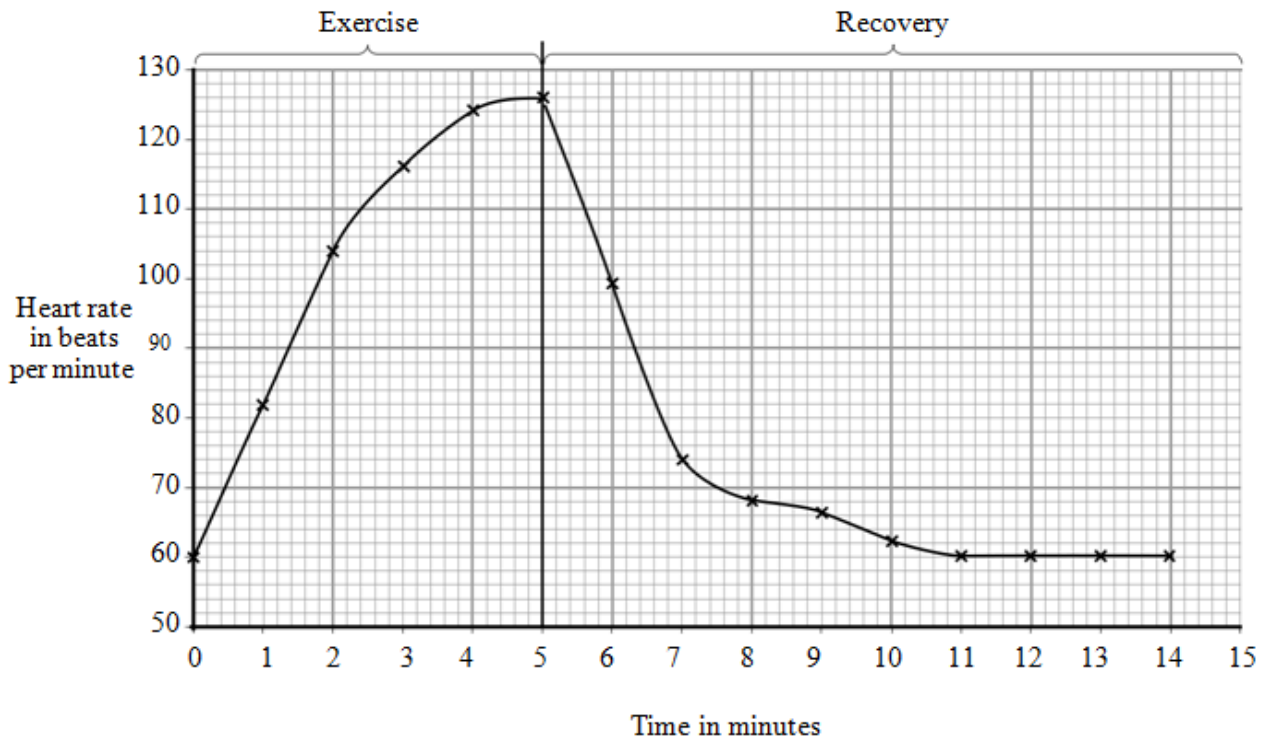


# Respiration and Exercise

**Q:1** 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 marks)**

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

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**(1 mark)**

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

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**(4 marks)**

**Q:2 (a)** The table shows the effect of exercise on the action of one person's heart.

	<b>At rest</b>	<b>During exercise</b>
Heart rate in beats per minute	72	165
Volume of blood leaving the heart in each beat in cm <sup>3</sup>	75	120
Heart output in cm <sup>3</sup> per minute	5400	

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

Show clearly how you work out your answer.

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Answer = \_\_\_\_\_ cm<sup>3</sup> per minute

**(2 marks)**

**(a)(ii)** During exercise, more oxygen is carried to the working muscles. Explain why this is helpful during exercise.

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**(2 marks)**

**(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 marks)**

**(b)(ii)** Give one way in which this fall in pH is useful in yoghurt production.

\_\_\_\_\_  
\_\_\_\_\_

**(1 mark)**

**(c)** Suggest why the yoghurt is stored at 5 °C.

\_\_\_\_\_  
\_\_\_\_\_

**(1 mark)**

**Q:3** Lactic acid production during exercise affects an athlete's performance.

**(a)** Explain why lactic acid is produced during exercise.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**(2 marks)**

**Q:4** 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 <sup>3</sup> 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
<b>Total</b>	<b>9 500</b>	<b>17 600</b>	<b>25 000</b>

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

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**(1 mark)**

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

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**(1 mark)**

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

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**(1 mark)**

**(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 marks)**

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

Explain what causes this increase.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**(3 marks)**

**Q:5** 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.

1. \_\_\_\_\_  
\_\_\_\_\_

2. \_\_\_\_\_  
\_\_\_\_\_

**(2 marks)**

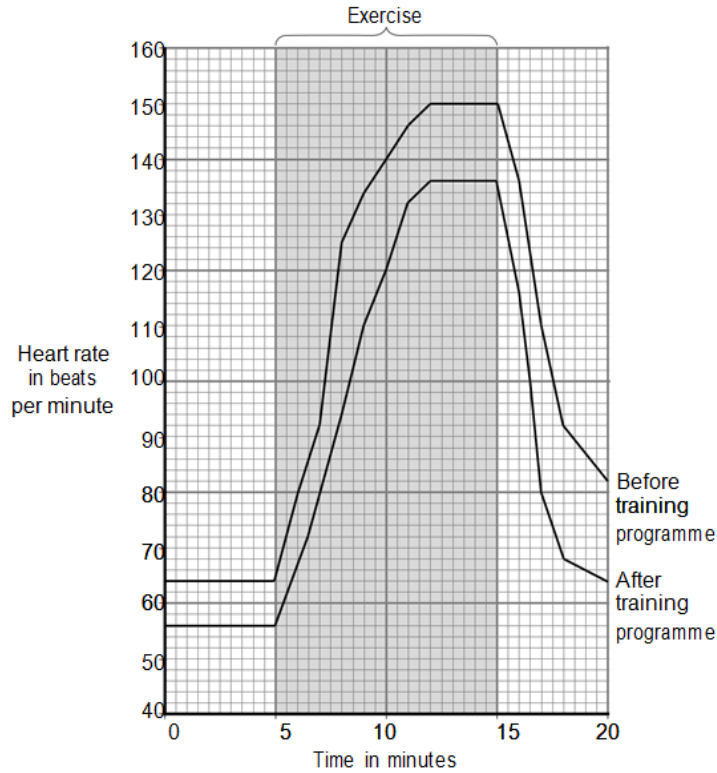
**(b)** Our breathing rate is much higher when running than when walking. Explain the advantage of this to the body.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**(3 marks)**

**Q:6** 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 mark)**

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

After the training programme

Difference 1 \_\_\_\_\_

\_\_\_\_\_

Difference 2 \_\_\_\_\_

\_\_\_\_\_

**(2 marks)**



**(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 marks)**

**TOTAL MARKS=34**