

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

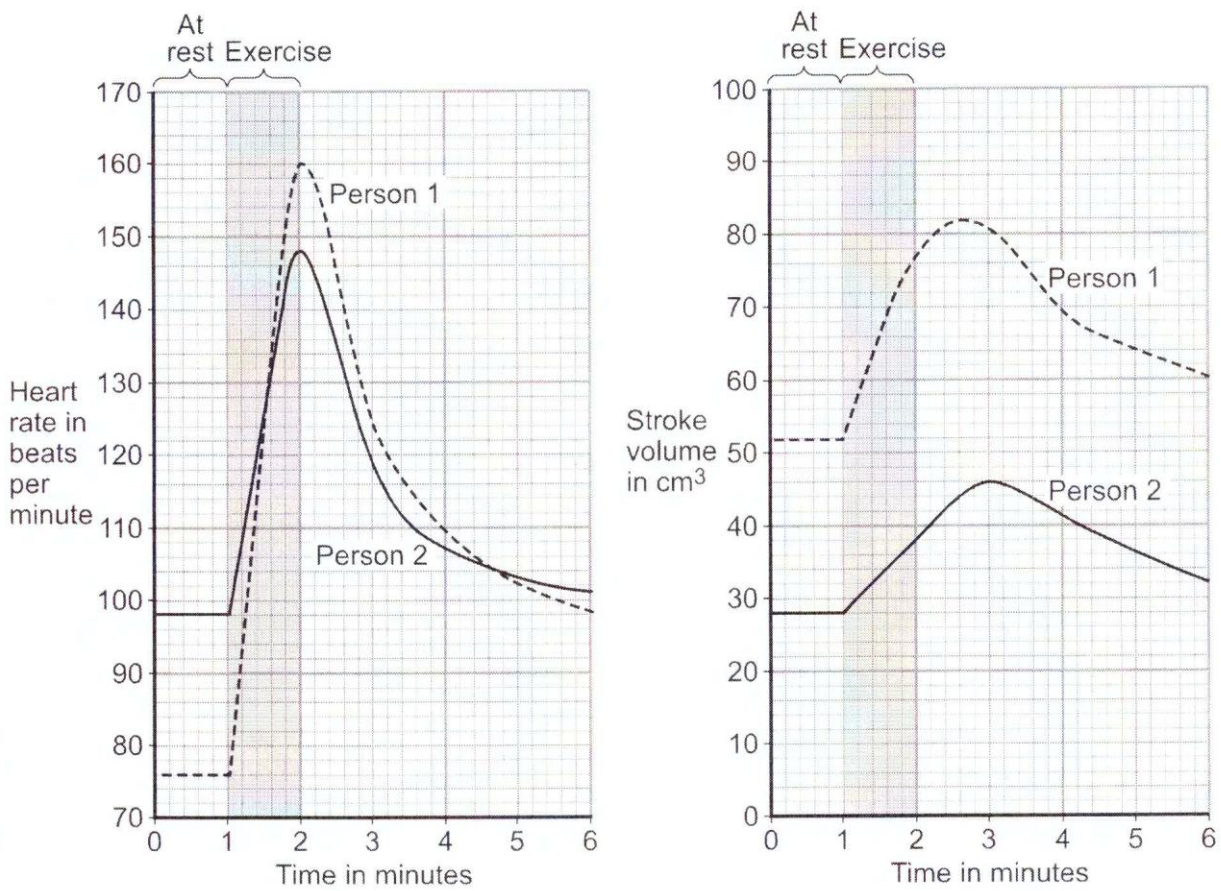
The 'heart rate' is the number of times the heart beats each minute.

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.

Figure 7 shows the scientists' results.

Figure 7



5 (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 7** to complete the following calculation of **Person 2**'s cardiac output at the end of the exercise.

[3 marks]

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

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

5 (b) (i) Use information from **Figure 7** to suggest the **main** reason for the lower cardiac output of **Person 2**.

[1 mark]

.....
.....

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

Use information from **Figure 7** and your own knowledge to explain why.

[5 marks]

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

9

Turn over ►



Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	5624	<p>allow 2 marks for:</p> <ul style="list-style-type: none"> correct HR = 148 and correct SV = 38 plus wrong answer / no answer <p>or</p> <ul style="list-style-type: none"> only one value correct and ecf for answer <p>allow 1 mark for:</p> <ul style="list-style-type: none"> incorrect values and ecf for answer <p>or</p> <ul style="list-style-type: none"> only one value correct 	3	AO2 2.6, 2.6.1g
5(b)(i)	Person 2 has low(er) stroke volume / SV / described	<p>eg Person 2 pumps out smaller volume each beat</p> <p>do not allow Person 2 has lower heart rate</p>	1	AO3 2.6, 2.6.1g
5(b)(ii)	<p>Person 1 sends <u>more blood</u> (to muscles / body / lungs)</p> <p>(which) supplies (more) oxygen</p> <p>(and) supplies (more) glucose</p> <p>(faster rate of) respiration or transfers (more) energy for use</p> <p>removes (more) CO₂ / lactic acid / heat</p> <p>or less lactic acid made</p> <p>or (more) muscle contraction / less muscle fatigue</p>	<p>ignore aerobic / anaerobic</p> <p>allow (more) energy release</p> <p>allow aerobic respiration transfers / releases more energy (than anaerobic)</p> <p>do not allow makes (more) energy</p> <p>allow less oxygen debt</p> <p>if no other mark awarded, allow person 1 is fitter (than person 2) for max 1 mark</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	AO1 / AO2 2.6.1b,e,f, g,h, 2.6.2c,d
Total			9	