AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



EXAM QUESTION PACK

4.4.2 RESPIRATION (PACK 2)

SCORE	PERCENTAGE
/224	%

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Q1.

One factor that may affect body mass is *metabolic rate*.

(a) (i) What is meant by *metabolic rate* ?

_____

_____

(1)

(ii) Metabolic rate is affected by the amount of activity a person does.

Give **two** other factors that may affect a person's metabolic rate.

1. _____

_____

2. _____

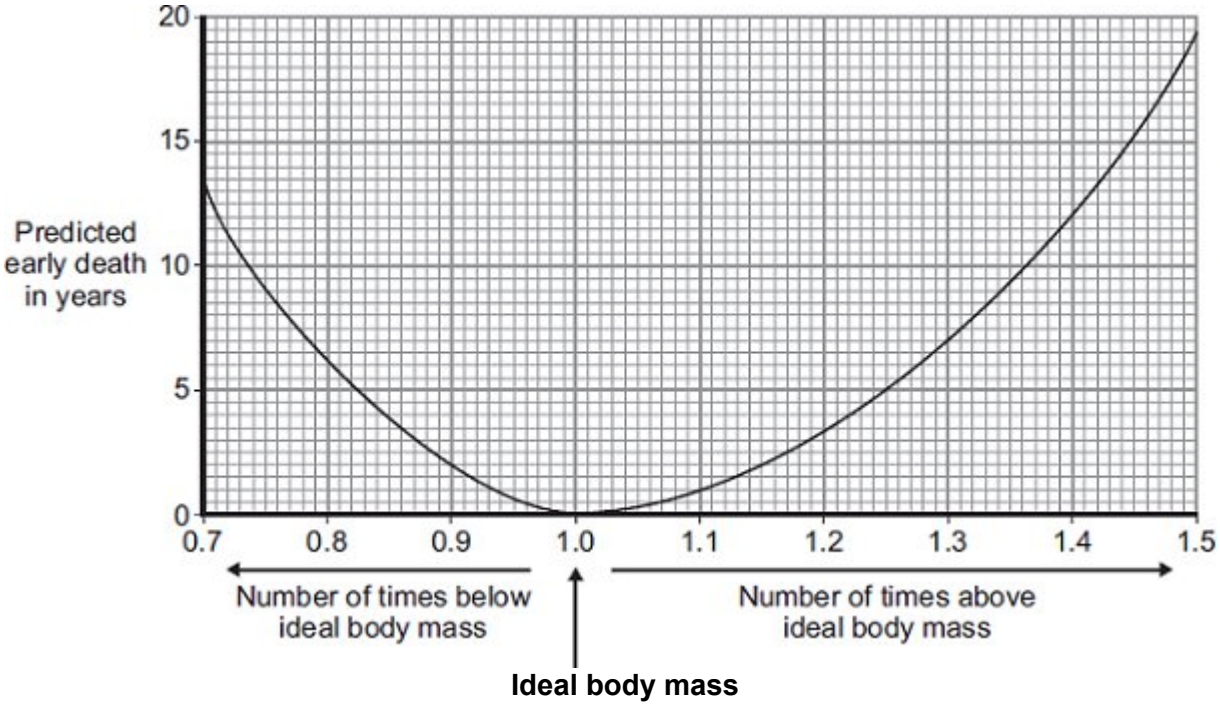
_____

(2)

(b) Predicted early death is the number of years that a person will die before the mean age of death for the whole population. The predicted early death of a person is affected by their body mass.

Scientists have calculated the effect of body mass on predicted early death.

The graph shows the results of the scientists' calculations.



The number of times above or below ideal body mass is given by the equation:

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$$\frac{\text{Actual body mass}}{\text{Ideal body mass}}$$

In the UK the mean age of death for women is 82.

A woman has a body mass of 70 kg. The woman's ideal body mass is 56 kg.

(i) Use the information from the graph to predict the age of this woman when she dies.

_____

_____

_____

Age at death = _____ years

(2)

(ii) The woman could live longer by changing her lifestyle.

Give **two** changes she should make.

1. _____

_____

2. _____

_____

(2)

(Total 7 marks)

Q2.

(a) Use words from the box to complete the equation for aerobic respiration.

alcohol	**glucose**	**lactic acid**	**water**

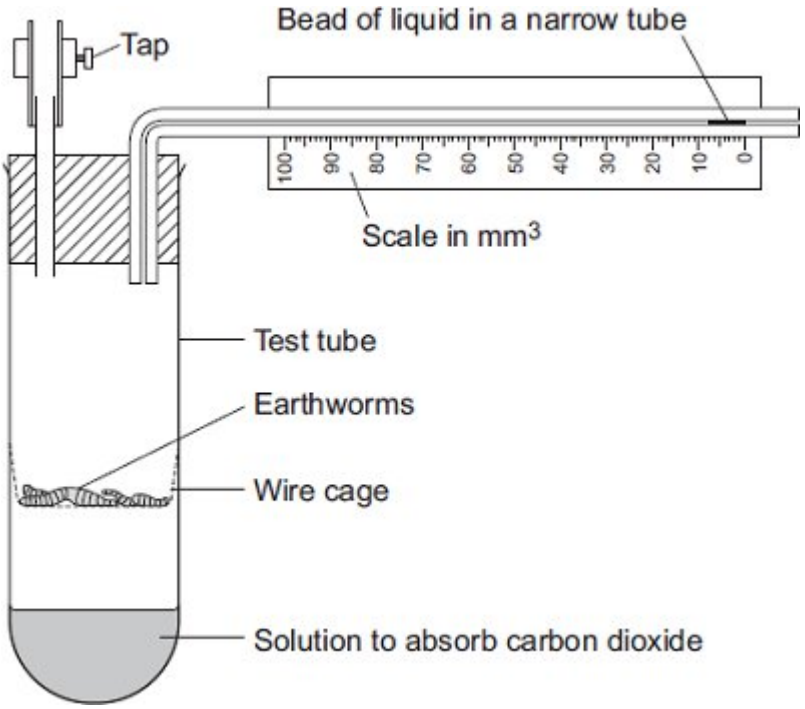
_____ + oxygen ⟶ carbon dioxide + _____ (+ energy)

(2)

(b) Some students investigated the effect of temperature on the rate of aerobic respiration in earthworms.

The diagram shows the apparatus the students used.
When the tap is closed, the bead of liquid moves to the left as the earthworms take in oxygen.

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The students put the test tube into a water bath at 20°C for 10 minutes.
They left the tap open during this time.

Why did the students put the test tube in the water bath at 20°C for 10 minutes?

Tick (✓) **one** box.

Because the air contains more oxygen at 20°C.	☐
Because the air contains less carbon dioxide at 20°C.	☐
So the earthworms' body temperature would change to 20°C.	☐

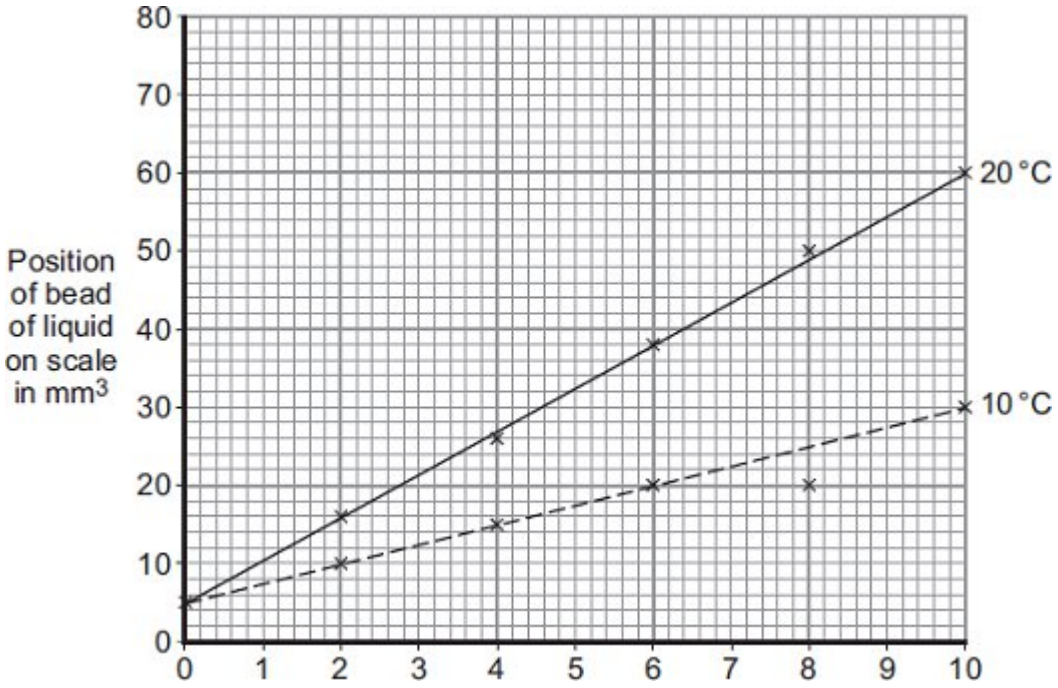
(1)

(c) The students then:

- closed the tap
- started a stopwatch
- recorded the position of the bead of liquid every 2 minutes for 10 minutes
- repeated the experiment at 10°C.

The graph shows the students' results.

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(i) How much oxygen did the earthworms take in during the 10 minutes at 20°C?

Use information from the graph to work out your answer.

_____

_____

_____

Volume of oxygen taken in = _____ mm^3

(2)

(ii) The earthworms took in this volume of oxygen in 10 minutes.

Use your answer from part (c)(i) to calculate how much oxygen the earthworms took in each minute.

_____

_____

Volume of oxygen taken in = _____ mm^3 per minute

(1)

(iii) The earthworms took in less oxygen each minute at 10°C than they took in at 20°C.

Explain why.

_____

_____

_____

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_____

(2)

(d) When drawing the line on the graph for the experiment at 10°C, the students ignored the reading at 8 minutes.

(i) Suggest why they ignored the reading at 8 minutes.

_____

_____

(1)

(ii) One student suggested they should repeat the experiment twice more at each temperature.

How would repeating the experiment improve the investigation?

_____

_____

(1)

(Total 10 marks)

Q3.

(a) Yeast cells can respire anaerobically.

The equation for anaerobic respiration in yeast is:

glucose ⟶ alcohol + carbon dioxide (+ energy)

Give **one** way in which anaerobic respiration in yeast cells is different from anaerobic respiration in human muscle cells.

_____

_____

(1)

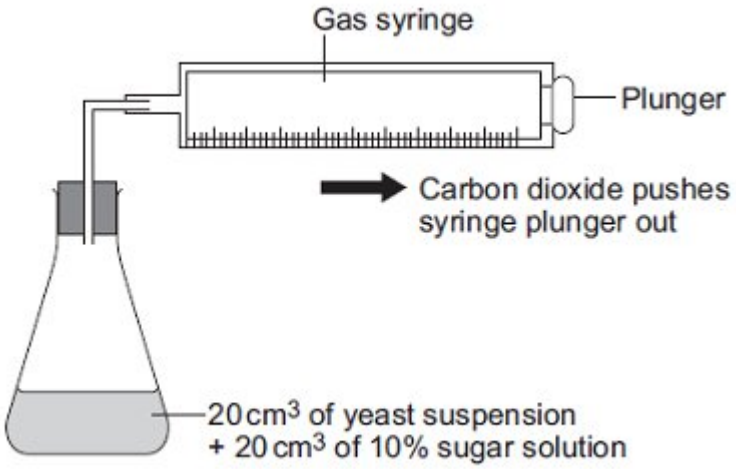
(b) Yeast can use other types of sugar instead of glucose.
Some scientists investigated the effect of three different types of sugar on the rate of anaerobic respiration in yeast.

The scientists:

- used the apparatus shown in **Diagram 1** with glucose sugar
- kept the apparatus at 20 °C
- repeated the investigation with fructose sugar and then with mannose sugar
- repeated the investigation with water instead of the sugar solution.

Diagram 1

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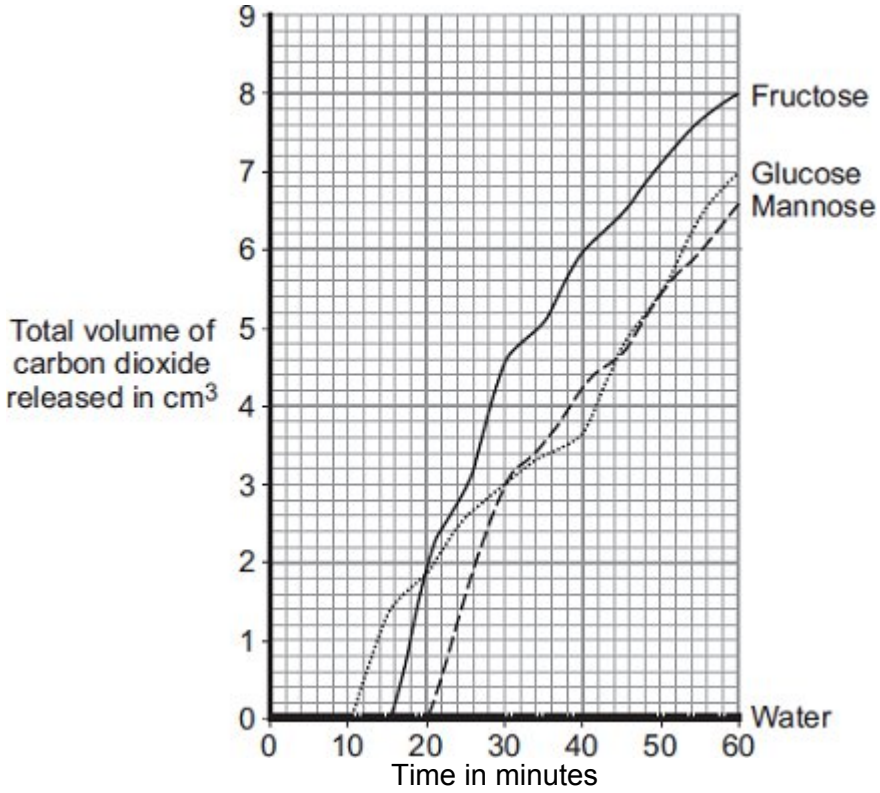
(i) Give **two** control variables the scientists used in this investigation.

_____

_____

(2)

(ii) The graph shows the scientists' results.



From this information, a company decided to use fructose to produce alcohol and **not** mannose or glucose.

Explain the reason for the company's choice.

_____

_____

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_____

_____

(2)

(Total 5 marks)

Q4.

Some students investigated the best temperature for gas production by yeast.

The students set up the apparatus as shown in **Diagram 1**.

Diagram 1

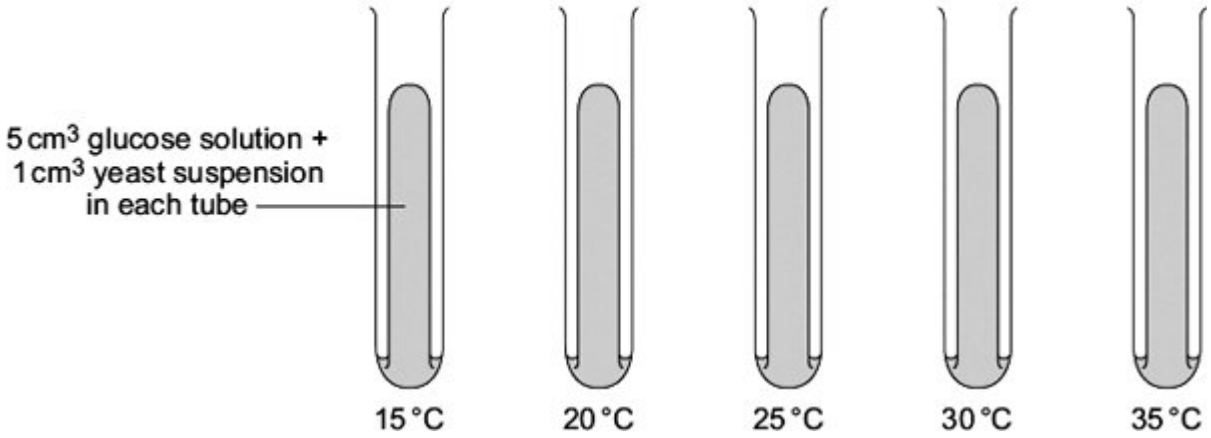
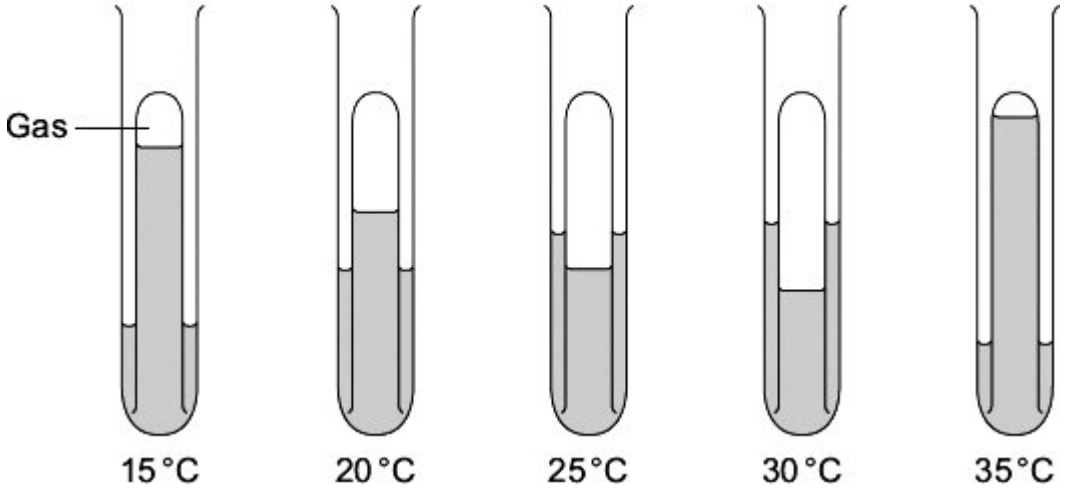


Diagram 2 shows the results after one hour.

Diagram 2



(a) In each apparatus the yeast produced a gas.

(i) Name this gas.

_____

(1)

(ii) Name the process which produces this gas.

_____

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(1)

(b) One student said that the best temperature for the yeast to produce the gas was 30 °C.

What is the evidence for this in **Diagram 2?**

_____

_____

(1)

(c) A second student said that the investigation might not have produced reliable results.

(i) What should the students do next to check the reliability of their results?

_____

_____

(1)

(ii) How would the students then know if their results were reliable?

_____

_____

(1)

(d) A third student said that the investigation might not have produced an accurate value for the best temperature for gas production.

What should the students do next to check that 30 °C was an accurate value for the best temperature?

_____

_____

_____

_____

(2)

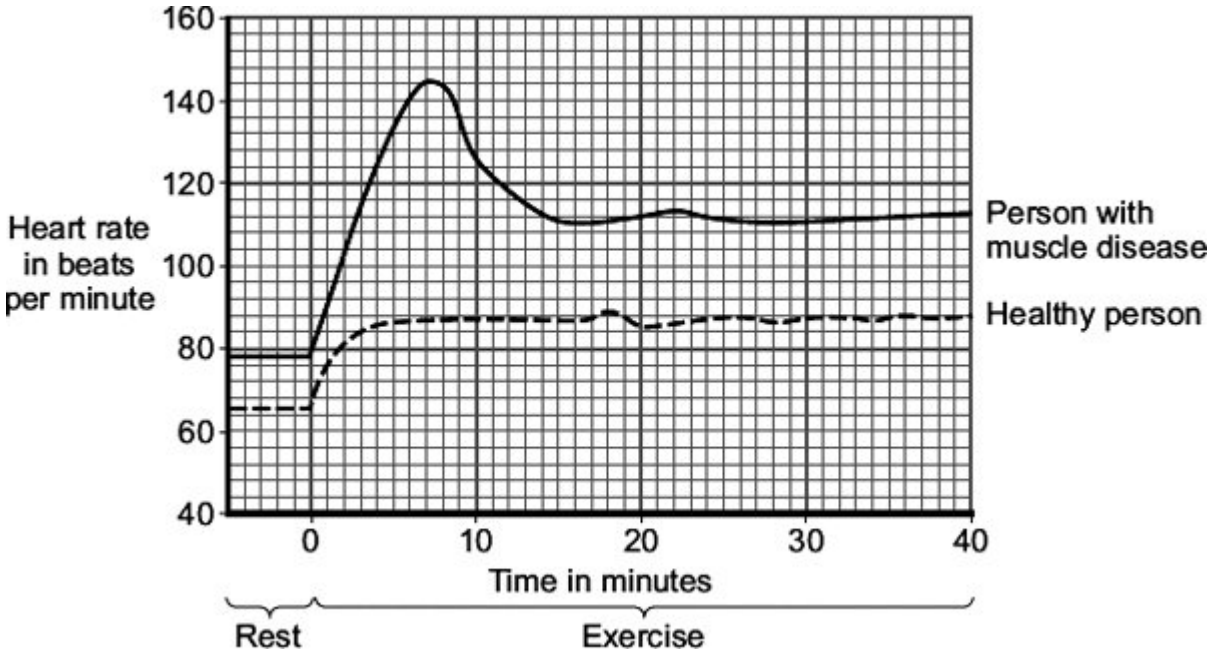
(Total 7 marks)

Q5.

Two people did the same amount of gentle exercise on an exercise cycle.
One person had a muscle disease and the other had healthy muscles.

The graph shows the effect of the exercise on the heart rates of these two people.

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(a) Describe **three** ways in which the results for the person with the muscle disease are different from the results for the healthy person.

To gain full marks in this question you need to include data from the graph in your answer.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(b) The blood transports glucose to the muscles at a faster rate during exercise than when a person is at rest.

(i) Name **one** other substance that the blood transports to the muscles at a faster rate during exercise.

_____

(1)

(ii) People with the muscle disease are not able to store glycogen in their muscles.

The results shown in the graph for the person with the muscle disease are different from the results for the healthy person.

Suggest an explanation for the difference in the results.

_____

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(3)

(Total 7 marks)

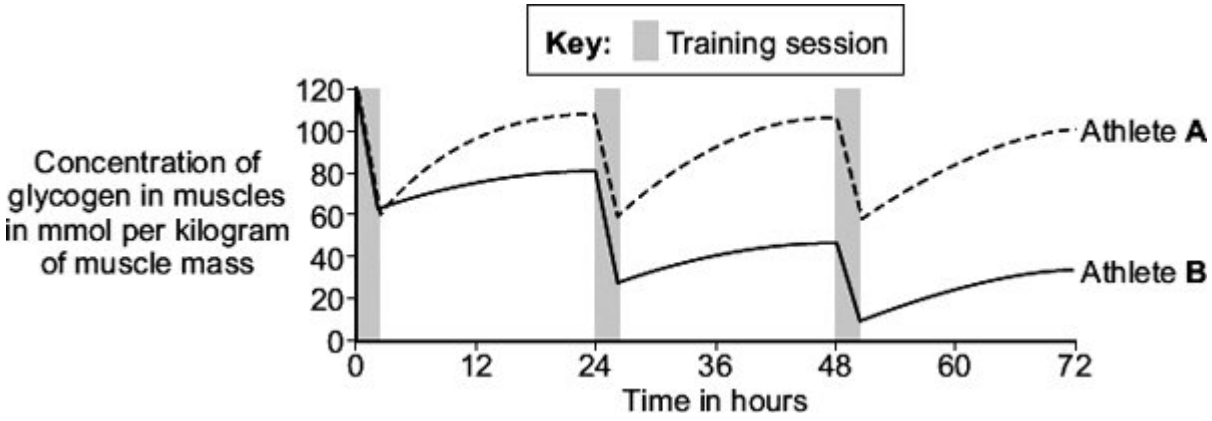
Q6.

Glycogen is stored in the muscles.

Scientists investigated changes in the amount of glycogen stored in the muscles of two 20-year-old male athletes, **A** and **B**.
Athlete **A** ate a high-carbohydrate diet. Athlete **B** ate a low-carbohydrate diet.

Each athlete did one 2-hour training session each day.

The graph shows the results for the first 3 days.



(a) (i) Give **three** variables that the scientists controlled in this investigation.

(3)

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(ii) Suggest **two** variables that would be difficult to control in this investigation.

_____

_____

_____

_____

(2)

(iii) Describe **one** way in which the results of Athlete **B** were different from the results of Athlete **A**.

_____

_____

(1)

(b) Both athletes were training to run a marathon.

Which athlete, **A** or **B**, would be more likely to complete the marathon?

Use information from the graph to explain your answer.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 10 marks)

Q7.

(a) Complete the equation for photosynthesis.

_____ + _____ $\xrightarrow{\text{light energy}}$ _____ + 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.

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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?

_____

_____

(1)

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

Explain why.

_____

_____

_____

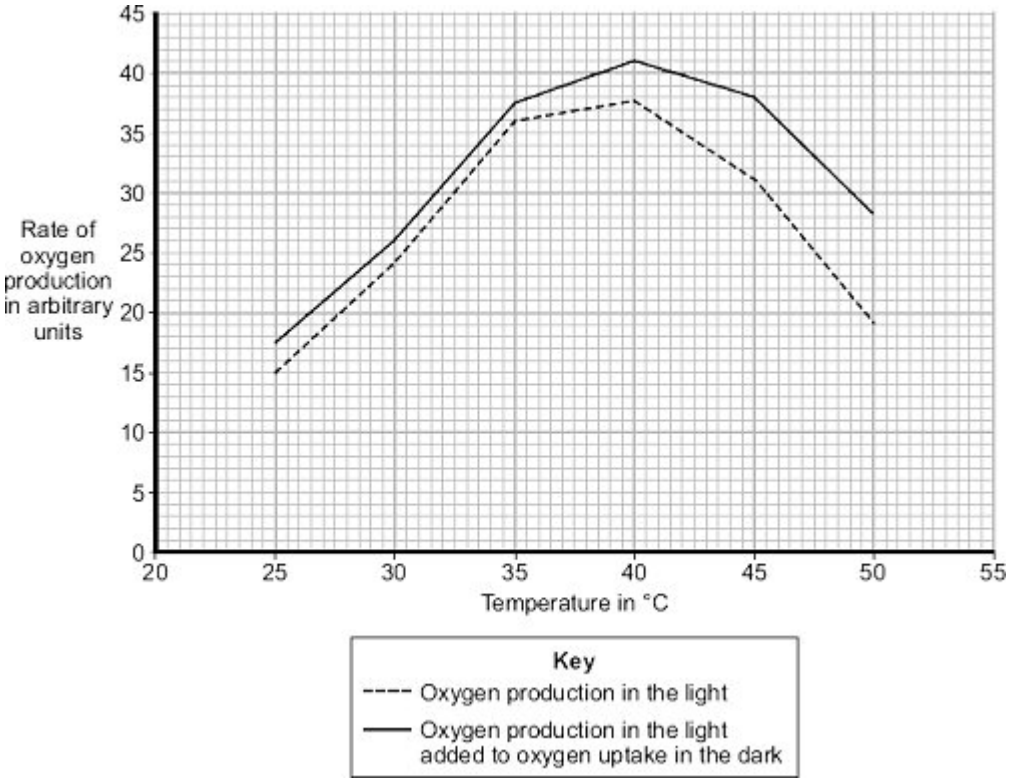
_____

(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.



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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.

_____

_____

_____

_____

(2)

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

from 25 °C to 35 °C

_____

_____

_____

from 40 °C to 50 °C.

_____

_____

_____

(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.

_____

_____

_____

_____

_____

_____

_____

_____

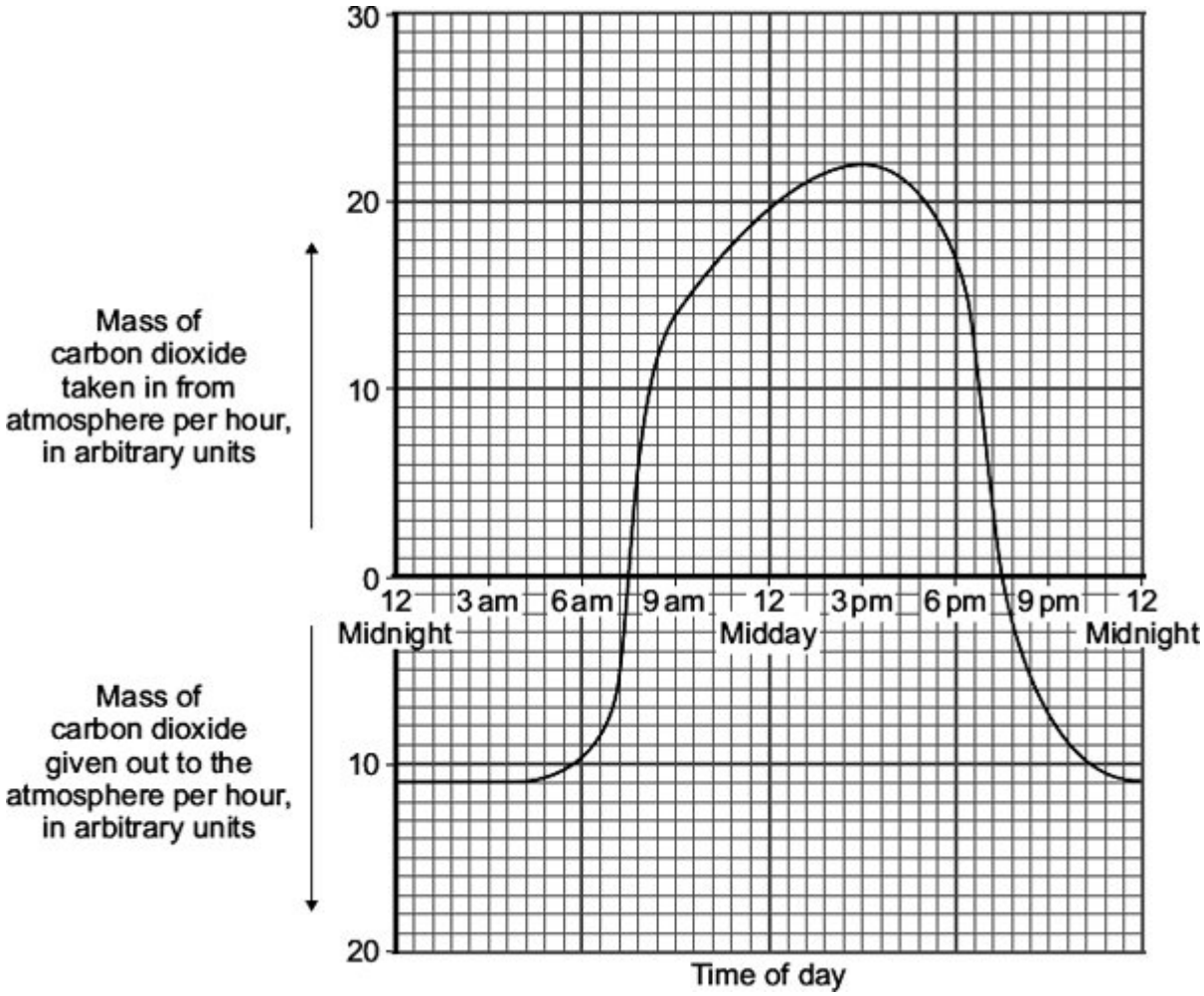
(3)

(Total 12 marks)

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Q8.

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 respires 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.

_____

_____

_____

_____

_____

_____

(2)

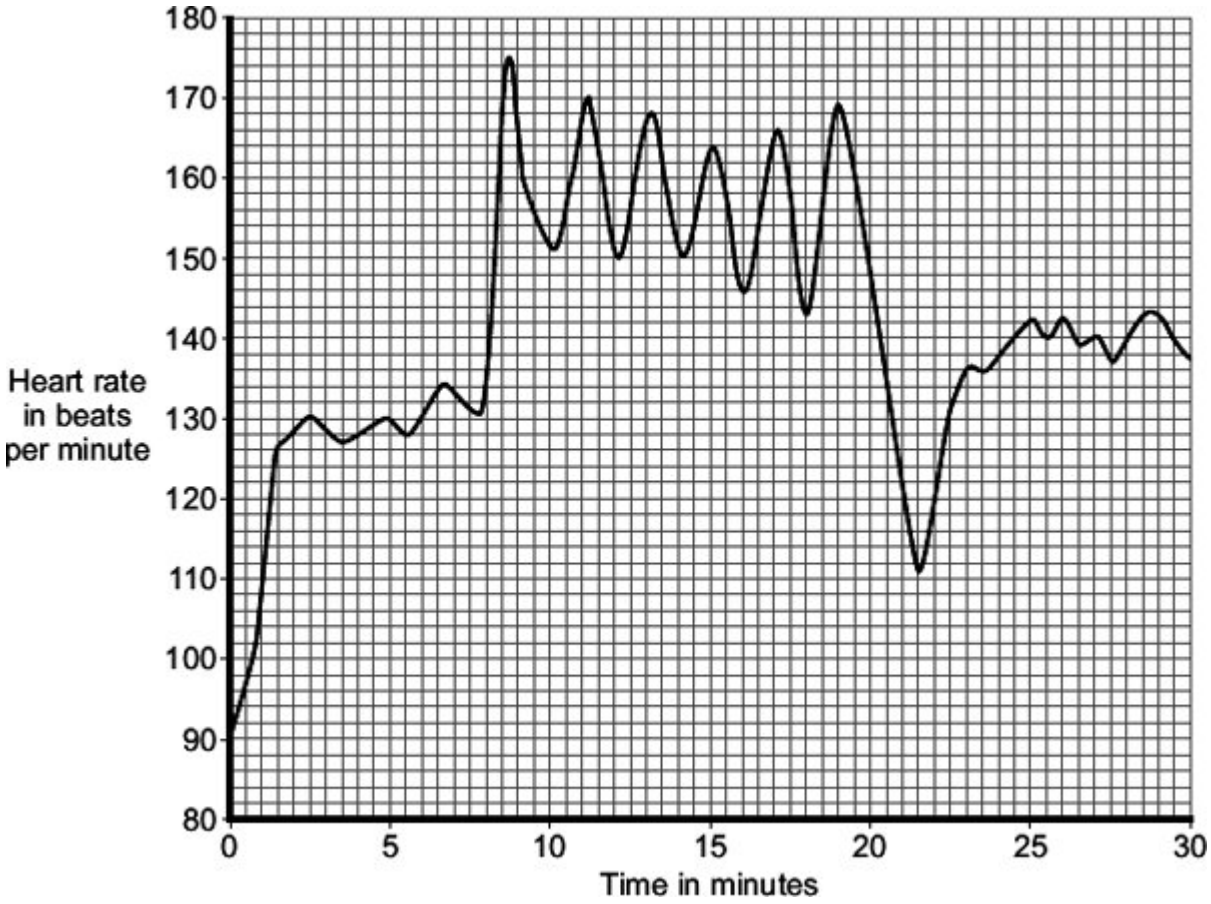
(Total 5 marks)

Q9.

One type of training exercise involves alternating periods of walking and running.

The graph shows how an athlete's heart rate changed during one 30-minute training session.

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(a) (i) The athlete ran 6 times during the 30-minute training session.

Describe the evidence for this in the graph.

_____

_____

(1)

(ii) Immediately after the final run, the athlete rested for a short time before he started to walk again.

For how many minutes did this rest last?

_____ minutes

(1)

(b) The heart rate increases during exercise.

This increase in heart rate increases blood flow to the muscles.

Explain, as fully as you can, why this increase in heart rate is necessary.

_____

_____

_____

_____

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_____

_____

_____

_____

_____

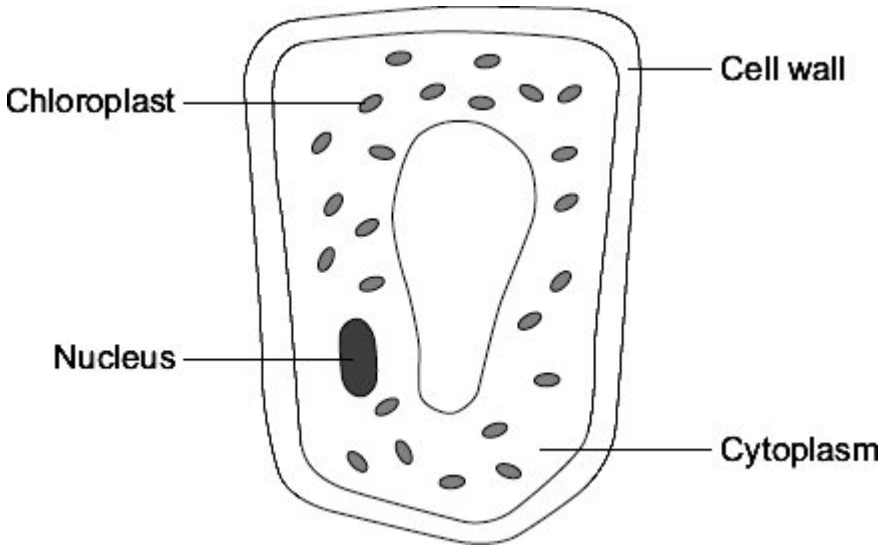
_____

(4)

(Total 6 marks)

Q10.

The diagram shows a plant cell from a leaf.



(a) **List A** gives the names of three parts of the cell.
List B gives the functions of parts of the cell.

Draw a line from each part of the cell in **List A** to its function in **List B**.

List A **Parts of the cell**	**List B** **Functions**
	Where most of the chemical reactions take place
Nucleus	
	Absorbs light energy to make food
Cytoplasm	

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	Strengthens the cell
Chloroplast	
	Controls the activities of the cell

(3)

(b) Respiration takes place in the cell.

Draw a ring around the correct answer to complete the sentence.

All cells use respiration to release | energy | oxygen. | sugar.

(1)

(Total 4 marks)

Q11.

The table shows the volume of blood flowing through different organs at three levels of exercise.

Organ(s)	Volume of blood flowing through organ(s) in cm^3 per minute		
	Light exercise	**Moderate exercise**	**Heavy exercise**
Gut	1 100	600	300
Kidneys	900	600	250
Brain	750	750	750
Heart muscles	350	750	1 000
Skeletal muscles	4 500	12 500	22 000
Skin	1 500	1 900	600
Other	400	500	100
Total	**9 500**	**17 600**	**25 000**

(a) (i) Which organ has a constant flow of blood through it?

_____

(1)

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(ii) Which organ has the greatest reduction in the volume of blood supplied during heavy exercise compared with light exercise?

_____

(1)

(iii) What proportion of the blood flows through the heart muscle during heavy exercise?

_____

(1)

(b) The volume of blood flowing through the skeletal muscles increases greatly during exercise.

Give **two** ways in which the body brings about this increase.

1. _____

_____

2. _____

_____

(2)

(c) During exercise, the concentration of carbon dioxide in the blood increases.

Explain what causes this increase.

_____

_____

_____

_____

_____

_____

(3)

(Total 8 marks)

Q12.

Muscles need energy during exercise.

Draw a ring around the correct answer in parts (a) and (b) to complete each sentence.

(a) (i) The substance stored in the muscles and used during exercise is

glycogen.
lactic acid.
protein.

(1)

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(ii) The process that releases energy in muscles is

digestion.
respiration.
transpiration.

(1)

(b) The table shows how much energy is used by two men of different masses when swimming at different speeds.

Speed of swimming in metres per minute	**Energy used in kJ per hour**	
	34 kg man	**70 kg man**
25	651	1155
50	1134	2103

(i) When the 34 kg man swims at 50 metres per minute instead of at 25 metres per minute,

the extra energy he uses each hour is

36 kJ.
483 kJ.
948 kJ.

(1)

(ii) When swimming at 50 metres per minute, each man's heart rate is faster than when swimming at 25 metres per minute.

A faster heart rate helps to supply the muscles with more

carbon dioxide.
glycogen.
oxygen.

(1)

(iii) During the exercise the arteries supplying the muscles would

constrict.
dilate.
pump harder.

(1)

(c) When a person starts to swim, the breathing rate increases.

Give **one** way in which this increase helps the swimmer.

_____

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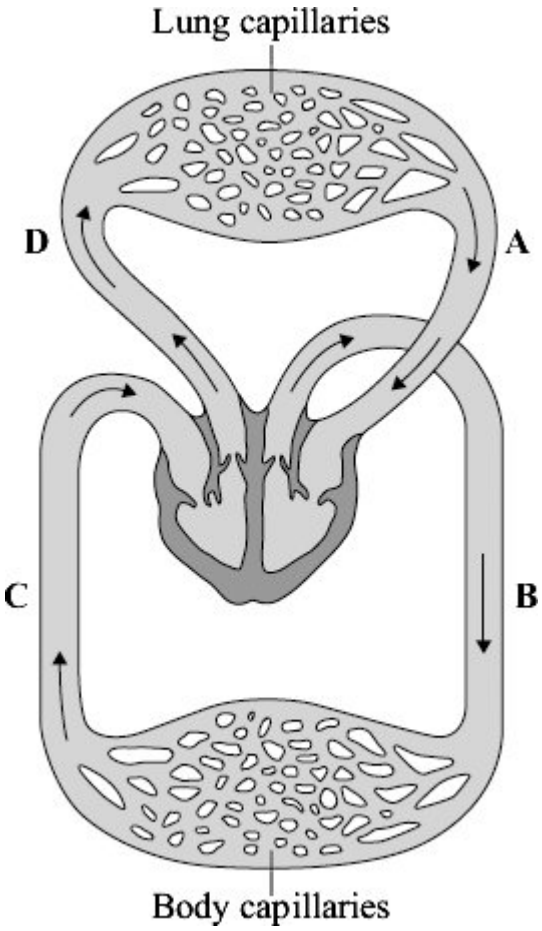
_____

(1)

(Total 6 marks)

Q13.

The diagram shows the human circulation system.



(a) (i) Give the letter of **one** blood vessel that is an artery. ☐

(1)

(ii) Give the letter of **one** blood vessel that carries oxygenated blood. ☐

(1)

(b) During exercise, the heart rate increases.

Explain, as fully as you can, why this increase is necessary.

_____

_____

_____

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_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 6 marks)

Q14.

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

Explain why lactic acid is produced during exercise.

_____

_____

_____

_____

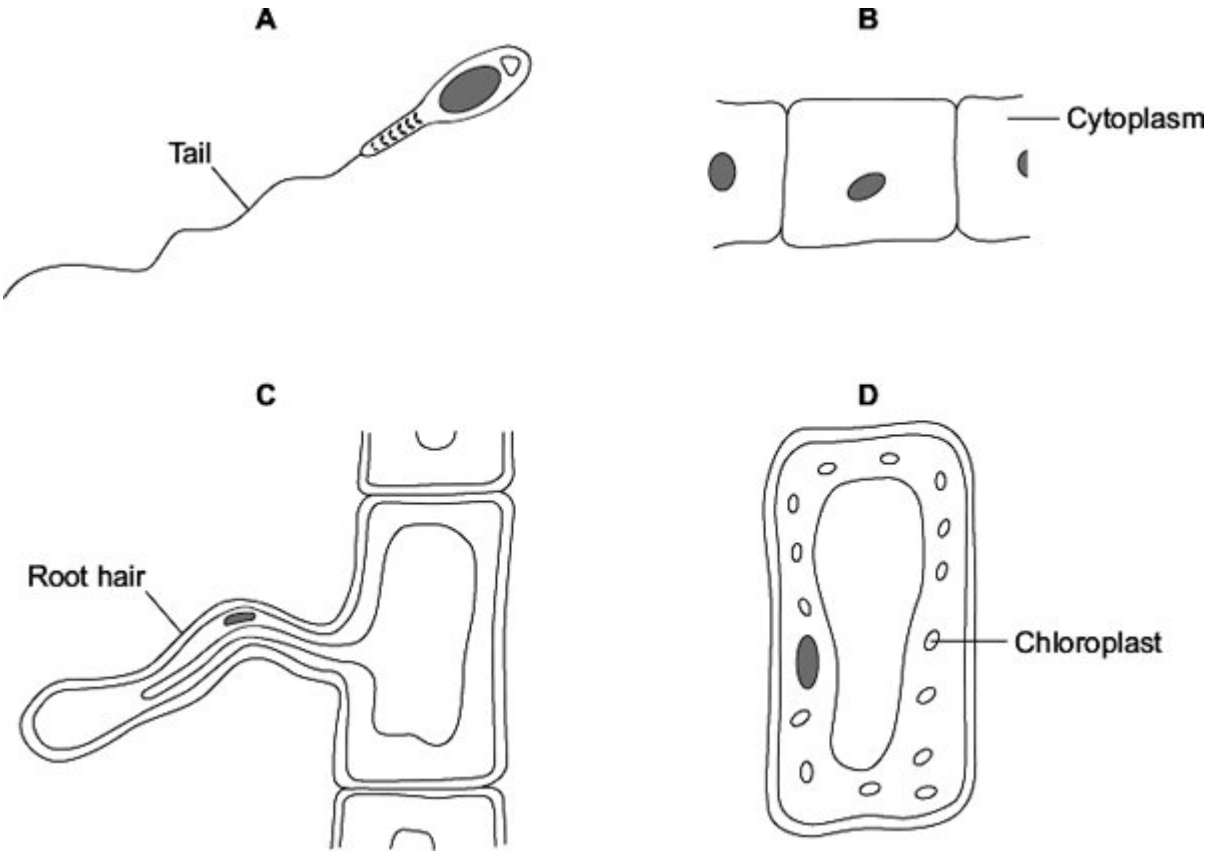
_____

(Total 2 marks)

Q15.

The diagrams show four types of cell, **A**, **B**, **C** and **D**.
Two of the cells are plant cells and two are animal cells.

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(a) (i) Which **two** of the cells are plant cells?

Tick (✓) **one** box.

A and **B** ☐

A and **D** ☐

C and **D** ☐

(1)

(ii) Which part is found **only** in plant cells?

Draw a ring around **one** answer.

cell membrane **cell wall** **nucleus**

(1)

(b) (i) Which cell, **A**, **B**, **C** or **D**, is adapted for swimming? ☐

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(1)

(ii) Which cell, **A**, **B**, **C** or **D**, can produce glucose by photosynthesis? ☐

(1)

(c) Cells **A**, **B**, **C** and **D** all use oxygen.

For what process do cells use oxygen?

Draw a ring around **one** answer.

osmosis **photosynthesis** **respiration**

(1)
(Total 5 marks)

Q16.

This question is about what happens during decay.

Draw a ring around the correct word to complete each sentence.

(a) After living things die, they are decayed by

animals.
microorganisms.
plants.

(1)

(b) Decay happens faster when there is plenty of oxygen and conditions are

cold.
dry.
moist.

(1)

(c) During decay carbon dioxide is produced by

osmosis.
respiration.
photosynthesis.

(1)

(d) Decay releases mineral salts into the soil.

These mineral salts are absorbed by plant

leaves.
roots.

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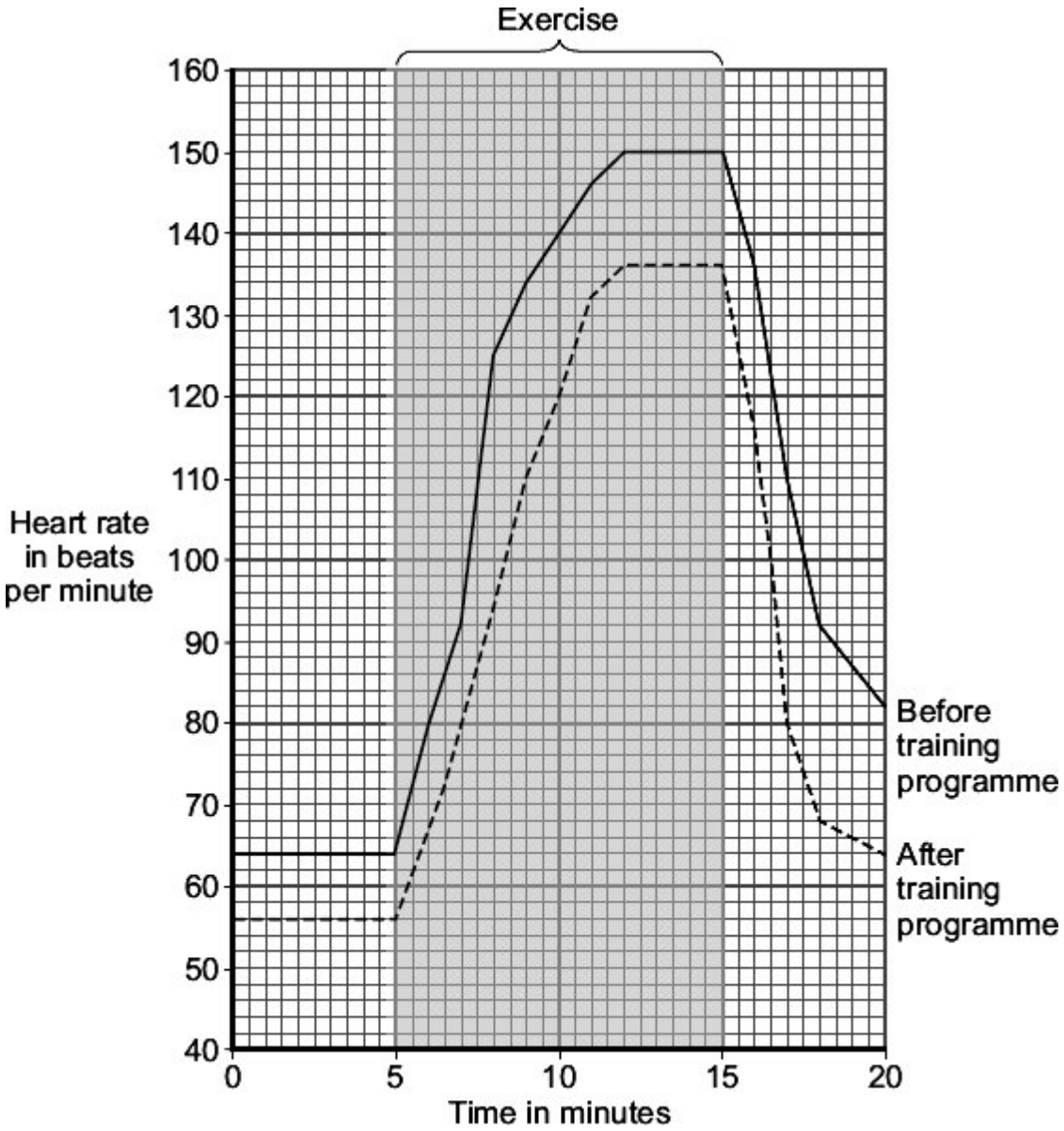
stems.

(1)
(Total 4 marks)

Q17.

An athlete did a 6-month training programme.

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



(a) (i) What was the maximum heart rate of the athlete during exercise before the training programme?

_____ beats per minute

(1)

(ii) Give **two** differences between the heart rate of the athlete before and after the training programme.

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After the training programme

Difference 1 _____

_____

Difference 2 _____

_____

(2)

(b) Which **two** substances need to be supplied to the muscles in larger amounts during exercise?

Tick (✓) **two** boxes.

Carbon dioxide	☐
Glucose	☐
Lactic acid	☐
Oxygen	☐
Urea	☐

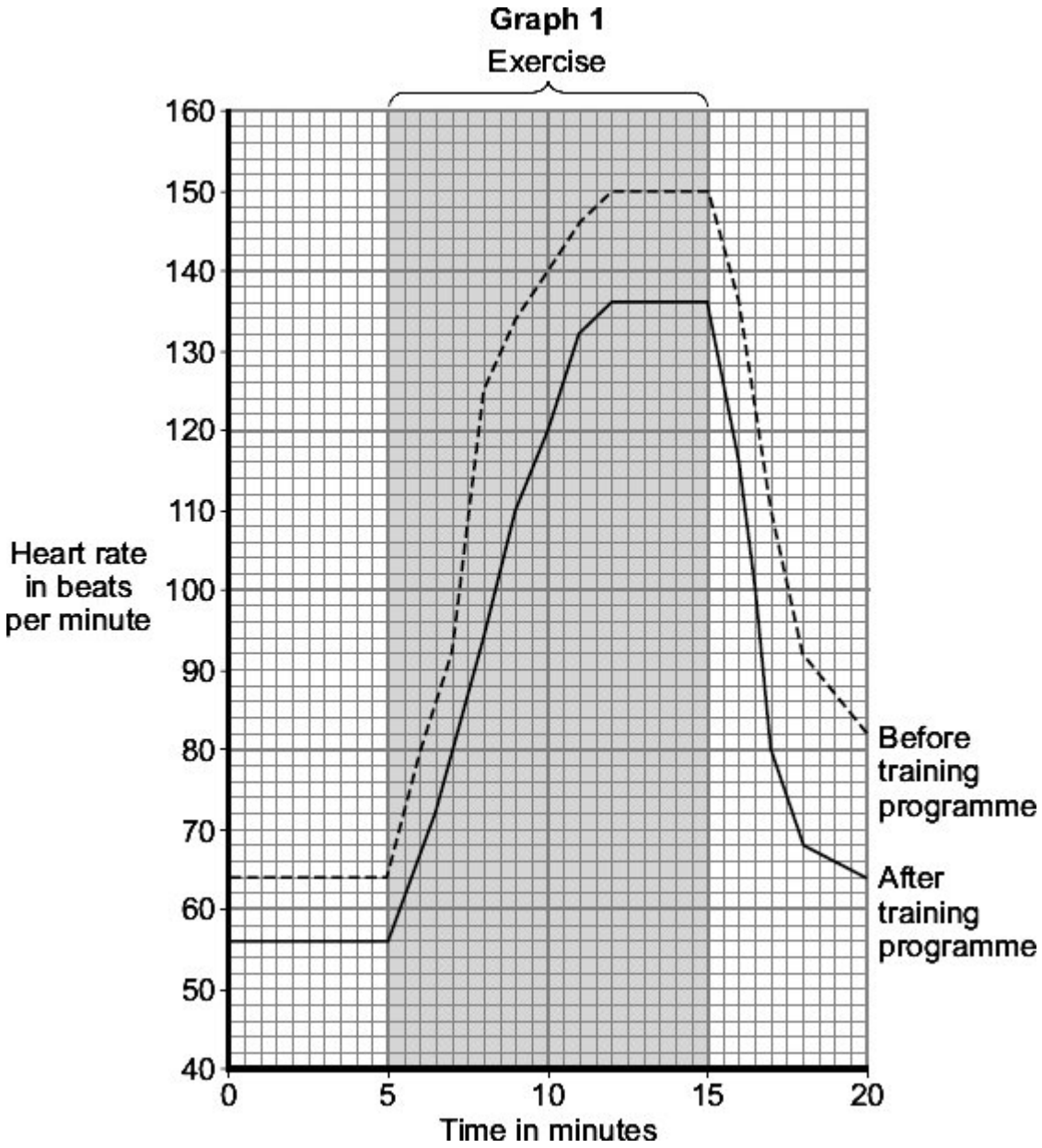
(2)
(Total 5 marks)

Q18.

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.

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

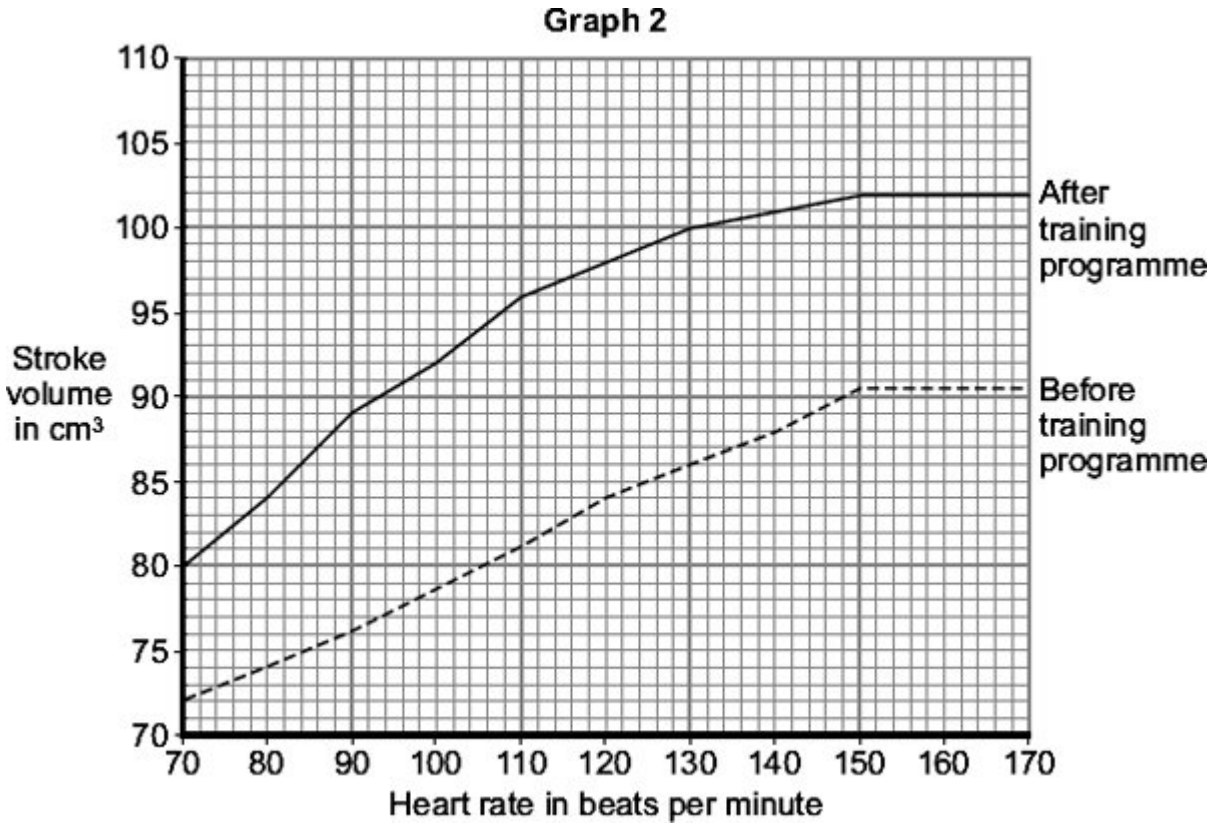
Heart rate = _____ beats per minute

(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.

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(ii) The *cardiac output* is defined as

cardiac output = heart rate × 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.

_____

_____

Cardiac output = _____ cm^3 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.

_____

_____

_____

_____

(2)

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

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Explain how this helps the athlete during exercise.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 9 marks)

Q19.

(a) The table shows the effect of exercise on the action of one person's heart.

	At rest	**During exercise**
Heart rate in beats per minute	72	165
Volume of blood leaving the heart in each beat in cm^3	75	120
Heart output in cm^3 per minute	5400	

(i) Calculate the heart output for this person during exercise.

Show clearly how you work out your answer.

_____

_____

_____

_____

Answer = _____ cm^3 per minute

(2)

(ii) During exercise, more oxygen is carried to the working muscles.

Explain why this is helpful during exercise.

_____

_____

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_____

_____

_____

(2)

(b) Give **two** other changes in the body that help to increase the amount of oxygen delivered to the working muscles during exercise.

1. _____

_____

2. _____

_____

(2)

(Total 6 marks)

Q20.

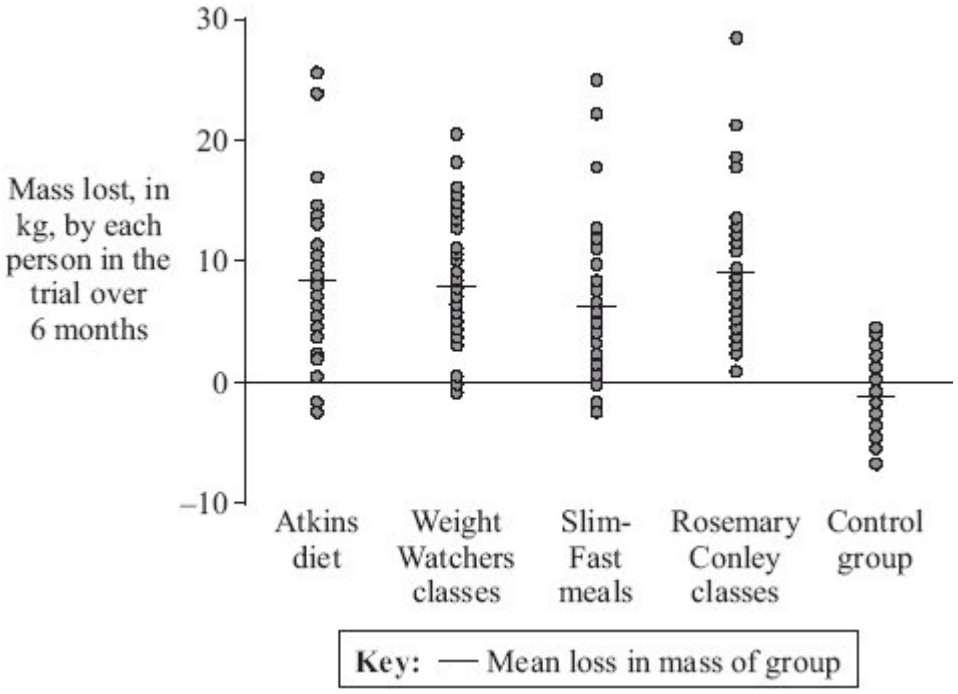
Many people who are overweight try slimming programmes.

A research study evaluated four different slimming programmes over 6 months.

Scientists selected a group of 40 people for each slimming programme and a control group.

Each of the five groups was matched for age, gender and mass.

The graph shows the results of the study.



Adapted from British Medical Journal, 2006, volume 332, pages 1309 –1314.

(a) Give **two** control variables that were used in this study.

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1. _____

2. _____

(2)

(b) Give **two** conclusions that can be drawn from the results of this study.

1. _____

_____

2. _____

_____

(2)

(c) The costs of the four programmes were:

- Atkins book cost £3
- Rosemary Conley classes cost £140 for 6 months
- Weight Watchers classes cost £170 for 6 months
- Twice-daily Slim-Fast meal replacements cost £240 for 6 months.

Use this information and the graph to answer this question.

Which is the most cost effective of the four programmes?

_____

Explain the reason for your answer.

_____

_____

_____

_____

(2)

(d) Some slimming programmes include daily exercise.

Explain how daily exercise helps a person to lose mass.

_____

_____

_____

_____

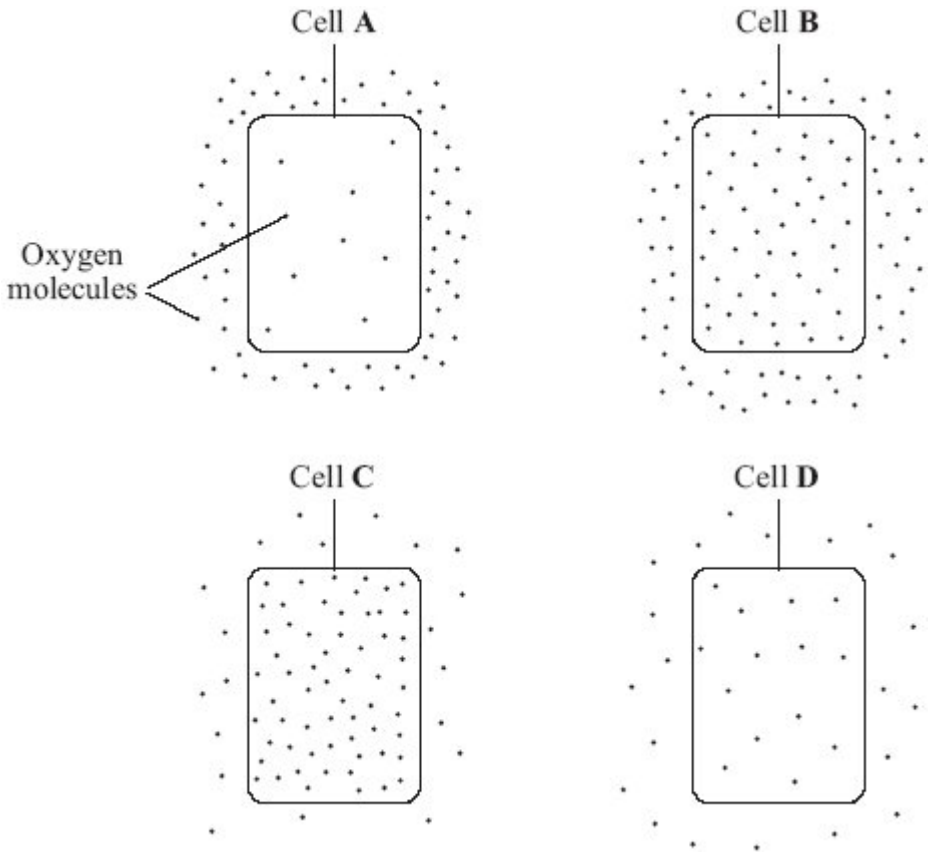
(2)

(Total 8 marks)

Q21.

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(a) The diagrams show cells containing and surrounded by oxygen molecules. Oxygen can move into cells or out of cells.



Into which cell, **A**, **B**, **C** or **D**, will oxygen move the fastest?

Write your answer, **A**, **B**, **C** or **D**, in the box. ☐

(1)

(b) Draw a ring around the correct word to complete each sentence.

(i) Oxygen is taken into cells by the process of

diffusion
osmosis
respiration

.

(1)

(ii) Cells need oxygen for

breathing
photosynthesis
respiration

.

(1)

(iii) The parts of cells that use up the most oxygen are the

membranes
mitochondria
nuclei

.

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(1)

(iv) Some cells produce oxygen in the process of

diffusion
photosynthesis
respiration

.

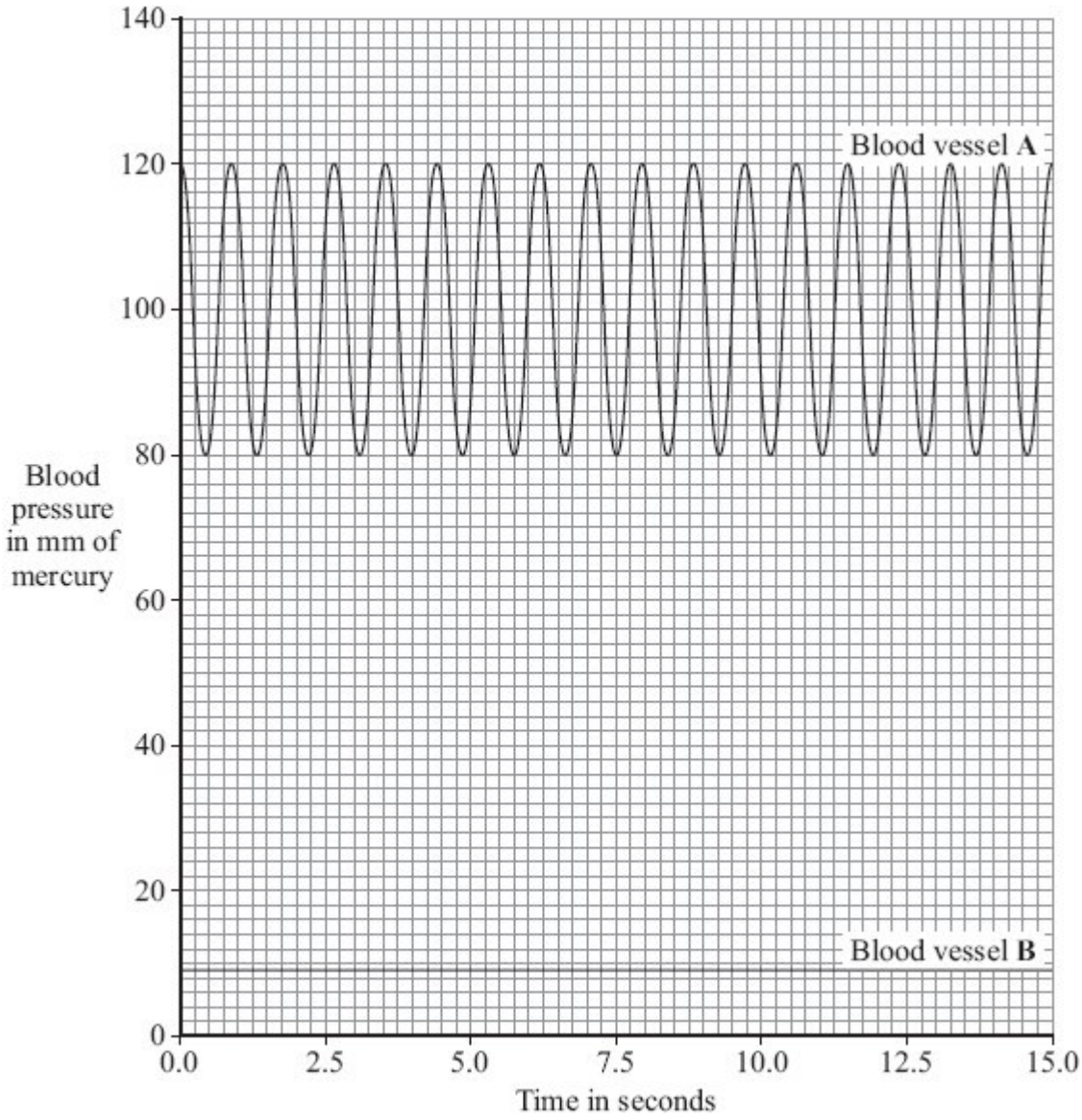
(1)

(Total 5 marks)

Q22.

The heart pumps blood around the body. This causes blood to leave the heart at high pressure.

The graph shows blood pressure measurements for a person at rest.
The blood pressure was measured in an artery and in a vein.



(a) Which blood vessel, **A** or **B**, is the artery?

Blood vessel _____

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Give **two** reasons for your answer.

Reason 1 _____

_____

Reason 2 _____

_____

(2)

(b) Use information from the graph to answer these questions.

(i) How many times did the heart beat in 15 seconds? _____

(1)

(ii) Use your answer from part (b)(i) to calculate the person's heart rate per minute.

_____

_____

Heart rate = _____ beats per minute

(1)

(c) During exercise, the heart rate increases. This supplies useful substances to the muscles and removes waste materials from the muscles at a faster rate.

(i) Name **two** useful substances that must be supplied to the muscles at a faster rate during exercise.

1. _____

2. _____

(2)

(ii) Name **one** waste substance that must be removed from the muscles at a faster rate during exercise.

_____

(1)

(Total 7 marks)

Q23.

(a) The concentration of sulfate ions was measured in the roots of barley plants and in the water in the surrounding soil.

The table shows the results.

	Concentration of sulfate ions in mmol per dm^3
Roots of barley plants	1.4

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Soil	0.15

Is it possible for the barley roots to take up sulfate ions from the soil by diffusion?

Draw a ring around your answer. **Yes / No**

Explain your answer.

_____

_____

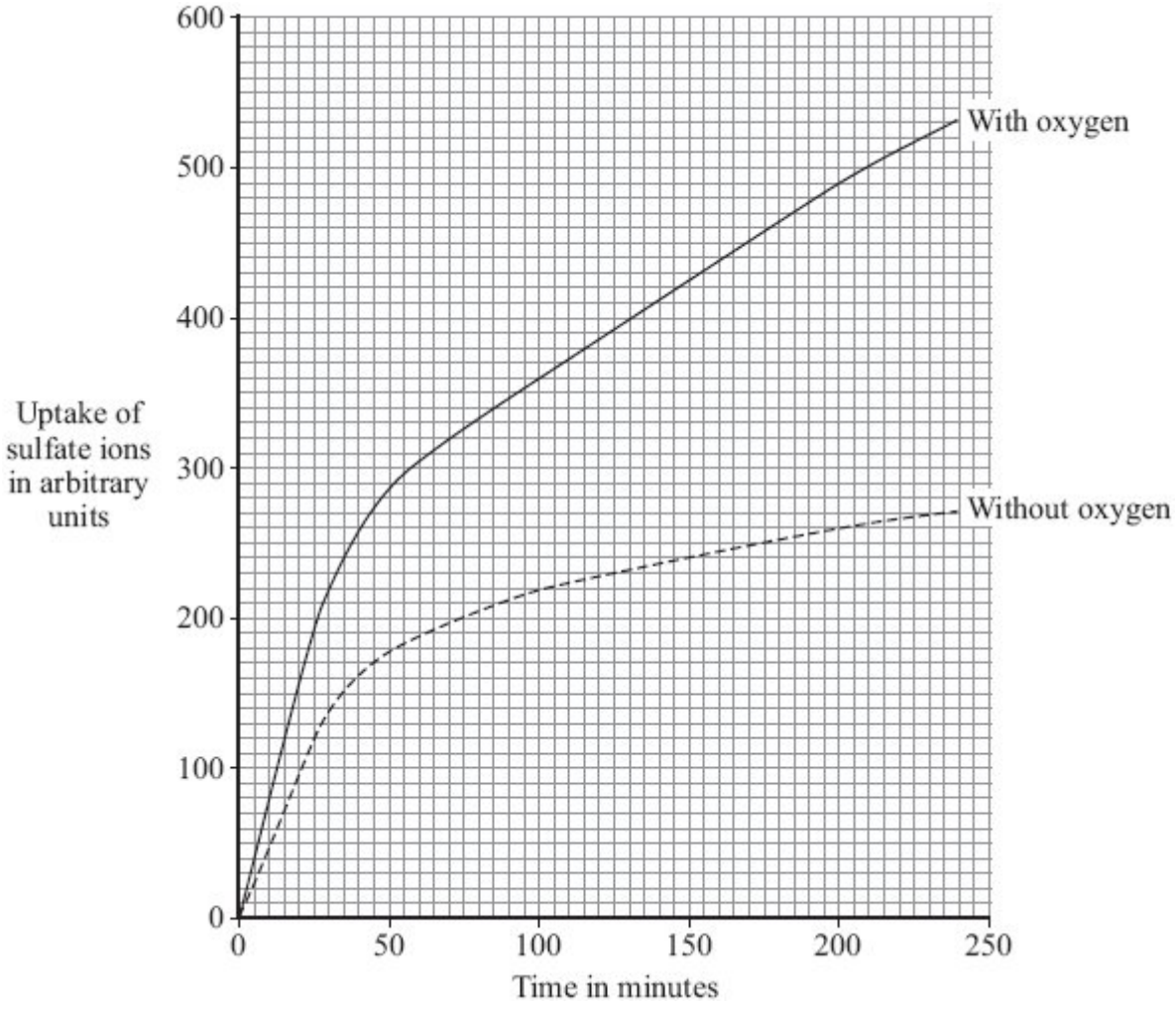
_____

_____

(2)

(b) Some scientists investigated the amounts of sulfate ions taken up by barley roots in the presence of oxygen and when no oxygen was present.

The graph below shows the results.



(i) The graph shows that the rate of sulfate ion uptake between 100 and 200 minutes, **without** oxygen, was 0.4 arbitrary units per minute.

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The rate of sulfate ion uptake between 100 and 200 minutes, **with** oxygen, was greater.

How much greater was it? Show clearly how you work out your answer.

_____

_____

_____

Answer _____ arbitrary units

(2)

(ii) The barley roots were able to take up more sulfate ions with oxygen than without oxygen.

Explain how.

_____

_____

_____

_____

_____

_____

(3)

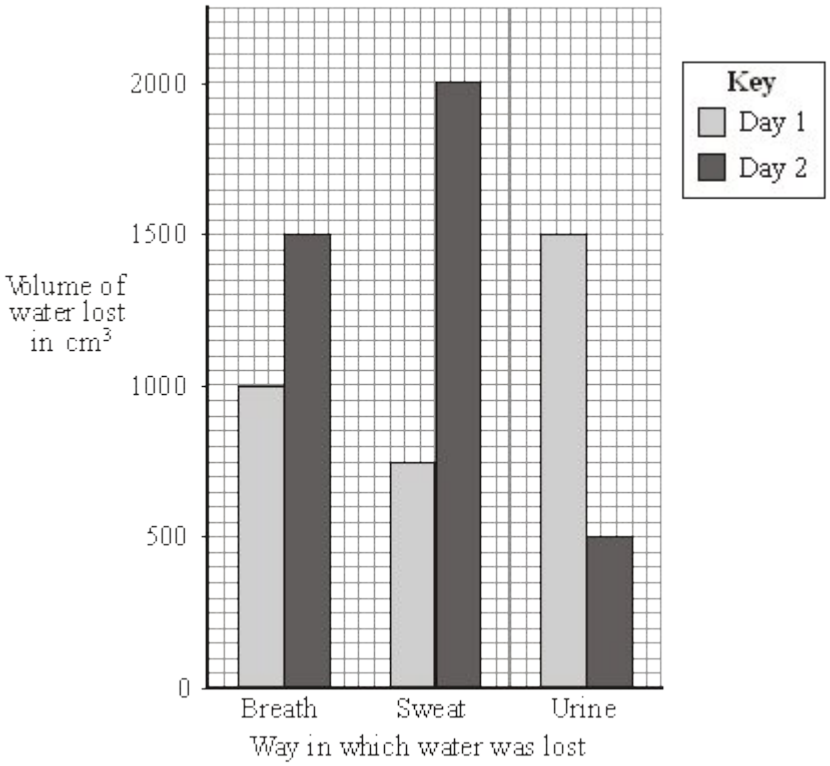
(Total 7 marks)

Q24.

The bar chart shows the amount of water lost from the body of a student on two different days.

The student ate the same amount of food and drank the same amount of liquid on the two days. The temperature of the surroundings was similar on the two days.

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(a) The total volume of water lost on day 1 was 3250 cm^3.

How much water was lost on day 2? Show all your working.

_____

_____ cm^3

(2)

(b) The student did much more exercise on one of the days than on the other.

On which day did he do more exercise? Day _____

Give **two** reasons for your answer.

1. _____

_____

2. _____

_____

(2)

(c) (i) Which **one** of these is a chemical reaction that produces water in the body?

Put a tick (✓) in the box next to your choice.

Breathing	☐
Osmosis	☐

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Respiration ☐

Sweating ☐

(1)

(ii) How does sweating help the body?

_____

_____

(1)

(iii) If the body loses more water than it gains, it becomes dehydrated.
The concentration of the solution surrounding the body cells increases.
This causes the cells to lose water.

By which process do cells lose water?

Put a tick (✓) in the box next to your choice.

Breathing ☐

Osmosis ☐

Respiration ☐

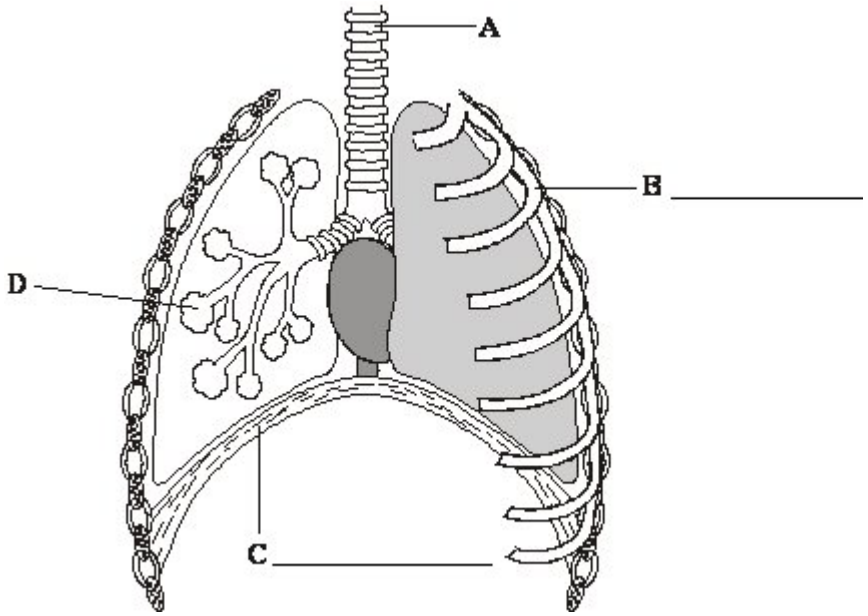
Sweating ☐

(1)
(Total 7 marks)

Q25.

The diagram shows the human breathing system.

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(a) On the diagram, label structures **B** and **C**.

Choose your answers from the list in the box.

alveoli	**diaphragm**	**rib**	**trachea**

(2)

(b) (i) Which letter, **A**, **B**, **C** or **D**, shows the site of gas exchange? _____

(1)

(ii) Which **one** of the following gases has a higher concentration in exhaled air than in inhaled air?

Draw a circle around **one** answer.

carbon dioxide **nitrogen** **oxygen**

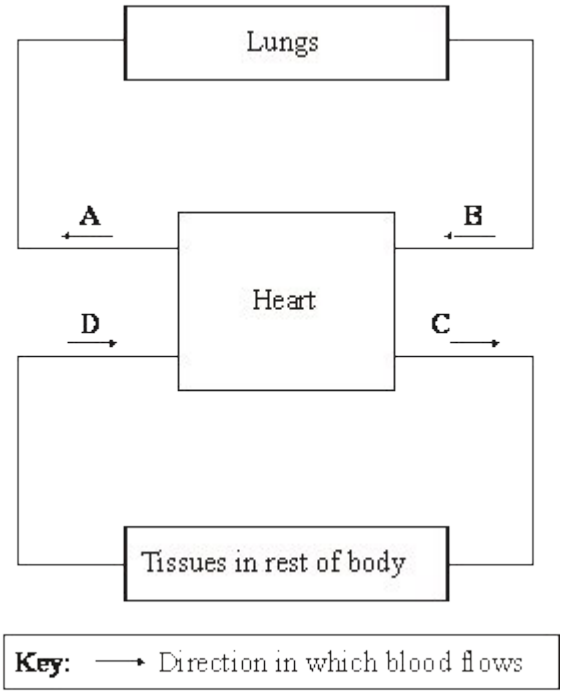
(1)

(Total 4 marks)

Q26.

The diagram represents the human blood circulation system.

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(a) **A**, **B**, **C** and **D** are blood vessels.

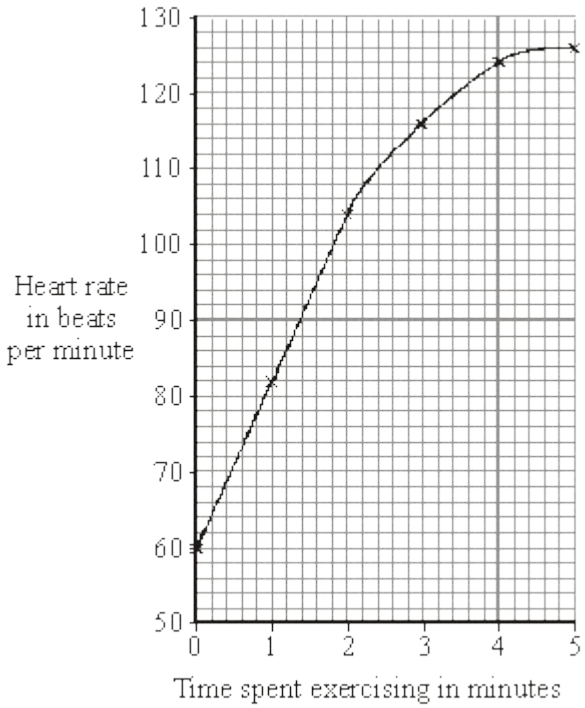
(i) Give the letter of **one** blood vessel that is an artery. _____

(1)

(ii) Give the letter of **one** blood vessel that is a vein. _____

(1)

(b) A student pedalled an exercise cycle at constant speed for 5 minutes. The student's heart rate was recorded at one-minute intervals during the exercise. The results are shown in the graph.



(i) What was the student's heart rate before the exercise began?

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_____ per minute

(1)

(ii) How long was it before the student's heart rate reached 124 beats per minute?

_____ minutes

(1)

(c) Which of the following parts of the blood carries most oxygen?

Draw a circle around **one** answer.

plasma **red blood cells** **white blood cells**

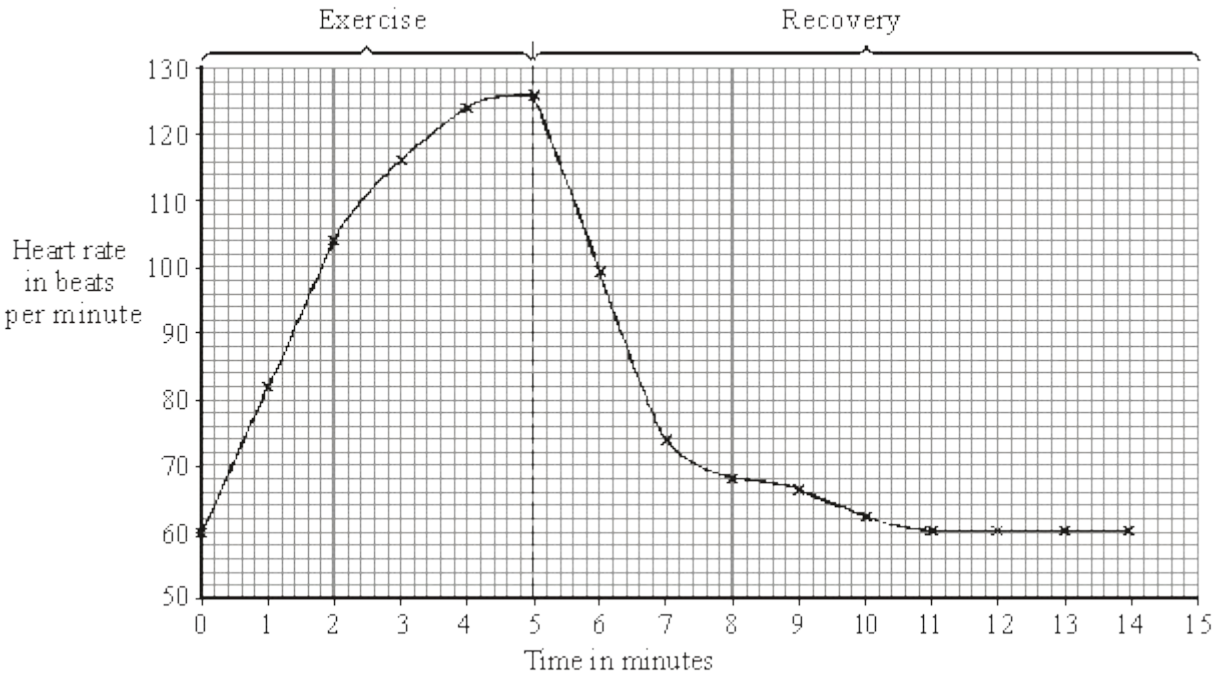
(1)

(Total 5 marks)

Q27.

A student pedalled an exercise cycle at constant speed for 5 minutes. The student's heart rate was recorded at one-minute intervals during the exercise and also during recovery.

The results are shown in the graph.



(a) Describe, in as much detail as you can, the changes in heart rate between 0 and 14 minutes.

_____

_____

_____

_____

_____

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_____

_____

(3)

(b) How do arteries supplying the leg muscles alter the rate of blood flow through them during exercise?

_____

_____

(1)

(c) Explain how an increase in heart rate helped the student during exercise.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

Q28.

The table shows the amounts of energy used in running and in walking at different speeds by people of different body masses.

Activity	Energy used in kilojoules per hour			
	34 kg person	**50 kg person**	**70 kg person**	**90 kg person**
Running, 9 km per hour	1530	1850	2770	3700
Running, 11 km per hour	2140	2560	3860	5120
Running, 16 km per hour	2980	3570	5380	7140
Walking, 3 km per hour	530	670	1010	1340
Walking, 5 km per hour	740	880	1340	1760
Walking, 7 km per hour	1030	1240	1850	2480

(a) Describe **two** patterns you can see in the data.

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1. _____

_____

2. _____

_____

(2)

(b) Our breathing rate is much higher when running than when walking.

Explain the advantage of this to the body.

_____

_____

_____

_____

_____

_____

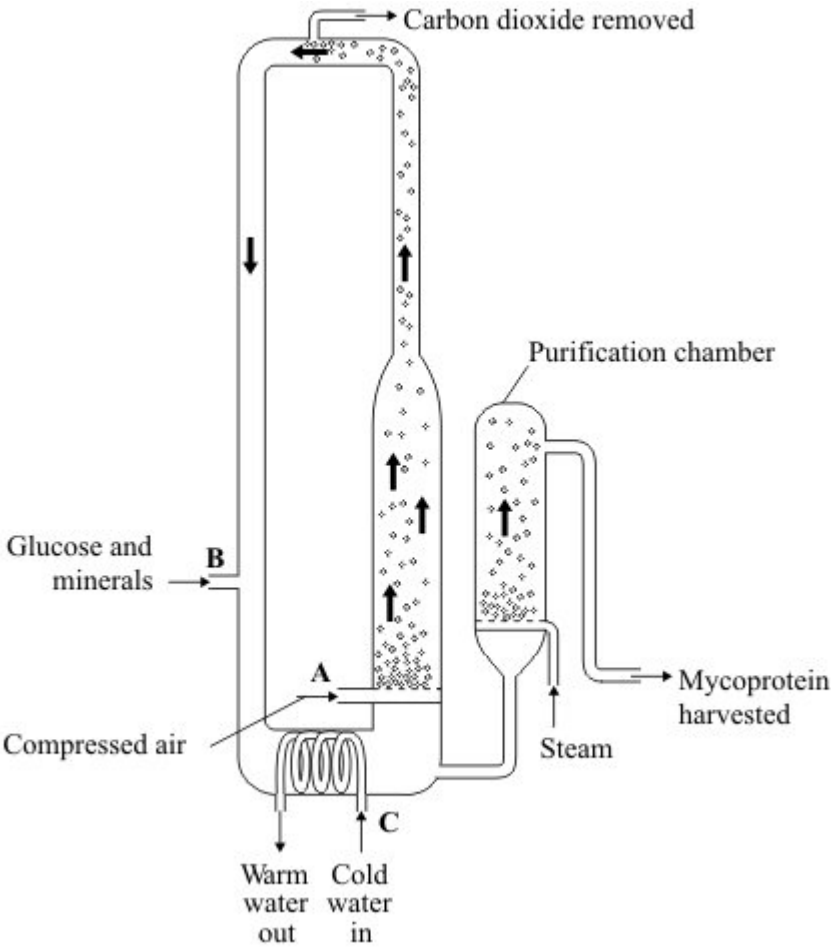
(3)

(Total 5 marks)

Q29.

The diagram shows a fermenter. This fermenter is used for growing the fungus *Fusarium* which is used to make mycoprotein.

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(a) Bubbles of air enter the fermenter at **A.**

Give **two** functions of the air bubbles.

1. _____

_____

2. _____

_____

(2)

(b) Glucose is added to the fermenter at **B.**

Explain why glucose is added.

_____

_____

(1)

(c) The fermenter is prevented from overheating by the cold water flowing in through the heat exchanger coils at **C.**

Explain what causes the fermenter to heat up.

_____

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_____

(1)

(d) It is important to prevent microorganisms other than *Fusarium* from growing in the fermenter.

(i) Why is this important?

_____

_____

(1)

(ii) Suggest **two** ways in which contamination of the fermenter by microorganisms could be prevented.

1. _____

_____

2. _____

_____

(2)

(e) Human cells cannot make some of the amino acids which we need. We must obtain these amino acids from our diet.

The table shows the amounts of four of these amino acids present in mycoprotein, in beef and in wheat.

Name of amino acid	Amount of amino acid per 100 g in mg			Daily amount needed by a 70 kg human in mg
	Mycoprotein	Beef	Wheat	
Lysine	910	1600	300	840
Methionine	230	500	220	910
Phenylalanine	540	760	680	980
Threonine	610	840	370	490

A diet book states that mycoprotein is the best source of amino acids for the human diet.

Evaluate this statement.

Remember to include a conclusion in your evaluation.

_____

_____

_____

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_____

_____

_____

_____

_____

(4)

(Total 11 marks)

Q30.

A runner might drink a special 'sports drink' at intervals during a marathon race. The table shows the substances present in a sports drink.

Substance	Percentage
Water	
Sugar	5.0
Ions	0.2

(a) Complete the table to show the percentage of water in the sports drink.

(1)

(b) The runner sweats and also breathes heavily during the race.

(i) Why does the runner need to sweat?

_____

(1)

(ii) Which **two** substances in the table are lost from the body in sweat?

_____

(1)

(iii) Which substance in the table is lost from the body during breathing?

_____

(1)

(c) How does the sugar in the sports drink help the athlete during the marathon?

_____

_____

(2)

(Total 6 marks)

Q31.

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Complete the table by writing the correct process next to its description.

Choose your answers from the list in the box

breathing	**diffusion**	**digestion**	**osmosis**	**respiration**

Description	Process
Moving air in and out of the lungs	
The movement of particles of a substance from high to low concentration	
The release of energy from glucose	

(Total 3 marks)

Q32.

Paula is training for a marathon. When she runs, her heart beats faster than it does when she is resting.

Complete the sentences, using words from the box.

blood	**breathe**	**carbon dioxide**	**glucose**
heat	**nitrogen**	**oxygen**	**respire**

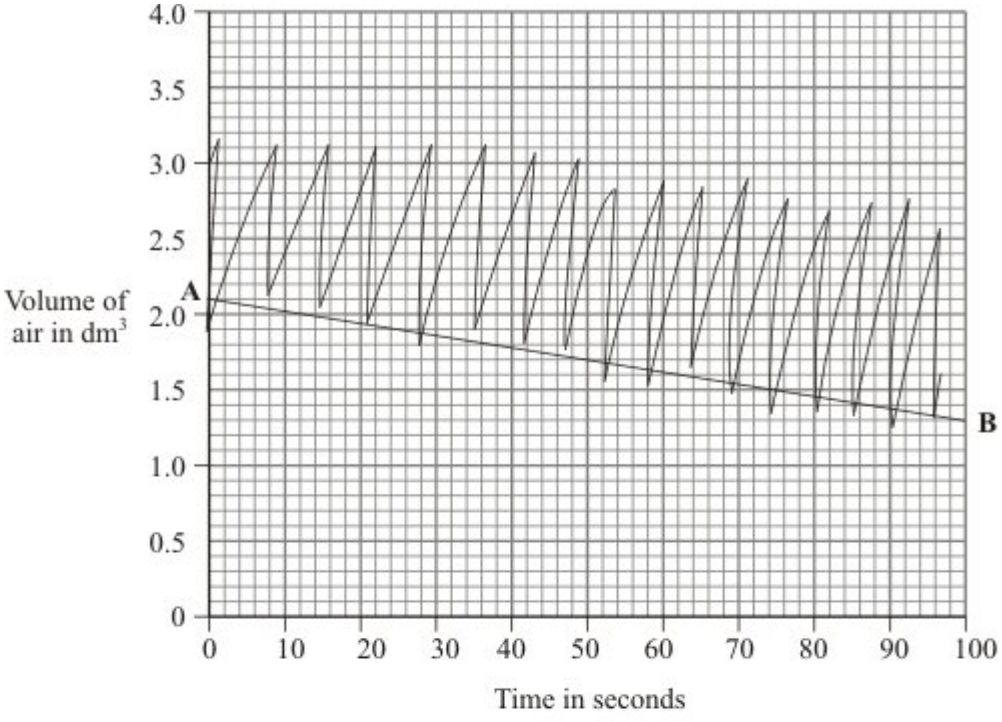
When she is running, Paula's muscle activity increases. To do this, her muscle cells _____ at a faster rate to give her more energy. Her muscles need to be supplied with _____ and _____ more quickly. Her heart beats faster to increase the flow of _____ which carries the products _____ and _____ away from her muscles.

(Total 6 marks)

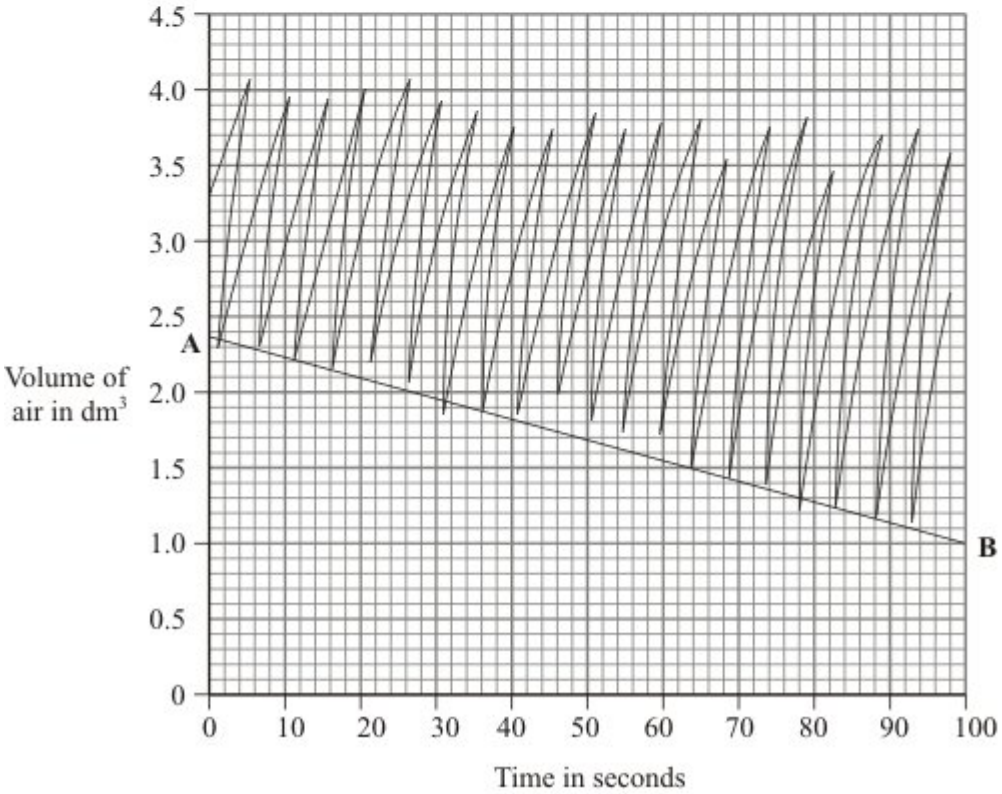
Q33.

A student's breathing was monitored before and after vigorous exercise. The student breathed in and out through a special apparatus. The graphs show the changes in the volume of air inside the apparatus. Each time the student breathed in, the line on the graph dropped. Each time the student breathed out, the line went up.

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Before exercise



After exercise

(a) How many times did the student breathe in per minute:

before exercise; _____

after exercise? _____

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(1)

(b) On each graph, the line **A** – **B** shows how much oxygen was used. The rate of oxygen use before exercise was 0.5 dm^3 per minute. Calculate the rate of oxygen use after exercise.

_____

_____

_____

Rate of oxygen use after exercise = _____ dm^3 per minute

(2)

(c) The breathing rate and the amount of oxygen used were still higher after exercise, even though the student sat down to rest. Why were they still higher?

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 7 marks)

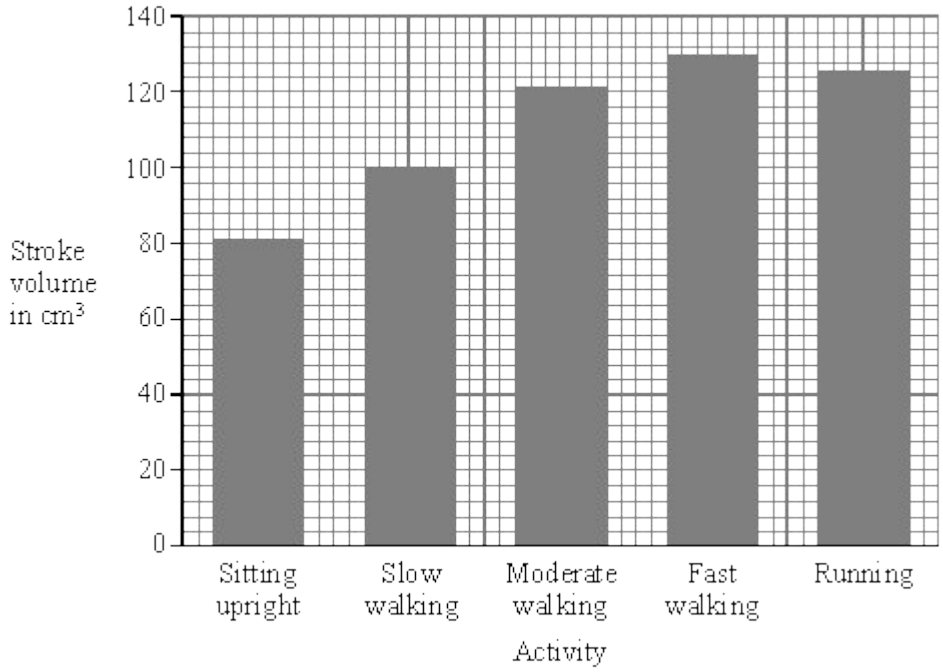
Q34.

A person did five different activities in turn. These activities needed increasing amounts of energy. For each activity two measurements were made. These were the rate of contraction of the left ventricle and its stroke volume (the volume of blood pumped at each beat). From these measurements the cardiac volume was calculated.

Some of these results are shown in the table and the bar chart.

Activity	Rate of contraction of left ventricle in beats per minute	Cardiac output in cm^3 per minute
Sitting upright	68	5 500
Slow walking		8 000
Moderate walking	98	12 000
Fast walking	130	17 500
Running	150	19 000

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(a) (i) Describe how a person can count the rate of beating of the left ventricle.

_____

_____

(1)

(ii) Calculate the rate of ventricle contraction in beats per minute when the person was walking slowly. Show clearly how you work out your final answer.

_____

_____

_____

_____

Rate of ventricle contraction _____ beats per minute.

(2)

(iii) The pattern of results for stroke volume shows an anomalous result when the person is running. In what way is it anomalous?

_____

_____

(1)

(iv) There was a change in cardiac output when the person's movement changed from fast walking to running. How did the heart produce this change?

_____

_____

(1)

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(b) Over a period of time, regular exercise can strengthen the heart muscle. This change in the heart muscle enables a person to run for longer before lactic acid build up occurs. Explain the reason for this.

_____

_____

_____

_____

(2)

(Total 7 marks)

Q35.

Regular exercise is important, as it helps to maintain an efficient supply of blood to the muscles, the heart and the lungs. This is helped by an increase in the heart rate during exercise.

Explain why it is necessary for the heart rate to increase during exercise.

_____

_____

_____

_____

_____

_____

_____

_____

(Total 4 marks)

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