

Respiration

Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Biology
Exam Board	AQA
Topic	4.4 Bioenergetics
Sub-Topic	Respiration
Difficulty Level	Gold Level
Booklet	Question Paper 1

Time Allowed: 54 minutes

Score: /54

Percentage: /100

Grade Boundaries:

Q1. A student investigated the effect of pond organisms on the amount of carbon dioxide in their surroundings.

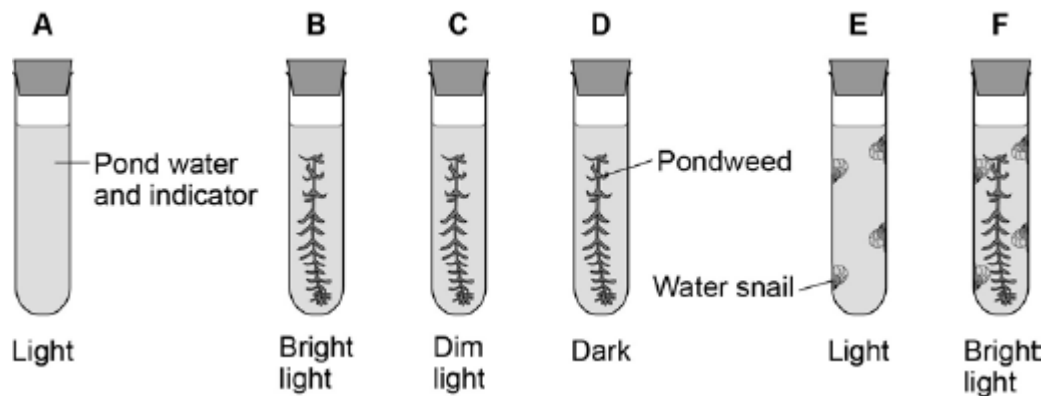
The student set up six boiling tubes as shown in the figure below.

They were left for 2 days.

Each boiling tube contained pond water with an indicator.

The indicator was pink at the start of the investigation.

- If the amount of carbon dioxide in the water increased the indicator turned yellow.
- If the amount of carbon dioxide in the water decreased the indicator turned purple.



(a) What is the purpose of boiling tube **A**?

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(2)

(b) In which boiling tube would the indicator be the **most yellow** after 2 days?

Explain your answer.

Boiling tube

Explanation

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(3)

- (c) The colour of the indicator in boiling tube **C** had not changed after 2 days.

Suggest why.

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(1)

(Total 6 marks)

Q2.Plants need nitrate ions in order to make proteins.

A plant is growing in soil flooded with water.

Explain why the plant cannot absorb enough nitrate ions.

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(Total 5 marks)

Q3.The UK contains large areas of peat bogs that have been present for thousands of years.

- (a) Peat is removed from peat bogs.

The peat can be mixed with air and added to garden compost.

The release of carbon dioxide from peat is a problem.

Give **two other** reasons why gardeners should use less peat-based compost in the future.

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(2)

(b) Explain why mixing peat with air leads to the release of carbon dioxide.

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(4)

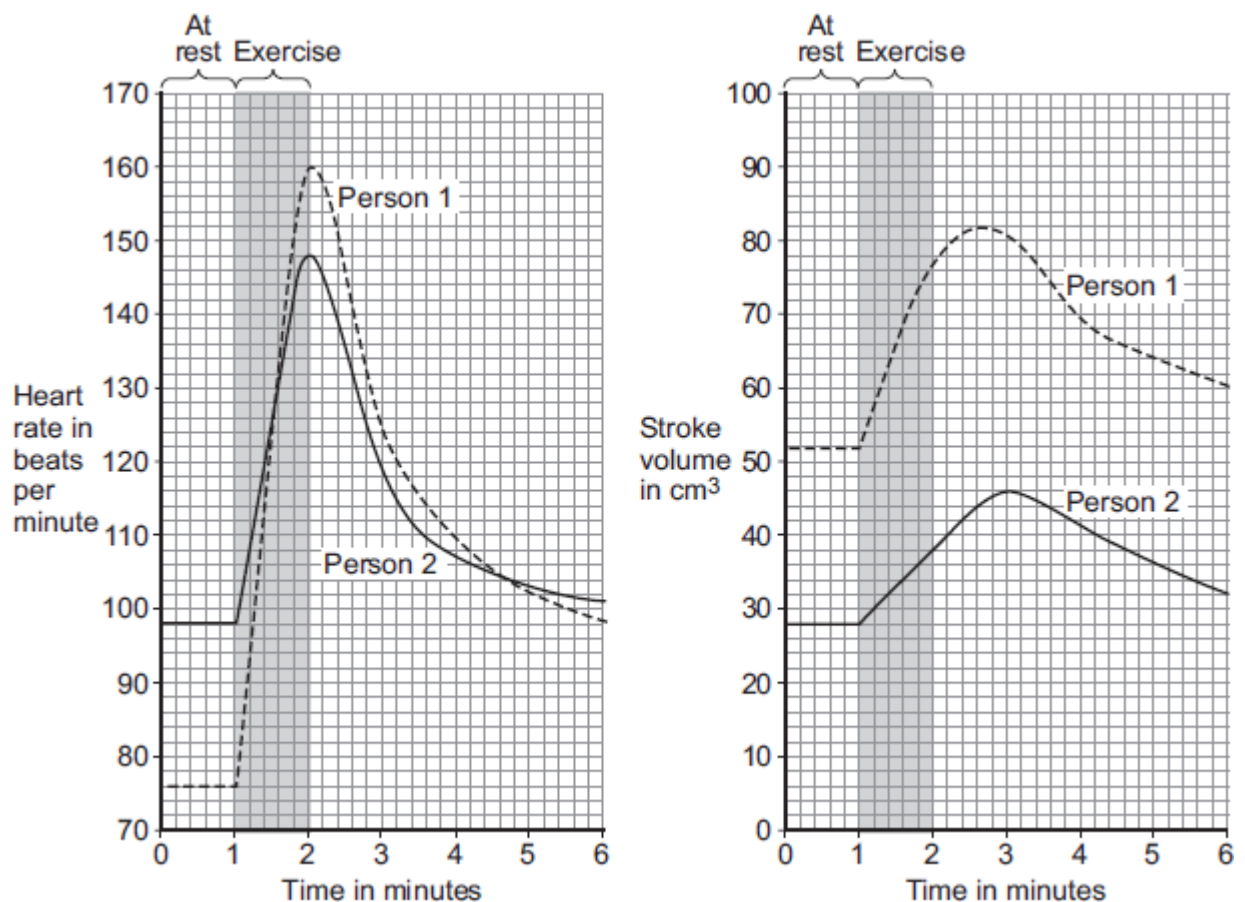
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Q4. During exercise, the heart beats faster and with greater force.

The 'heart rate' is the number of times the heart beats each minute. The volume of blood that travels out of the heart each time the heart beats is called the 'stroke volume'.

In an investigation, **Person 1** and **Person 2** ran as fast as they could for 1 minute. Scientists measured the heart rates and stroke volumes of **Person 1** and **Person 2** at rest, during the exercise and after the exercise.

The graph below shows the scientists' results.



- (a) The 'cardiac output' is the volume of blood sent from the heart to the muscles each minute.

$$\text{Cardiac output} = \text{Heart rate} \times \text{Stroke volume}$$

At the end of the exercise, **Person 1's** cardiac output = $160 \times 77 = 12\,320 \text{ cm}^3$ per minute.

Use information from **Figure above** to complete the following calculation of **Person 2's** cardiac output at the end of the exercise.

At the end of the exercise:

Person 2's heart rate = beats per minute

Person 2's stroke volume = cm^3

Person 2's cardiac output = cm^3 per minute

(3)

- (b) **Person 2** had a much lower cardiac output than **Person 1**.

- (i) Use information from **Figure above** to suggest the **main** reason for the lower cardiac output of **Person 2**.

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(1)

- (ii) **Person 1** was able to run much faster than **Person 2**.

Use information from **Figure above** and your own knowledge to explain why.

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(5)

(Total 9 marks)

- Q5.** (a) Complete the equation for photosynthesis.

..... + $\xrightarrow{\text{lightenergy}}$ + oxygen

(2)

- (b) Scientists investigated how temperature affects the rate of photosynthesis. The scientists grew some orange trees in a greenhouse. They used discs cut from the leaves of the young orange trees.

The scientists used the rate of oxygen production by the leaf discs to show the rate

of photosynthesis.

- (i) The leaf discs did not produce any oxygen in the dark.

Why?

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(1)

- (ii) The leaf discs took in oxygen in the dark.

Explain why.

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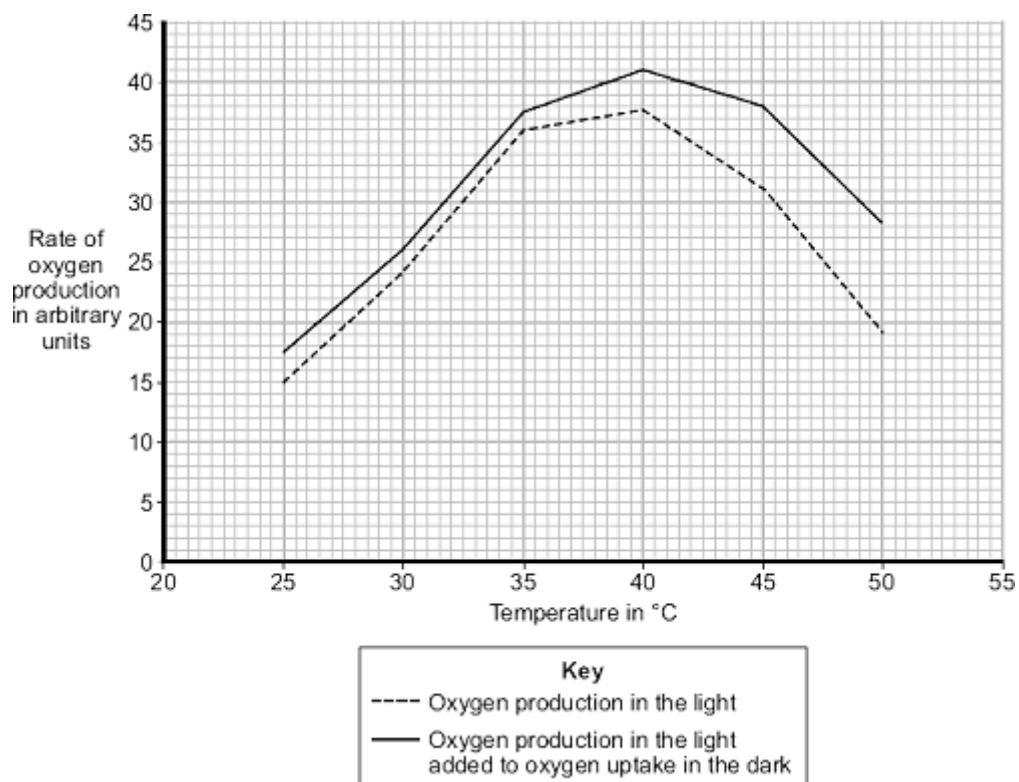
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(2)

- (c) In their investigation, the scientists measured the rate of oxygen release by the leaf discs in the light. The scientists then measured the rate of oxygen uptake by the leaf discs in the dark.

The graph shows the effect of temperature on

- oxygen production in the light
- oxygen production in the light added to oxygen uptake in the dark.



Use the information from the graph to answer each of the following questions.

- (i) Describe the effect of temperature on oxygen production in the light.

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(2)

- (ii) Explain the effect of temperature on oxygen production in the light when the temperature is increased:

from 25 °C to 35 °C

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from 40 °C to 50 °C.

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(2)

- (d) A farmer in the UK wants to grow orange trees in a greenhouse. He wants to sell the oranges he produces at a local market.
He decides to heat the greenhouse to 35 °C.

Explain why he should **not** heat the greenhouse to a temperature higher than 35 °C.
Use information from the graph in your answer.

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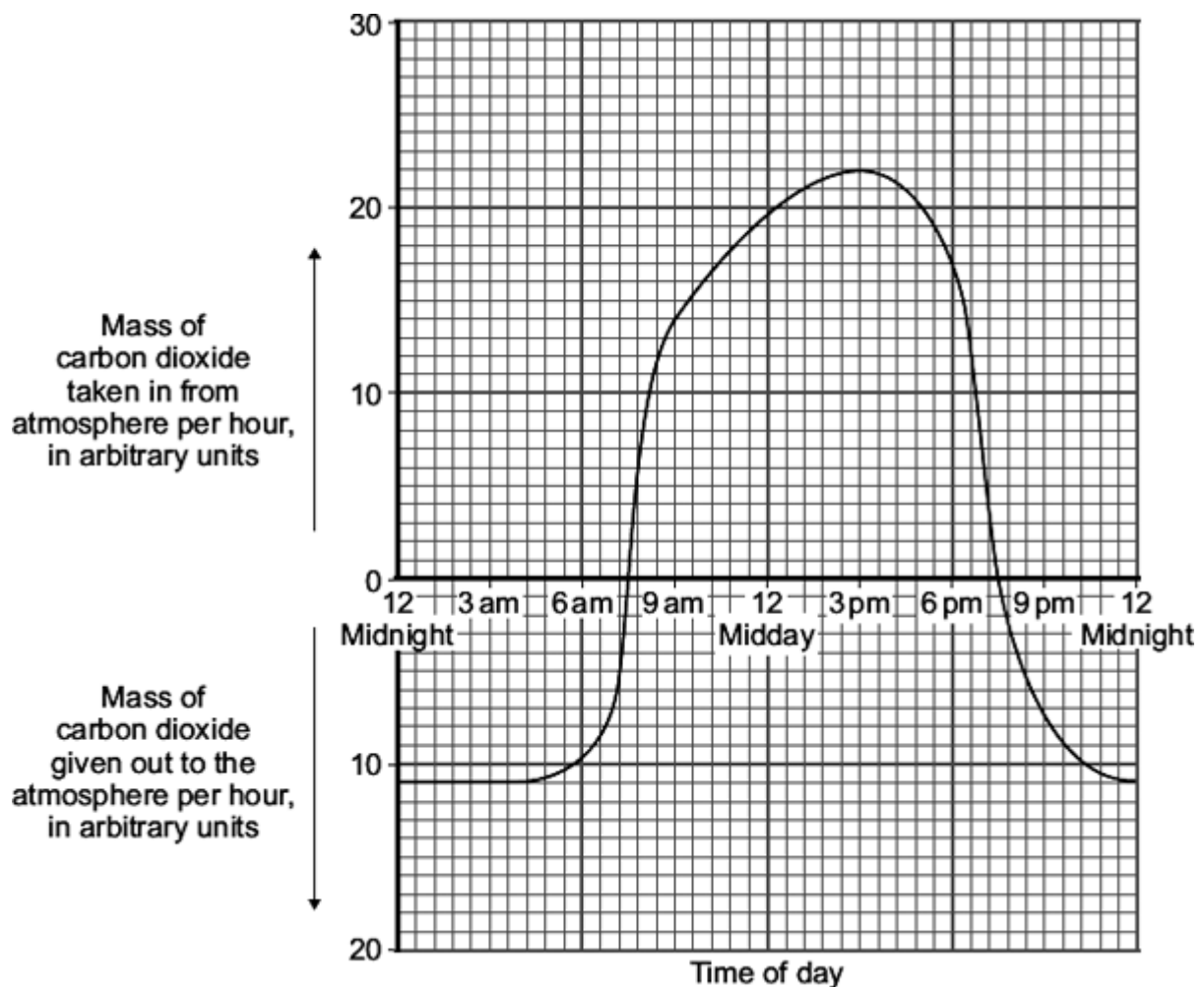
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(3)

(Total 12 marks)

- Q6.** The graph shows the uptake of carbon dioxide and the release of carbon dioxide by a bean plant on a hot summer's day.



- (a) At which **two** times in the day did the rate of photosynthesis exactly match the rate of respiration in the bean plant?

1 2

(1)

- (b) The bean plant respire at the same rate all through the 24 hour period.

- (i) How much carbon dioxide is released each hour during respiration?

..... arbitrary units

(1)

- (ii) How much carbon dioxide is used by photosynthesis in the hour beginning at 3 pm?

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Answer = arbitrary units

(1)

- (c) Over the 24 hour period, the total amount of carbon dioxide taken in by the bean plant was greater than the total amount of carbon dioxide given out by the bean plant.

Explain, in detail, why this was important for the bean plant.

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(2)

(Total 5 marks)

Q7.Lactic acid production during exercise affects an athlete's performance.

Explain why lactic acid is produced during exercise.

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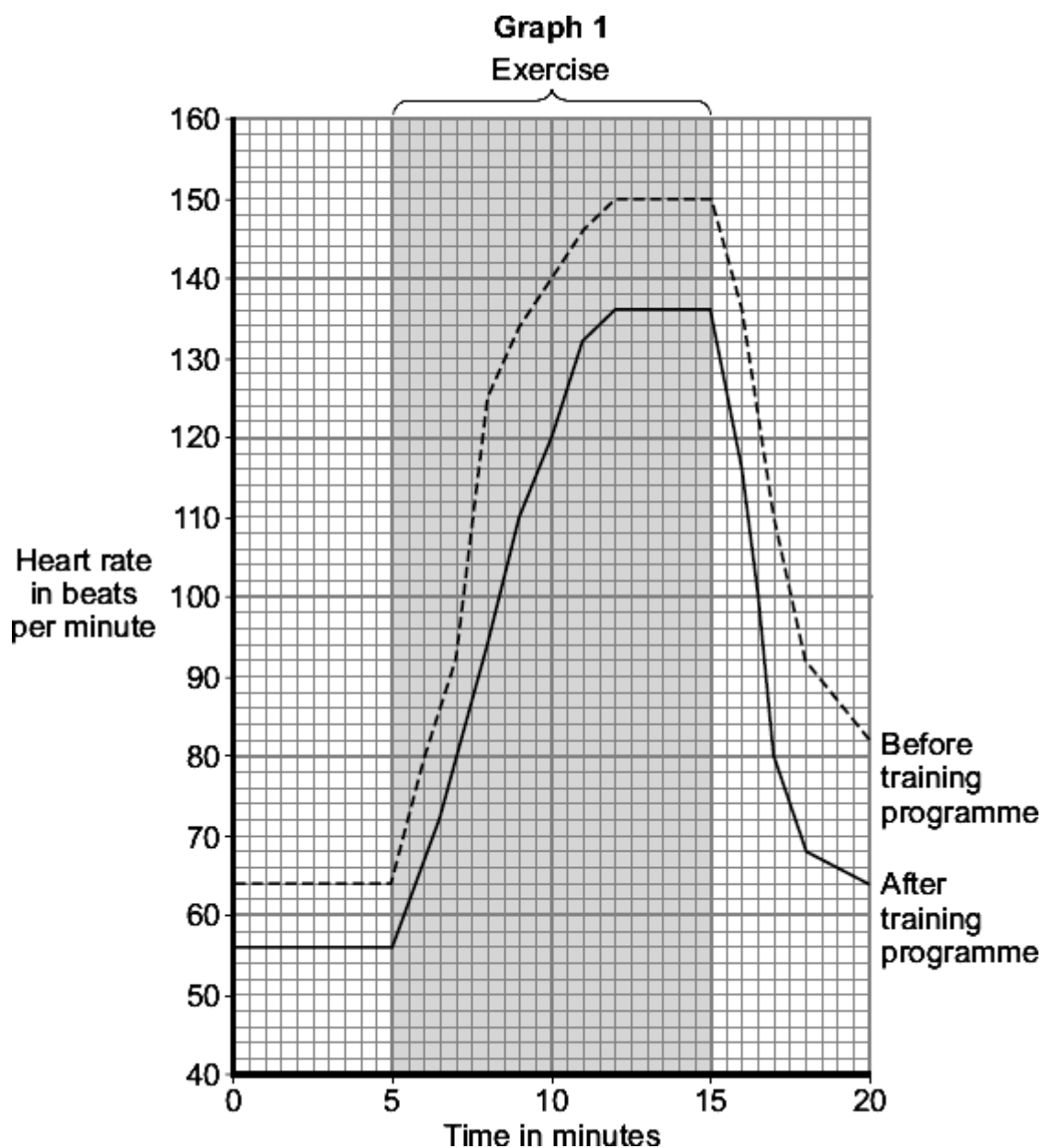
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(Total 2 marks)

Q8. An athlete carried out a 6-month training programme.

Graph 1 shows the effect of the same amount of exercise on his heart rate before and after the training programme.



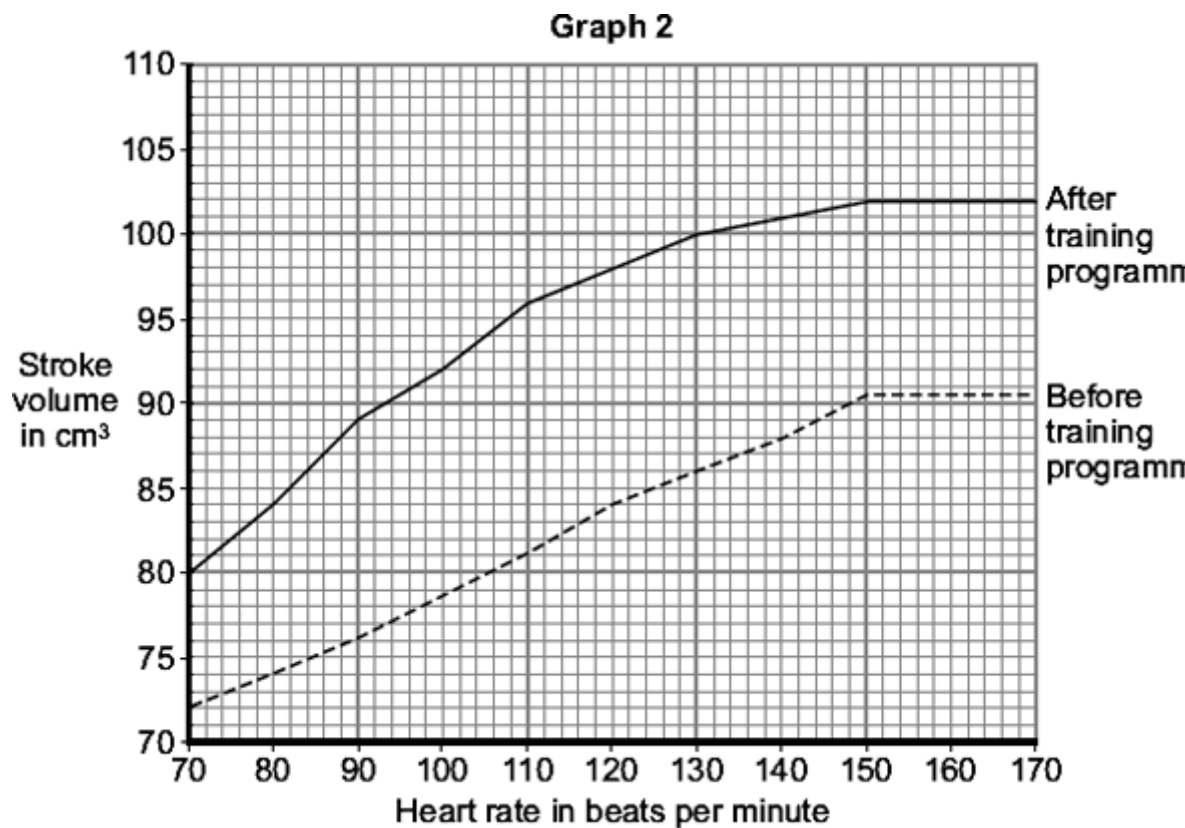
- (a) (i) Use **Graph 1** to find the heart rate of the **trained** athlete 5 minutes after the start of the exercise.

Heart rate = beats per minute

(1)

The stroke volume of the heart is the volume of blood pumped out of the left side of the heart in one heart beat.

Graph 2 shows the relationship between the stroke volume and the heart rate before and after the athlete did the training programme.



- (ii) The *cardiac output* is defined as

$$\text{cardiac output} = \text{heart rate} \times \text{stroke volume}$$

Calculate the cardiac output of the **trained** athlete 5 minutes after the start of the exercise. Use your answer to part (a)(i), and information from **Graph 2**.

Show clearly how you work out your answer.

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Cardiac output = cm³ blood per minute

(2)

- (b) **Graph 1** shows that, for the same amount of exercise, the heart of the trained

athlete was beating more slowly than it did before the training programme.

Use information from **Graph 2** to explain why.

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(2)

- (c) An increased cardiac output will provide more oxygen and more glucose to the working muscles.

Explain how this helps the athlete during exercise.

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(4)

(Total 9 marks)