Respiration and Exercise 3

Q:1 Scientists investigated how exercise affects blood flow to different organs in the body. The scientists made measurements of blood flow to different organs of:

- a person resting in a room at 20 °C
- the same person, in the same room, doing vigorous exercise at constant speed on an exercise cycle.

The table shows the scientists' results.

Organ	Blood flow in cm^3 per minute whilst ...	
	resting	doing vigorous exercise
Brain	750	750
Heart	250	1000
Muscles	1200	22 000
Skin	500	600
Other	3100	650

(a) In this investigation, it was better to do the exercise indoors on an exercise cycle than to go cycling outdoors on the road.

Suggest two reasons why.

Do not include safety reasons.

1 _____

_____

_____

2 _____

_____

_____

(2 marks)

(b) Blood flow to one organ did not change between resting and vigorous exercise.

Which organ? _____

(1 mark)

(c) (i) How much more blood flowed to the muscles during vigorous exercise than when resting?

.

_____

_____

Answer = _____ cm3 per minute **(2 marks)**

(c) (ii) Name two substances needed in larger amounts by the muscles during vigorous exercise than when resting.

1 _____

2 _____

(2 marks)

(c) (iii) Tick (☒) one box to complete the sentence.

The substances you named in part (c)(ii) helped the muscles to

make more lactic acid. ☐

respire aerobically. ☐

make more glycogen. ☐

(1 mark)

(c) (iv) The higher rate of blood flow to the muscles during exercise removed larger amounts of waste products made by the muscles.

Which two substances need to be removed from the muscles in larger amounts during vigorous exercise?

Tick (☒) two boxes.

Amino acids ☐

Carbon dioxide ☐

Glycogen ☐

Lactic acid ☐

(2 marks)

(d) The total blood flow was much higher during exercise than when resting.

One way to increase the total blood flow is for the heart to pump out a larger volume of blood each beat.

Give one other way to increase the blood flow.

_____

_____

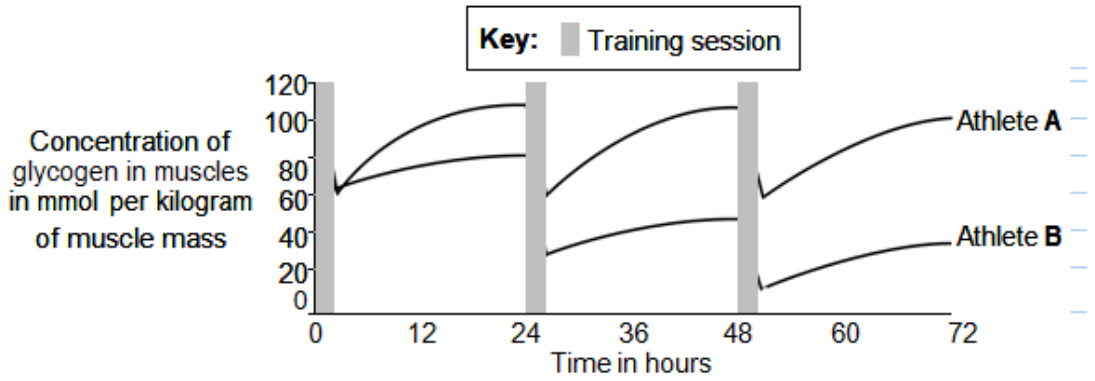
(1 mark)

Q:2 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 marks)

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

(2 marks)

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

(1 mark)

(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 marks)

Q:3 (a) Use words from the box to complete the equation for aerobic respiration.

alcohol glucose lactic acid water

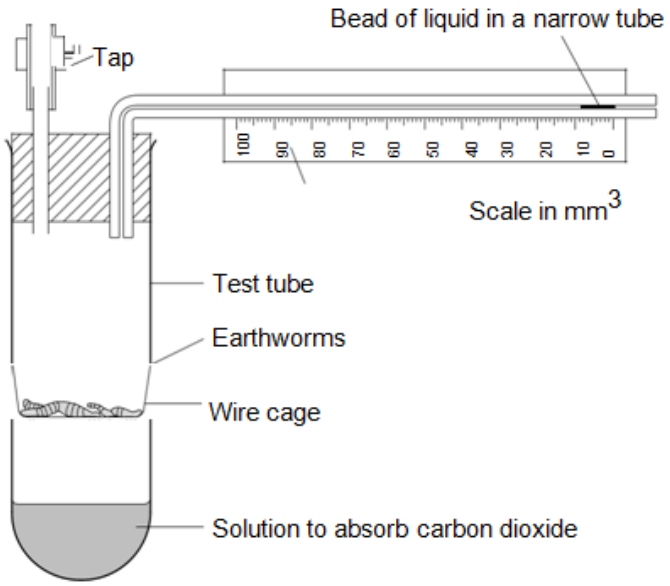
..... + oxygen ⟶ carbon dioxide + ——————— (+ energy)

(2 marks)

(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.



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. ☐

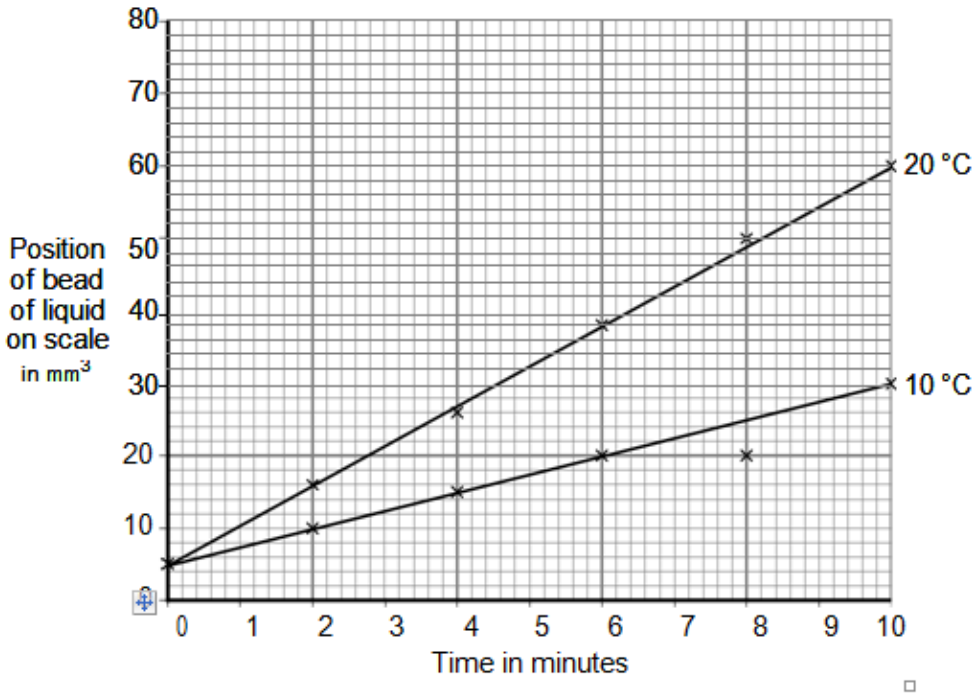
So the earthworms' body temperature would change to 20 °C. ☐

(1 mark)

(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.



(c) (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 = _____ mm3

(2 marks)

(c) (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 =_____ mm3 per minute **(1 mark)**

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

(2 marks)

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

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

(1 mark)

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

How would repeating the experiment improve the investigation?

_____

_____

(1 mark)

Q:4 Figure 2 shows an athlete running on a treadmill.

Figure 2

After running for several minutes, the athlete's leg muscles began to ache.

This ache was caused by a high concentration of lactic acid in the muscles

(a) The equation shows how lactic acid is made.

glucose ⟶ lactic acid (+ energy)

Name the process that makes lactic acid in the athlete's muscles.

_____

[1 mark]

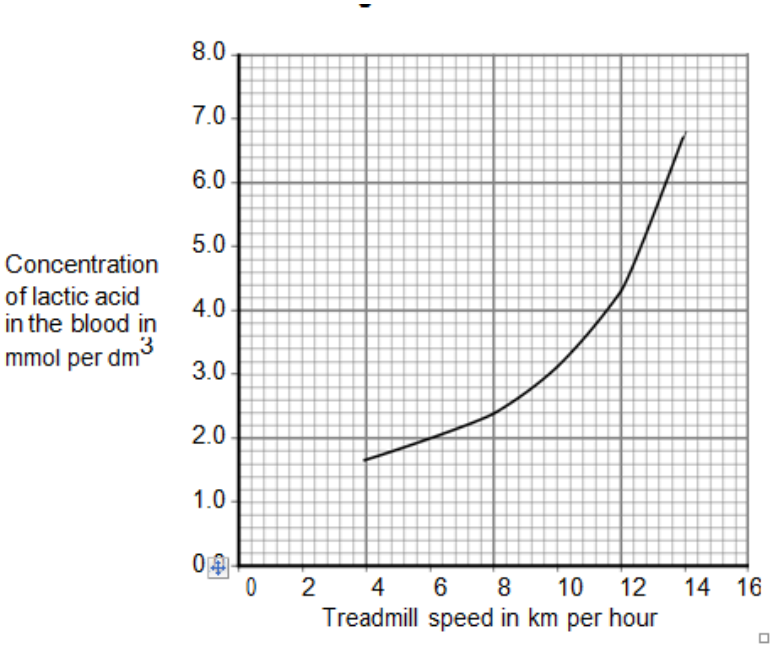
(b) Scientists investigated the production of lactic acid by an athlete running at different speeds.

In the investigation:

- the athlete ran on the treadmill at 4 km per hour
- the scientists measured the concentration of lactic acid in the athlete's blood after 2 minutes of running.

The investigation was repeated for different running speeds.

Figure 3 shows the scientists' results.



(b) (i) How much more lactic acid was there in the athlete's blood when he ran at 14 km per hour than when he ran at 8 km per hour?

Answer = _____ mmol per dm3

[2 marks]

(b) (ii) Why is more lactic acid made in the muscles when running at 14 km per hour than when running at 8 km per hour?

_____

_____

_____

_____

_____

_____

[3 marks]

TOTAL MARKS=37