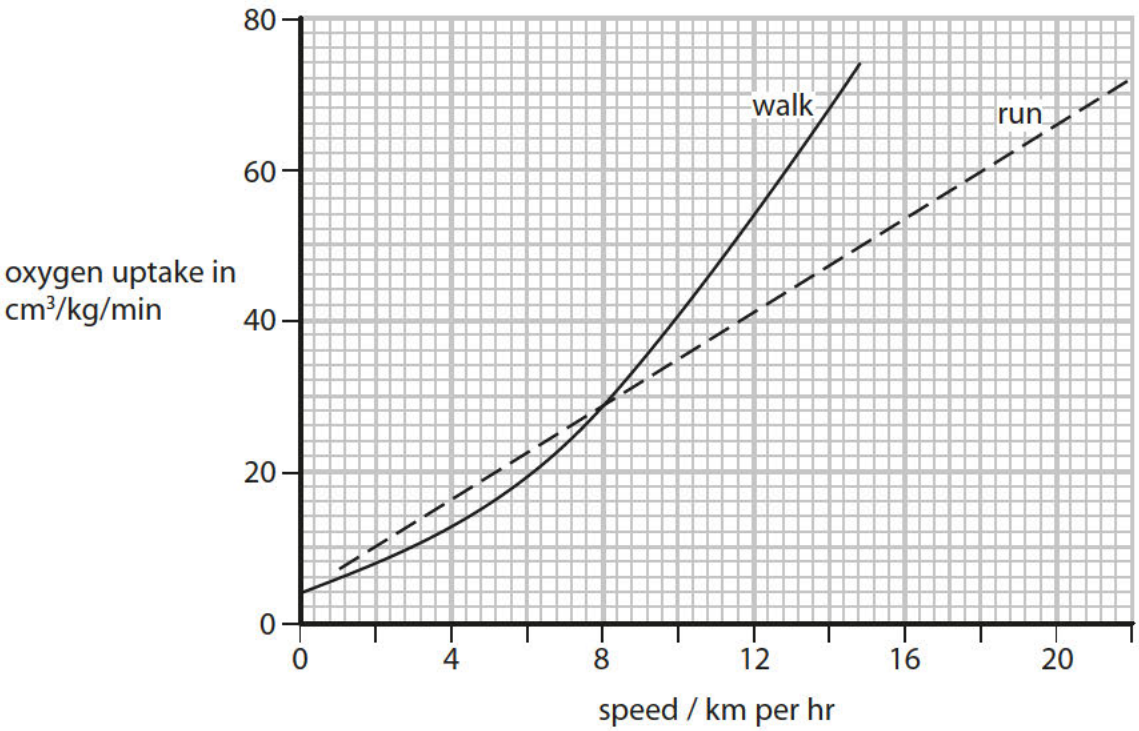
1 The graph shows the oxygen uptake for an athlete when walking and running.



(a) Compare the oxygen uptake when the athlete is walking and running at speeds from 6 to 10 km per hour.

(3)

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(b) (i) Complete the word equation for aerobic respiration.

(1)

oxygen + glucose ⟶ ..... + ...

(ii) Explain why oxygen uptake increases as an athlete runs at faster speeds.

(2)

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(iii) When athletes train hard they can respire anaerobically.

Which of the following statements about anaerobic respiration are true?

1. Lactic acid and carbon dioxide are produced.
2. Lactic acid can build up causing cramp.

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** statement 1 only

☐ **B** statement 2 only

☐ **C** both statement 1 and 2

☐ **D** neither statement 1 nor 2.

(c) The heart rate and stroke volume of an athlete training at a high intensity were measured and their cardiac output was calculated.

The table shows the measurements before, after 2 weeks and after 4 weeks of training.

	heart rate / beats per minute	**stroke volume / dm^3**	**cardiac output / dm^3 per minute**
Before training	142	0.08	11.4
After 2 weeks training	164	0.10	16.4
After 4 weeks training		0.12	24.0

(i) Calculate the heart rate after 4 weeks of training.

(2)

..... beats per minute

(ii) Explain how the higher cardiac output after 4 weeks of training increased the rate of aerobic respiration.

(2)

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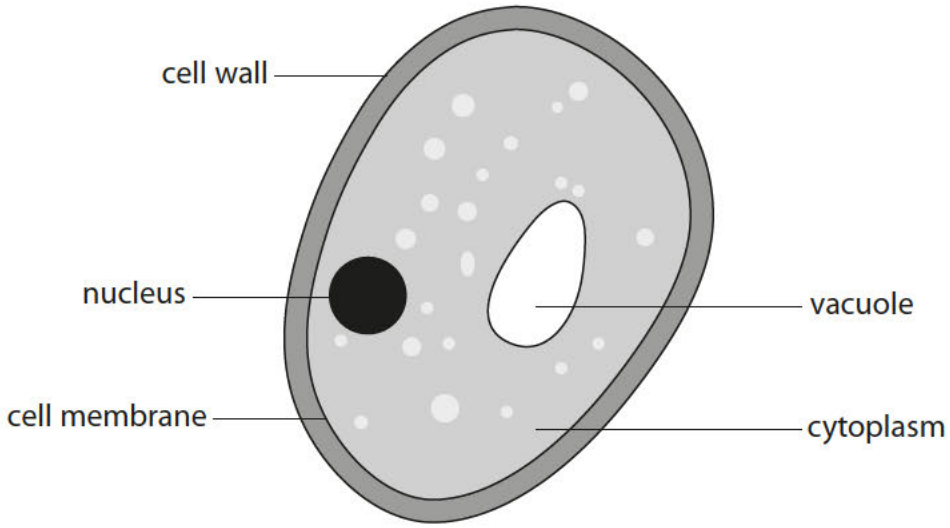
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(Total for Question 1 = 11 marks)

2 Yeasts are microorganisms that are used in the brewing and baking industries.

The diagram shows a yeast cell.



(a) (i) State **two** ways in which the structure of this yeast cell differs from the structure of a bacterial cell.

(2)

1 .....

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2 .....

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(ii) Plant cells can produce glucose.

Suggest why yeast cells cannot produce glucose.

(1)

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(b) The table shows the number of different components found in the blood of a healthy person and the blood of two other people.

	number of components per dm^3 of blood		
component of blood	**healthy person**	**person A**	**person B**
red blood cells	5×10^{12}	6×10^{12}	3×10^{12}
white blood cells	7×10^{9}	5×10^{10}	8×10^{10}
platelets	3×10^{11}	3×10^{11}	3×10^{11}

(i) Calculate the difference in the number of white blood cells per dm^3 of blood between the healthy person and person A.

(2)

answer = ...

(ii) Describe the functions of white blood cells.

(2)

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(iii) Person B has a low number of red blood cells compared to the healthy person.

Suggest an effect this may have on person B.

(1)

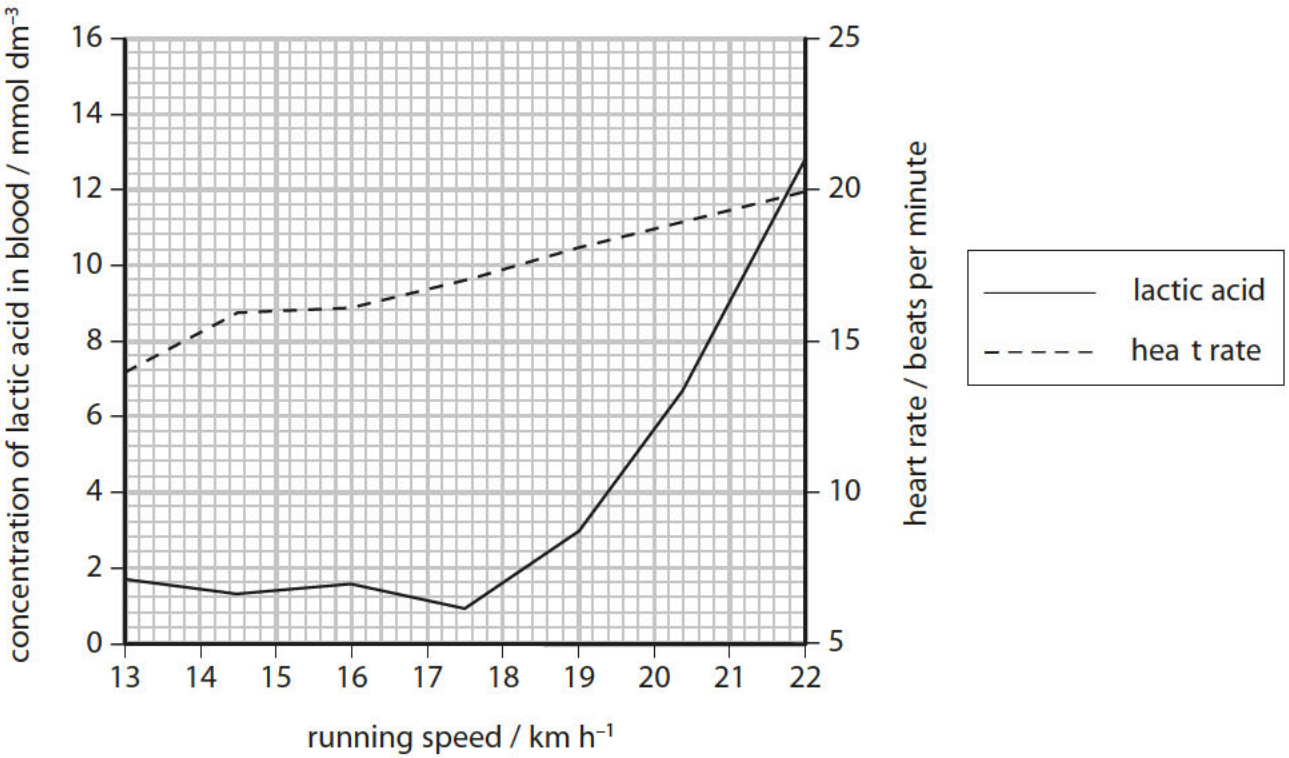
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(Total for Question 2 = 8 marks)

3 In an investigation, a person ran at different speeds.

(a) The graph shows the concentration of lactic acid in the blood and the heart rate of this person while running.



(i) When the running speed is 22 km h^{-1}, the stroke volume of the runner is 0.18 dm^3.

Calculate the cardiac output of the runner using the equation.

cardiac output = stroke volume × heart rate

(2)

answer = ... dm^3 per minute

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

When the heart rate is at its maximum the concentration of lactic acid in the blood is

(1)

☐ **A** 11.2 mmol dm^{-3}

☐ **B** 12.8 mmol dm^{-3}

☐ **C** 200.0 mmol dm^{-3}

☐ **D** 210.0 mmol dm^{-3}

(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

The graph shows that

☐ **A** as the heart rate increases the concentration of lactic acid increases

☐ **B** as the concentration of lactic acid increases the heart rate decreases

☐ **C** the concentration of lactic acid increases as running speed increases

☐ **D** the concentration of lactic acid is not dependent on heart rate

(iv) Explain why the concentration of lactic acid changes at running speeds greater than 18 km h^{-1}.

(3)

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(b) After running the person rested.

Explain why the concentration of lactic acid in the blood changes whilst resting.

(3)

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(Total for Question 3 = 10 marks)