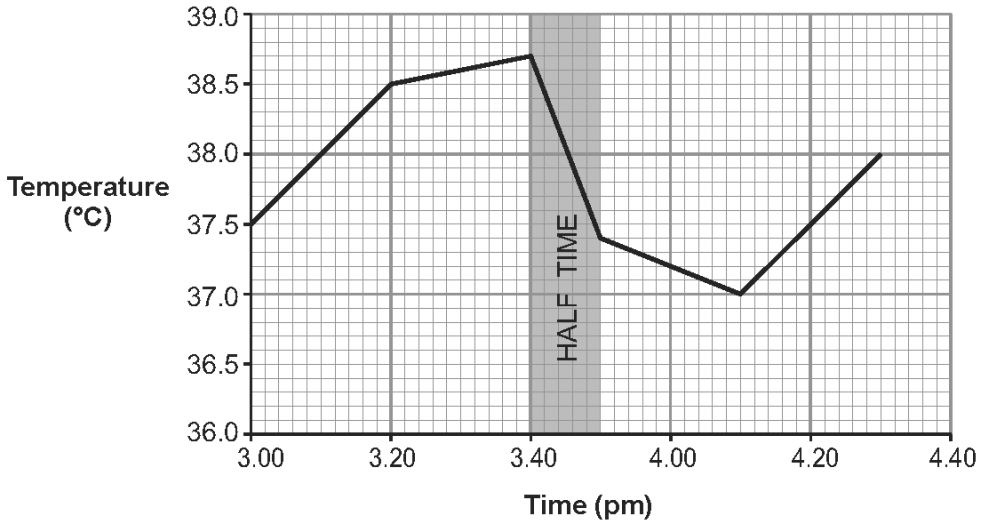
**31.** The diagram shows a section through the skin.




*(a)* Label parts **A** and **B** on the diagram. [2]

*(b)* The graph shows the body temperature of a player during the course of a rugby match.




(i) State **two** responses made by the skin to cause the change in body temperature observed between 3.40pm and 4.10pm. [2]

I. .....

II. .....

(ii) Explain how the narrowing of blood vessels in the skin helps maintain body temperature in cold conditions. [2]

.....

.....

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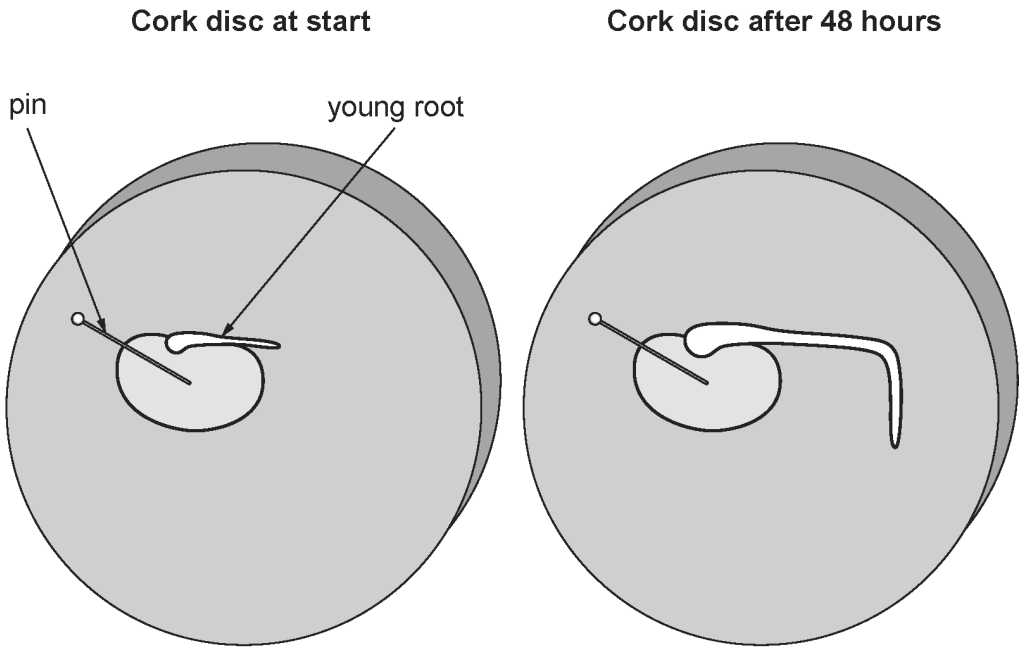
.....

**32.** *(a)* What is meant by the term *tropism*? [1]

.....

.....

*(b)* Some students in a school laboratory pinned a young bean seedling to a vertical (upright) cork disc which they left in the dark for 48 hours. After 48 hours the seedling was examined and the young root was found to have **grown** downwards. This is shown in the diagram below.



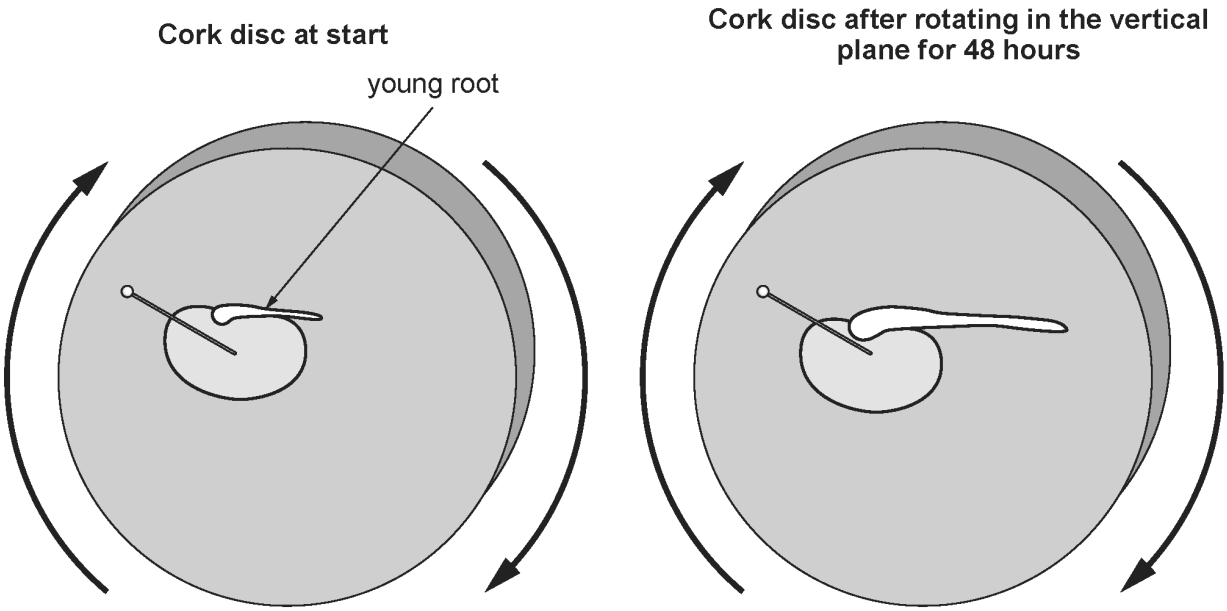

(i) State why the young root has **grown** downwards. [1]

.....

.....

(ii) At the same time another young bean seedling was pinned to a rotating vertical cork disc. After 48 hours in the dark, the young root was found to have continued to grow straight.

This is shown in the diagram below.




Give a reason for the appearance of the young root after 48 hours. [1]

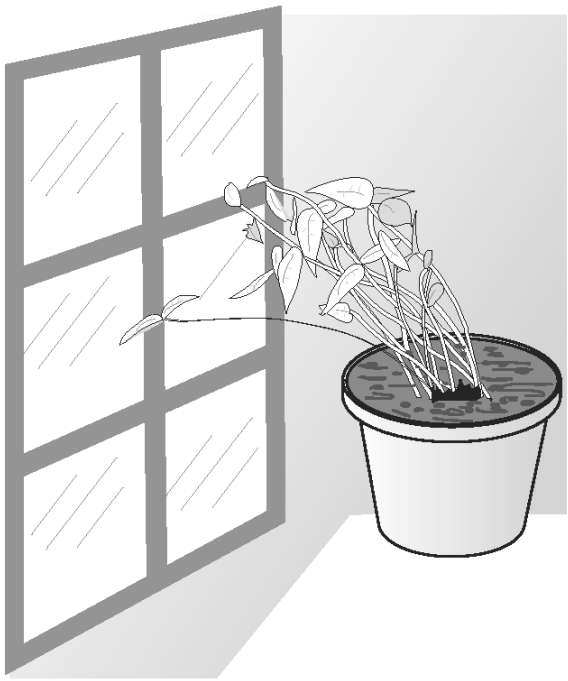
.....

.....

**33.** Describe an experiment you would set up to investigate the positive growth response (phototropism) of plant shoots to light coming from one side.
In your account you must explain the use of a control in your investigation. [6 QWC]

6

**34.** The plant in the diagram below shows positive phototropism.



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010005

*(a)* In a phototropic response, state what is:

(i) the stimulus; ..... [1]

(ii) the response. ..... [1]

*(b)* **Circle** the correct answer below to complete the following sentence. [1]

The response is due to **gravity / a hormone / an impulse**.

*(c)* State the advantage of phototropism to the plant. [1]

.....

.....

4

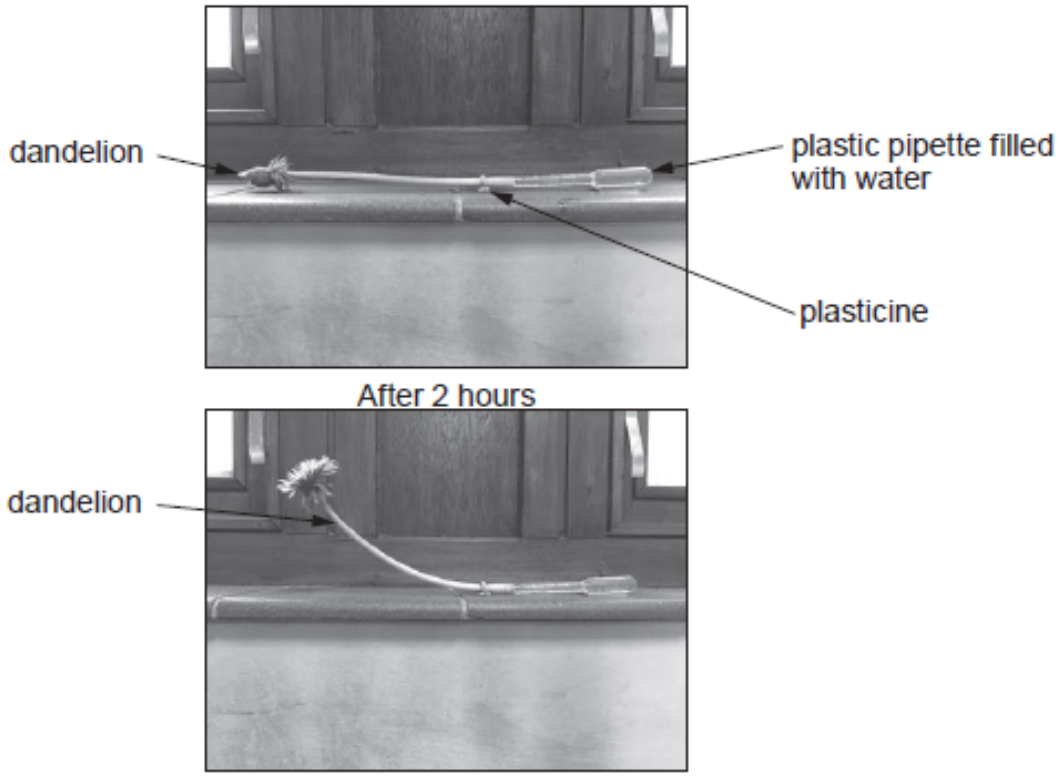
**35.** Some students investigated the tropic responses of the dandelion *(Taraxacum officinale)*.

*(a)* State what is meant by tropic responses. [1]

.....

.....

*(b)* The students set up the apparatus shown below on a south-facing window-sill.




The students concluded that the dandelion had shown positive phototropism.

Suggest why the students cannot be confident in their conclusion. Explain how they could change the method to improve confidence in their conclusion. [3]

.....

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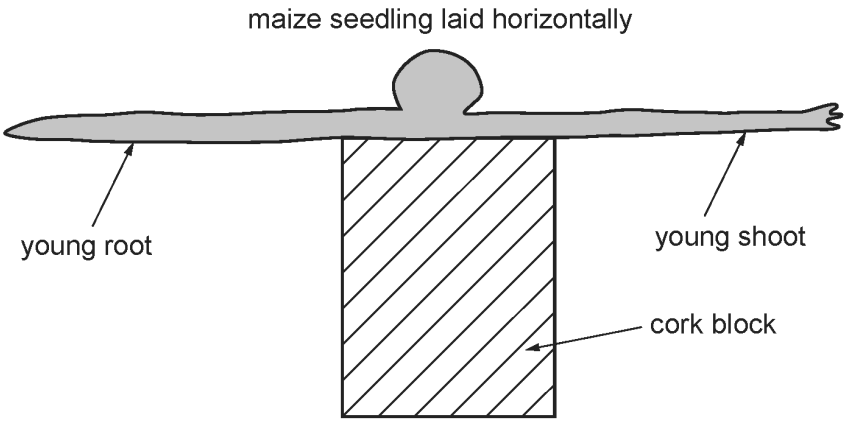
*(c)* State the name of the plant hormone responsible for phototropism. [1]

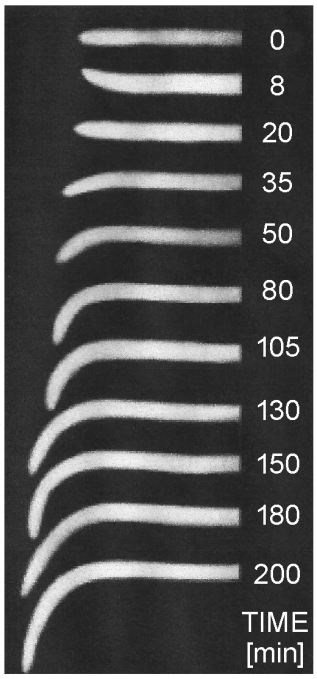
.....

**36.** A young maize seedling was laid horizontally in a dark room.




A series of time-lapse photographs was taken of the **young root**, at various time intervals, over a 200 minute period.

The series of photographs is shown below.




*(a)* (i) State three observations, **shown in the photographs**, about the young root over the time of the investigation. [3]

I. .....

II. .....

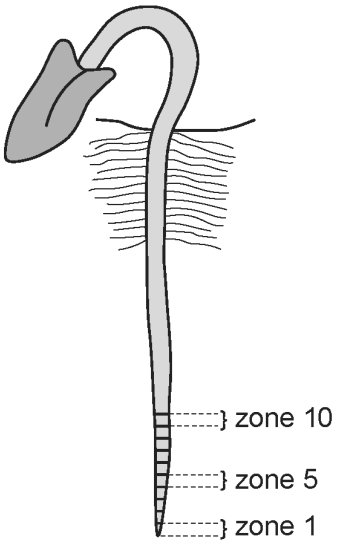
III. .....

(ii) Name the response shown by the young root between 35 and 200 minutes. [1]

.....

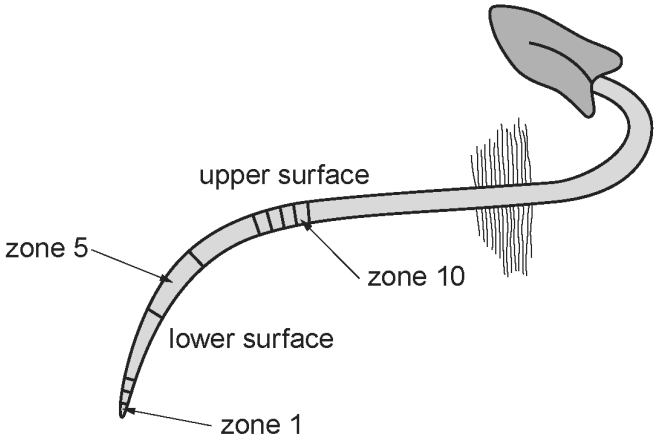
*(b)* The root tip of a young seedling was marked with ink at 2 mm intervals. Each of the 2 mm divisions is known as a zone and three zones are labelled in the drawing.

Drawing 1




The seedling was laid horizontally for 180 minutes after which time a drawing was made. This is shown below.

Drawing 2




(i) **Using Drawing 2 only** compare the growth rate of the upper and lower surfaces of the young root. [1]

.....

.....

(ii) Name the type of chemical responsible for the curvature of the young root. [1]

.....

**37.**

*(a)* What is a *tropism*? [2]

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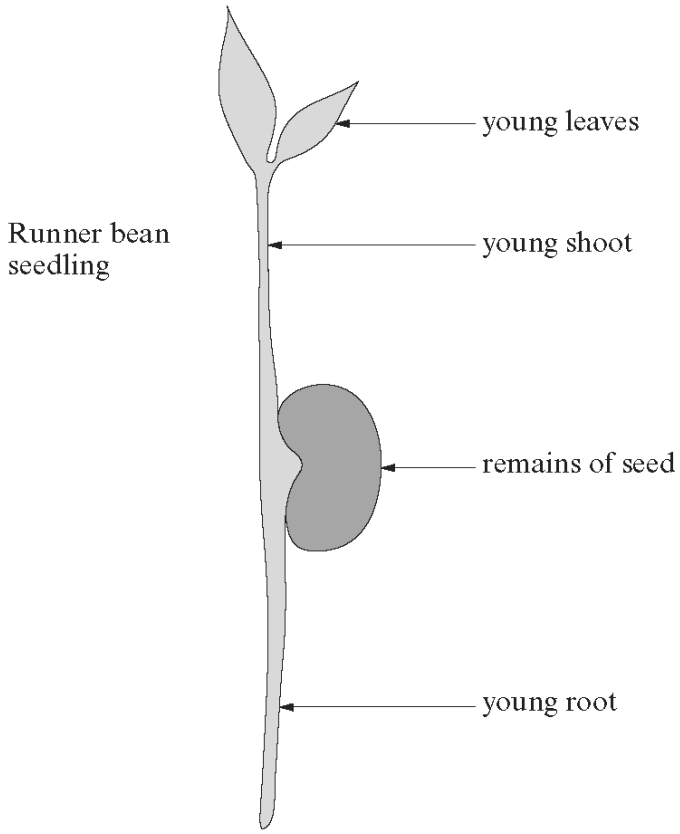
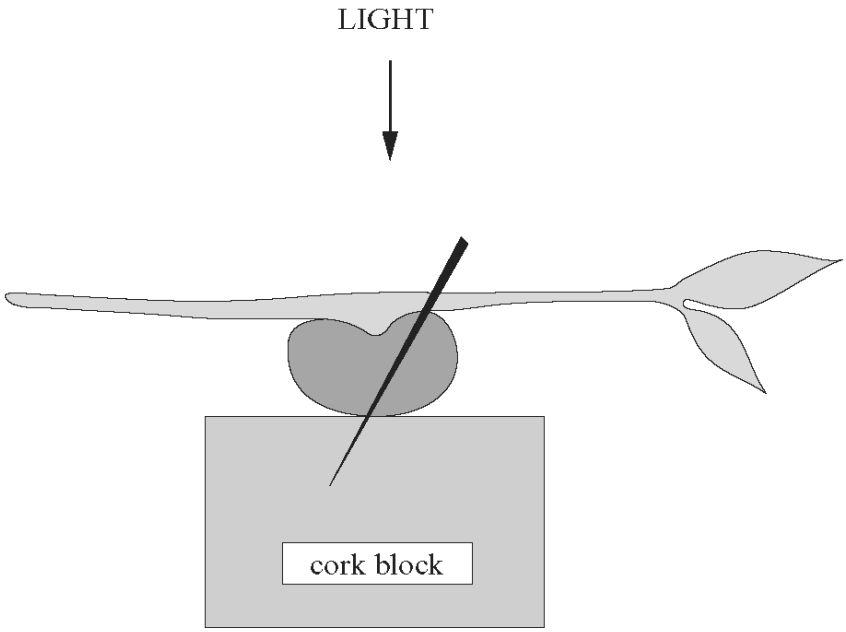
.....

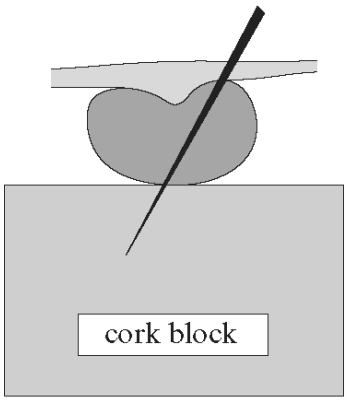
*(b)* A number of runner bean seedlings were grown in soil in a laboratory. After 5 days the seedlings were removed from the soil and their young roots were washed. The straightest of the seedlings was then selected.



The runner bean seedling was positioned horizontally and pinned to a cork block as shown below.




(i) After 3 days the seedling was examined.
Complete the diagram below by sketching the expected appearance of the young root **and** shoot. [2]




(ii) Name the response shown by

I the root, ..... [1]

II the shoot. ..... [1]