OXFORD

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Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

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I declare this is my own work.

INTERNATIONAL AS
BIOLOGY (9610)

Unit 2 Biological Systems and Disease

Wednesday 17 May 2023 07:00 GMT Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
- a ruler with millimetre measurements
- a scientific calculator, which you are expected to use where appropriate.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided.
  Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

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Answer **all** questions in the spaces provided.

0 1 Starch is a polysaccharide. Amylase is an enzyme involved in the digestion of starch.

0 1 . 1 Name the sugar produced when starch is digested by amylase.

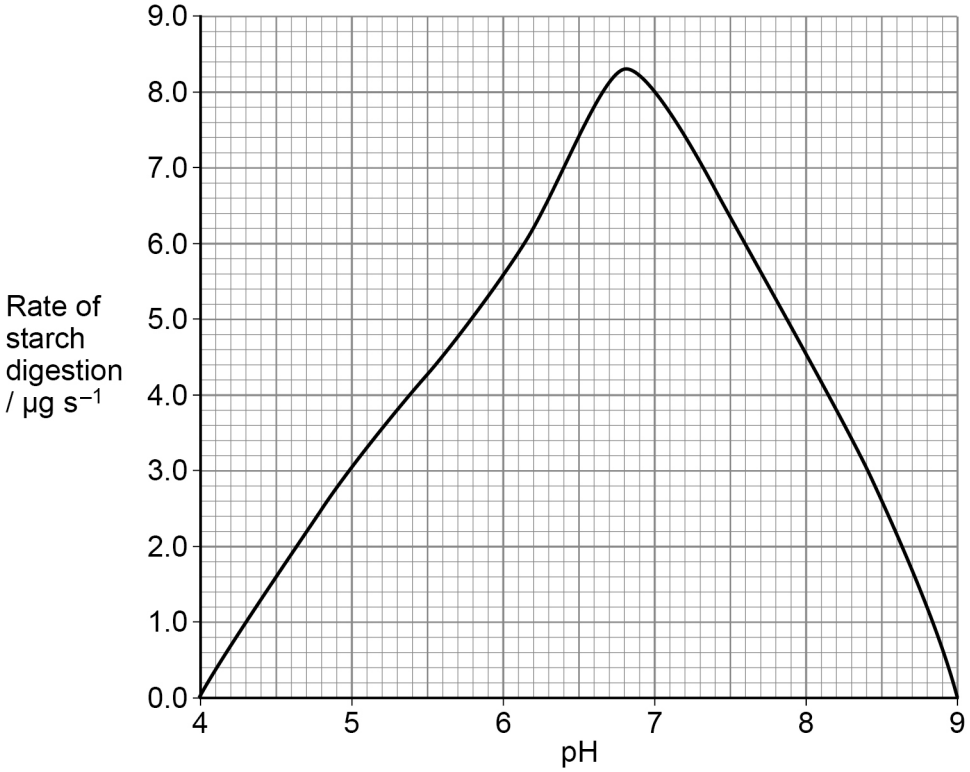
[1 mark]

_____

A student wants to find the optimum pH for the digestion of starch by amylase.

Figure 1 shows the rate of starch digestion by amylase at different pH values.

Figure 1



0 1 . 2 Give the optimum pH of amylase. Use **Figure 1**.

[1 mark]

pH: _____

0 1 . 3 State **one** variable that should be controlled when finding the optimum pH.

[1 mark]

_____

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Table 1 shows:

- the pH range of different parts of the digestive system
- the length of time food spends in each part of the digestive system.

Table 1

Part of digestive system	pH range	Length of time food spends in this part / minute
Mouth	6.7–7.3	0.50–1.00
Oesophagus	5.0–7.0	0.08–0.13
Stomach	1.0–2.5	120–360
Small intestine	6.6–7.5	180–300

Amylase is secreted by the salivary glands and the pancreas. These glands are in different parts of the digestive system.

0 1 . 4 Salivary amylase cannot digest all of the starch alone. Pancreatic amylase is needed.

Explain why.

Use information from **Figure 1** and **Table 1**.

[4 marks]

Question 1 continues on the next page

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0 1 . 5 After hydrolysis by amylase, another type of enzyme is needed to digest starch completely.

Give the type of enzyme and the precise location of the enzyme needed to complete the digestion of starch.

[2 marks]

Type of enzyme _____

_____

Precise location of enzyme _____

_____

0 1 . 6 The pH of the stomach is 1.0–2.5

Suggest **two** advantages of the low pH in the stomach.

[2 marks]

1 _____

_____

2 _____

_____

11

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Turn over for the next question

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0 2 . 1 HIV is a virus that can cause AIDS in humans.

Complete **Table 2** to give **one** type of molecule found in each part of HIV.

[3 marks]

Table 2

Part of HIV	**Type of molecule**
Genetic material	
Envelope	
Capsid	

HIV contains some enzymes.

Drugs used for treating HIV inhibit these enzymes.

Table 3 gives information about how three of these drugs work.

Table 3

Drug name	**Description of how the drug works**
Abacavir	Stops the HIV genetic material being changed to match the genetic material in the host cell.
Cabotegravir	Stops the HIV genetic material from being inserted into the genetic material of the host cell.
Tipranavir	Stops the hydrolysis of peptide bonds so functional proteins are not made. This prevents HIV infecting new host cells.

0 2 . 2 Identify the HIV enzyme that is inhibited by each of the drugs.

Use information from **Table 3**.

[3 marks]

Abacavir _____

Cabotegravir _____

Tipranavir _____

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0 2 . 3 HIV has a high rate of mutation.

Drugs used for treating HIV bind to and inhibit enzymes.

A combination of drugs is given at the same time to treat HIV.

Explain why.

[3 marks]

0 2 . 4 Current drug treatments stop a person infected with HIV from developing AIDS.

However, scientists continue to try to develop a vaccine against HIV.

Suggest **one** reason why.

[1 mark]

10

Turn over for the next question

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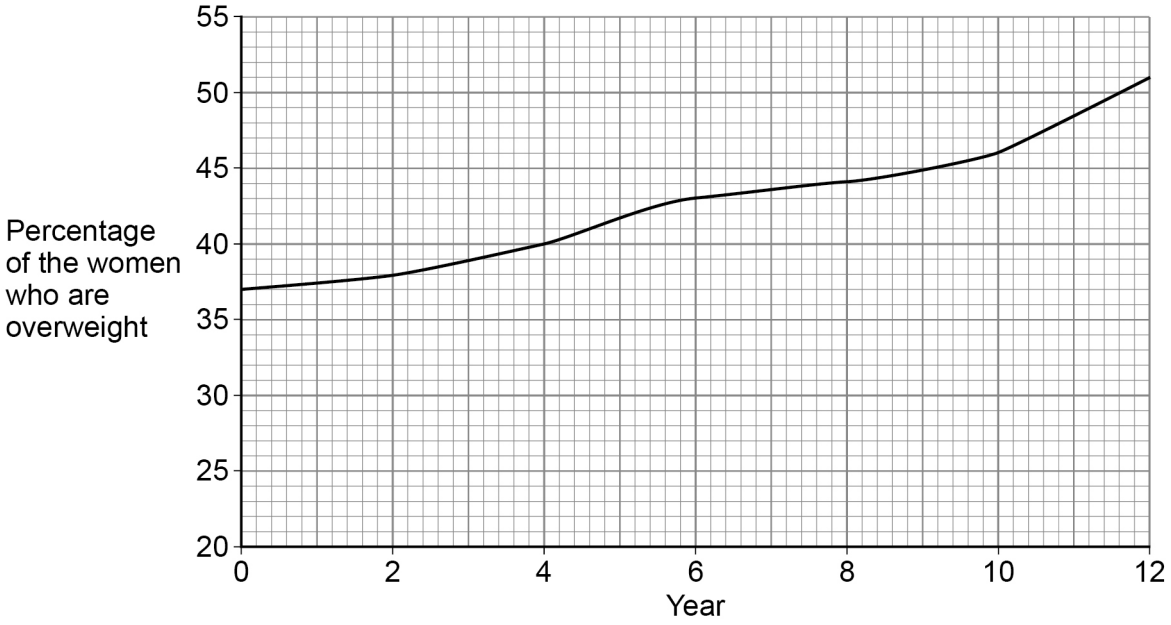
0 3 Scientists study specific risk factors linked to coronary heart disease (CHD).
The scientists collect data from 86 000 women for 12 years.

The scientists calculate the percentage of the women who are overweight in each year of the study.

Figure 2 shows the results.

Figure 2



0 3 . 1 The change in the percentage of overweight women shown in **Figure 2** would be expected to affect the number of cases of CHD during the study.

Predict how.

[1 mark]

_____

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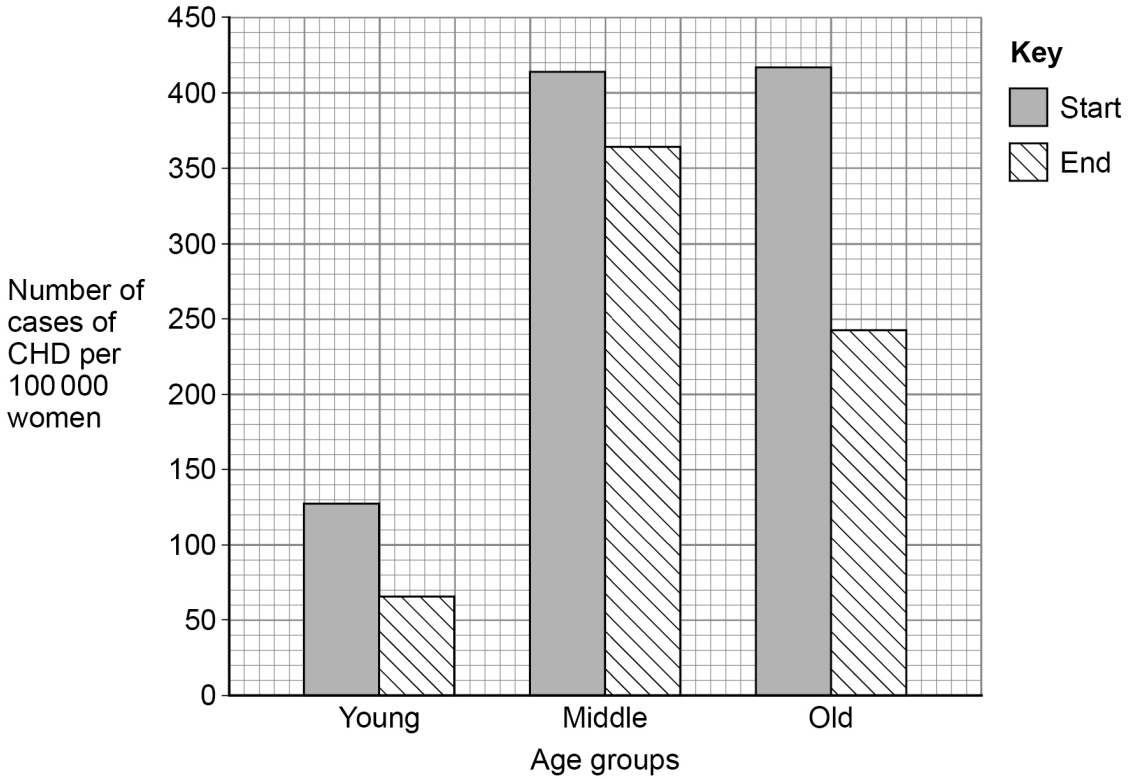
The scientists record the number of cases of CHD at the start and at the end of the study.

Figure 3 shows the results.

Figure 3



0 3 . 2 The scientists calculate the number of cases of CHD per 100 000 women and use these values to plot the graph shown in **Figure 3**.

Give **one** reason why the scientists calculate the number of cases of CHD per 100 000 women.

[1 mark]

_____

_____

0 3 . 3 The number of cases of CHD changes between the start of the study and the end of the study.

Describe how.

Use information from **Figure 3**.

[1 mark]

_____

Question 3 continues on the next page

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0 3 . 4 Give **one** advantage and **one** disadvantage of the way the scientists did the study.

[2 marks]

Advantage _____

_____

Disadvantage _____

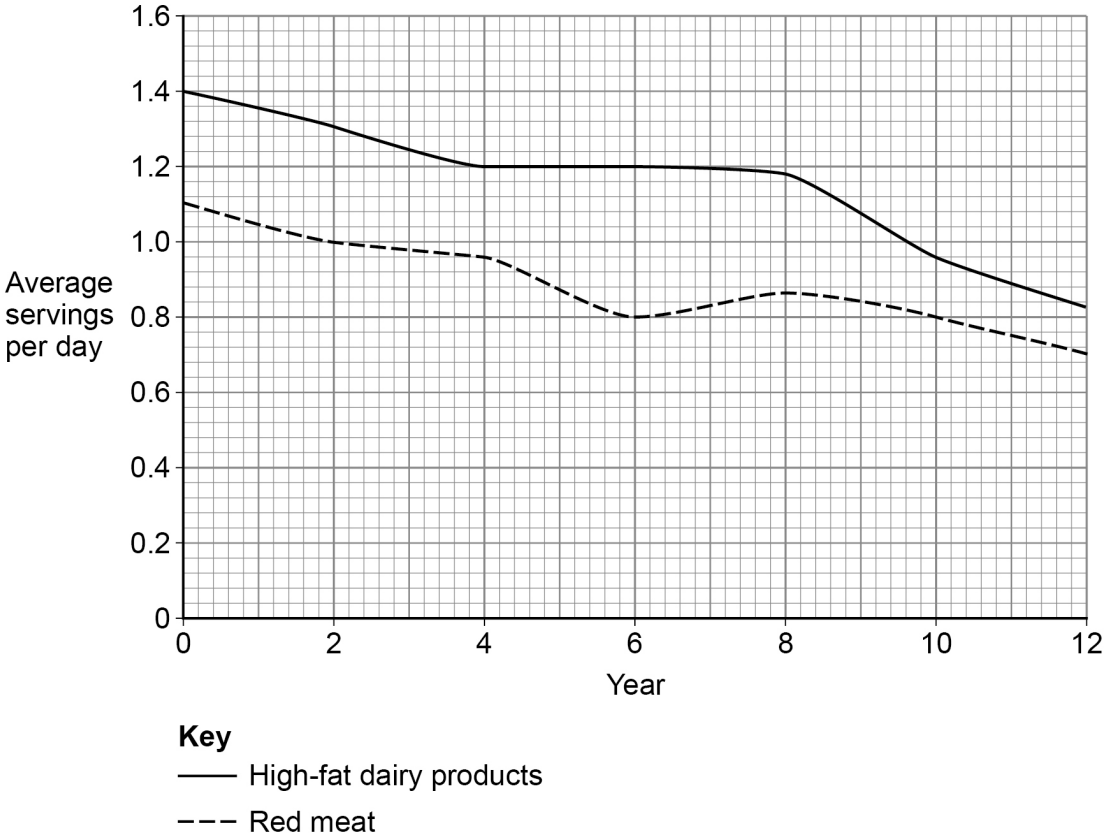
_____

The scientists investigate the women's diets in more detail. The scientists consider the average number of servings per day that the women have of:

- red meat
- high-fat dairy products.

The results are shown in **Figure 4**.

Figure 4



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0 3 . 5 The scientists conclude that the changes in the women's diets cause the changes in the number of cases of CHD.

Explain how the changes in diet may have caused the change in the number of cases of CHD.

[2 marks]

0 3 . 6 Describe how an atheroma forms and how the atheroma could cause CHD.

[3 marks]

10

Turn over for the next question

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0 4 Tobacco mosaic virus (TMV) is a plant virus. TMV is transmitted from one plant to another when an infected leaf touches a leaf that is not infected.

0 4 . 1 Give **one** other way that a virus can be transmitted from plant to plant.

[1 mark]

_____

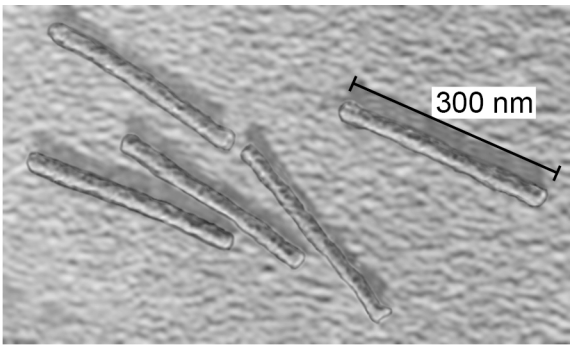
_____

TMV is a rod-shaped virus.

Figure 5 shows TMV particles viewed using a transmission electron microscope.

Each virus particle is a cylinder with a volume of 76 000 nm^3

Figure 5



0 4 . 2 Calculate the **diameter** of a TMV particle.

Use data from **Figure 5** and the equation:

$V = \pi r^2 h$

Use π = 3.14

Give your answer to the nearest whole nm

[3 marks]

Diameter = _____ nm

Do not write outside the box

TMV is made up of a single strand of RNA surrounded by a protein coat.

0 4 . 3 TMV spreads by infecting neighbouring cells. To do this, TMV loses the protein coat to leave a small molecule of RNA.

The RNA moves to the next cell using the symplastic pathway.

Describe the symplastic pathway.

[2 marks]

Question 4 continues on the next page

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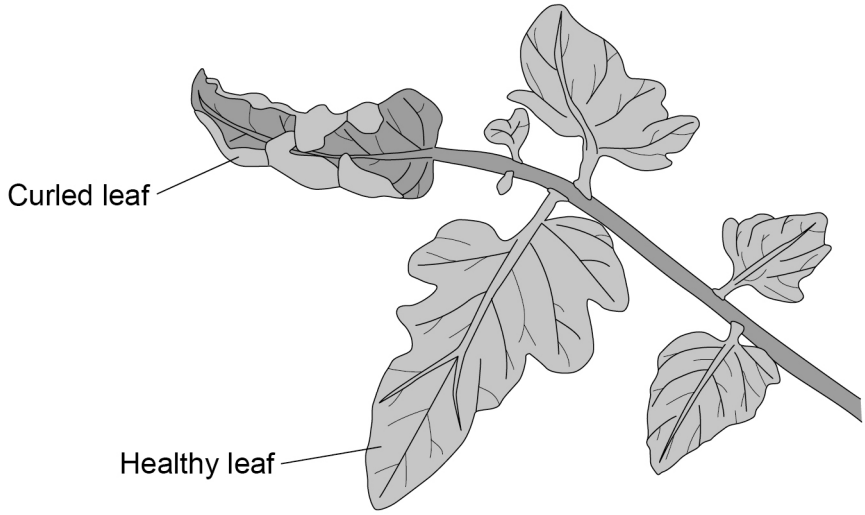
0 4 . 4 TMV infection causes the plant leaves to curl.

Figure 6 shows part of a plant infected with TMV.

Figure 6



Plants with curled leaves grow more slowly.

Suggest why.

[3 marks]

9

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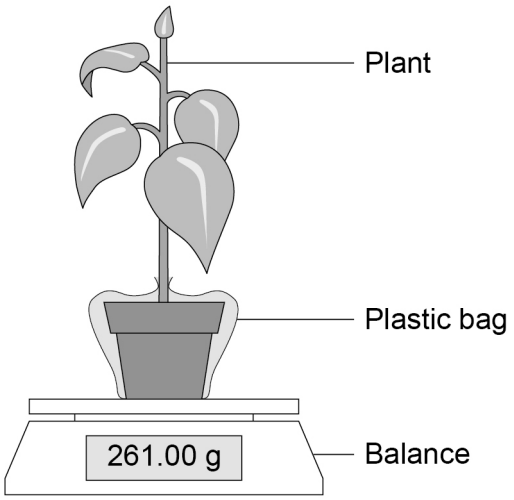
0 5 Students compare two methods of estimating transpiration rate.

Method **1** – Measuring mass

The students:

- set up the equipment as shown in **Figure 7**
- measure the mass of the plant and its pot
- measure the mass of the plant and its pot again after a known time
- use the difference in these two values of mass to estimate the rate of transpiration.

Figure 7



0 5 . 1 In **Figure 7**, a sealed plastic bag is covering the pot.

Give a reason why.

[1 mark]

_____

_____

_____

Question 5 continues on the next page

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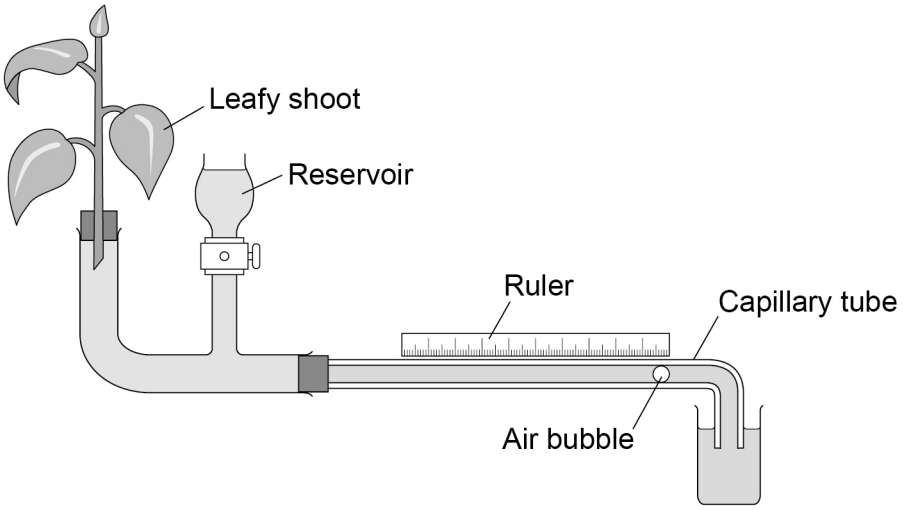
Method **2** – A potometer

The students:

- set up the equipment as shown in **Figure 8**
- record where the air bubble is at the start
- record the distance that the air bubble moves after a known time
- use the difference in these two values to estimate the rate of transpiration.

Figure 8



0 5 . 2 It is difficult to compare the rates of transpiration obtained by method **1** and method **2**.

Suggest why.

[2 marks]

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The students decide to use method **2** to investigate a factor that affects transpiration rate. A potometer measures the rate of water uptake.

Figure 9 shows how water uptake is related to the rate of transpiration.

Figure 9

Rate of transpiration $\propto$ rate of water uptake

0 5 . 3 The relationship in **Figure 9** shows that using a potometer is a suitable method to investigate a factor that affects transpiration rate.

State how the relationship in **Figure 9** shows this.

[1 mark]

The students use five identical potometers to investigate the effect of changing light intensity on the rate of transpiration.

The students:

- put a leafy shoot taken from the same plant into each potometer
- position the air bubble on each potometer at the end of the ruler as shown in **Figure 8**
- put each potometer into a separate box containing a light bulb. Each light bulb has a different light intensity (brightness)
- leave the five potometers for the same amount of time
- record the distance the air bubble moves in each potometer.

0 5 . 4 Give **two** possible sources of error with the way the equipment is set up.

[2 marks]

1

2

Question 5 continues on the next page

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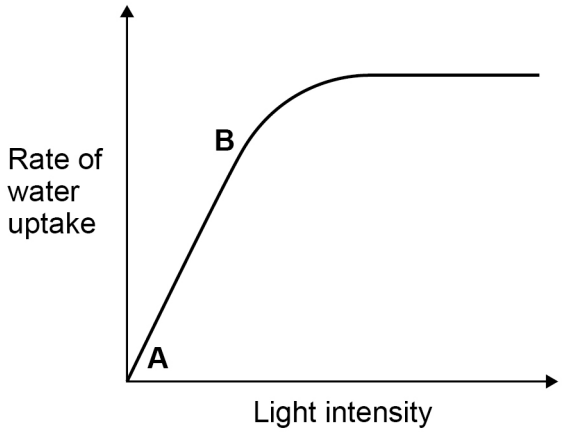
Figure 10 shows the pattern of the students' results.

Figure 10



0 5 . 5 The rate of water uptake changes between **A** and **B** in **Figure 10**.

Explain why.

[3 marks]

0 5 . 6 At higher light intensities, there is no further increase in the rate of water uptake.

Suggest **one** reason why.

[1 mark]

10

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0 6 Scientists investigate the effect of fitness training on heart rate.

The scientists collect data from 100 people in the investigation.

All the people:

- are between 18 and 50 years old
- have healthy hearts
- have never smoked.

0 6 . 1 The scientists use a large number of people for their investigation.

Give **two** reasons why.

[2 marks]

1 _____

_____

2 _____

_____

At the start of the investigation, each person's heart rate is measured at rest. Their heart rates are also measured during exercise.

All the people then train regularly for 10 weeks:

- 50 people use low-intensity (LI) training
- 50 people use high-intensity (HI) training.

0 6 . 2 State how the scientists should put the people in the LI training or HI training groups.

[1 mark]

_____

_____

_____

Question 6 continues on the next page

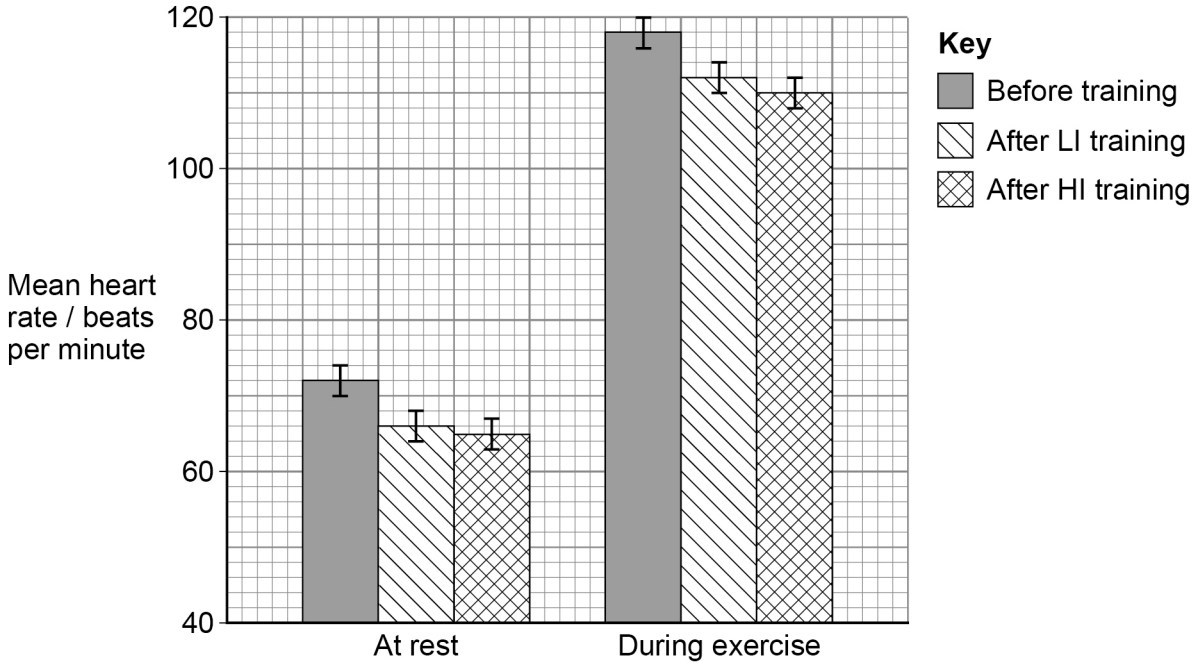
Do not write outside the box

At the end of the 10 weeks of training, the heart rate for each person is measured at rest and while they do the same exercise.

Figure 11 shows the mean heart rates for each group.

Error bars show ± 2 standard deviations.

Figure 11



0 6 . 3 A student states:

"High-intensity training is better for improving fitness than low-intensity training."

Evaluate the student's statement.

Use information from **Figure 11**.

[3 marks]

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0 6 . 4 **Figure 11** shows that both LI training and HI training change the mean resting heart rate.

However, neither LI training nor HI training changes resting cardiac output.

Explain why cardiac output does not change, even though the heart rate changes.

Use an equation in your answer.

[2 marks]

Question 6 continues on the next page

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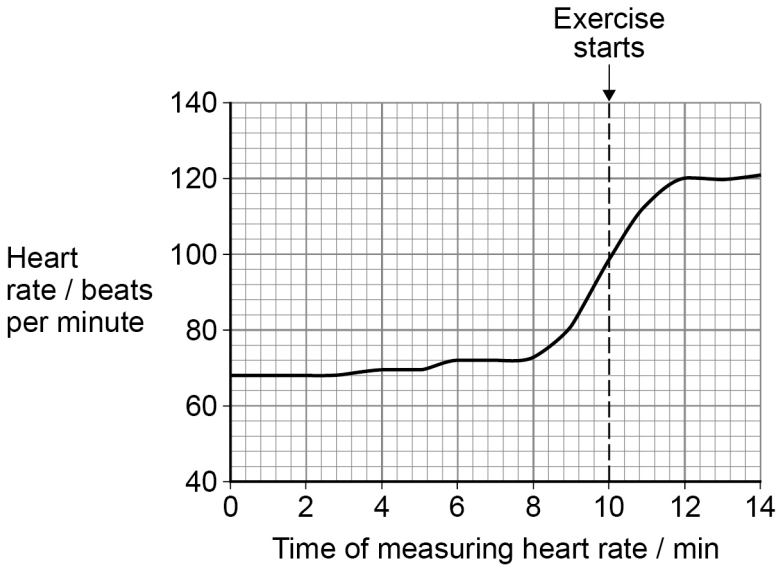
The scientists measure heart rate before and during exercise for all the people in the investigation. **Figure 12** shows typical results for one person.

The exercise starts at 10 min.

Figure 12



0 6 . 5 The person's heart rate starts to increase **before** exercise starts.

Suggest the advantage of heart rate increasing before the exercise starts.

[2 marks]

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Question 6 continues on the next page

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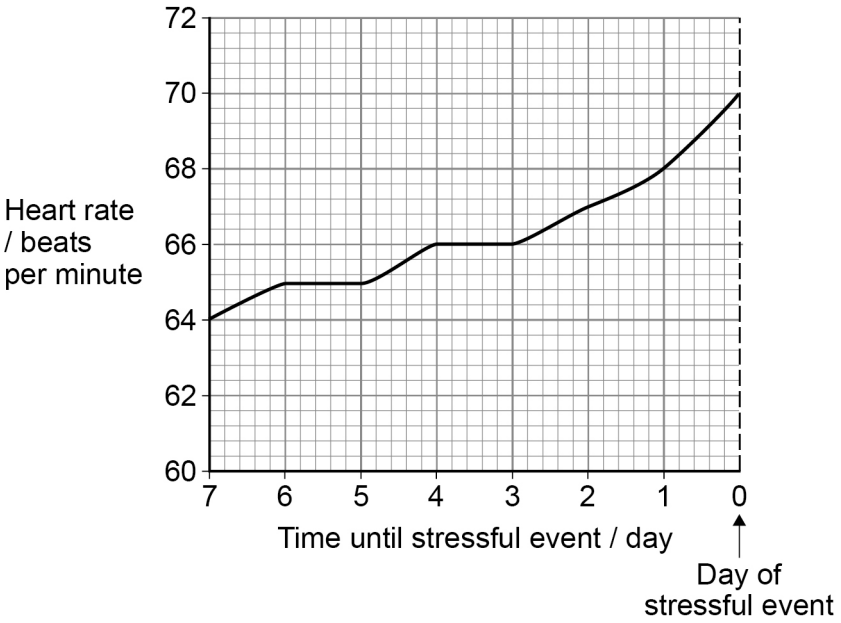
Stress also increases heart rate.

One of the students in the investigation wants to know if resting heart rate increases **before** a stressful event.

The student measures his resting heart rate once a day for a week before the stressful event.

Figure 13 shows the student's heart rate.

Figure 13



0 6 . 6 Calculate the percentage change in the student's heart rate between the start and end of the week.

[2 marks]

Percentage change = _____ %

Do not write outside the box

0 6 . 7 The student concludes that heart rate always increases for 7 days before any stressful event.

Evaluate this conclusion.

Use information from **Figure 13**.

[3 marks]

15

Turn over for the next question

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0 7 . 1 Pathogenic bacteria are prokaryotic cells that cause disease. During an infection, the bacteria can divide inside the host's body.

Describe how the bacteria divide.

[4 marks]

Do not write outside the box

0 7 . 2 The host's body responds to a bacterial infection by producing antibodies.

Explain how the structure of an antibody is related to its function.

[6 marks]

10

END OF QUESTIONS

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