

GCSE Combined Science: Trilogy

Worksheet: Response to exercise

TIME 35 min	TOTAL 32 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Response to exercise

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

A person’s resting heart rate was 80 beats per minute. During exercise, their heart rate increased to 152 beats per minute.

0 1 . 1

Calculate the percentage increase in the person’s heart rate during exercise.

.....

.....

.....

.....

Percentage increase = %

[2 marks]

0 2

During exercise the body needs to transfer more energy.

0 2 . 1

Which **three** changes happen in the body during exercise?

Tick (✓) **three** boxes.

Breathing rate increases

☐

Breath volume increases

☐

Heart rate decreases

☐

Heart rate increases

☐

Body temperature falls

☐

[3 marks]

0 2 . 2

Explain why these changes are needed during exercise.

.....

.....

.....

.....

[2 marks]

0 2 . 3

Which substance builds up in the muscles during vigorous exercise if not enough oxygen is supplied?

.....

.....

.....

.....

[1 mark]

0 3

The body responds to exercise in several ways.

0 3 . 1

Which change happens to the **heart rate** during exercise, and why?

Tick (✓) **one** box.

It decreases, to save energy.

☐

It stays the same, because the heart always beats at the same rate.

☐

It increases, to deliver blood to the muscles faster.

☐

It stops briefly at the start of exercise.

☐

[1 mark]

0 3 . 2

Explain why breathing rate increases during exercise.

.....

.....

.....

.....

[2 marks]

0 3 . 3

Name the substance that builds up in muscles during vigorous exercise, if they respire anaerobically.

.....

.....

.....

.....

[1 mark]

0 4

Table 1 shows measurements of a student's breathing at rest and during exercise.

Table 1

Measurement	At rest	During exercise
Breathing rate in breaths per minute	14	36
Volume of each breath in dm ³	0.5	2.2

0 4 . 1

Calculate the volume of air the student breathed in per minute at rest.

.....

.....

.....

Volume = dm³ per minute

[1 mark]

0 4 . 2

Calculate how many times greater the volume of air breathed in per minute was during exercise than at rest.

.....

.....

.....

.....

Number of times greater =

[2 marks]

0 4 . 3

Explain why the breathing rate and breath volume increased during exercise.

.....

.....

.....

.....

[2 marks]

0 4 . 4

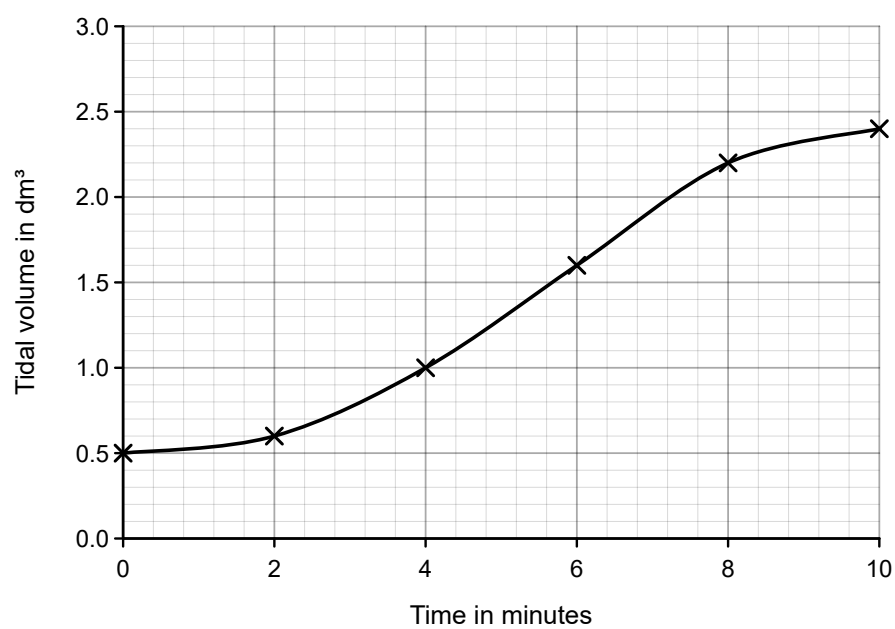
A trained athlete did the same exercise. The athlete’s breathing rate increased much less than the student’s.
Suggest **one** reason why.

[1 mark]

0 5

Figure 1 shows the volume of air breathed in with each breath (tidal volume) of a student as the intensity of exercise increased over 10 minutes.

Figure 1



0 5 . 1

Calculate the percentage increase in tidal volume from 0 minutes to 10 minutes.

Percentage increase = %

[2 marks]

0 5 . 2

Describe the relationship between exercise intensity and tidal volume shown in Figure 1.

.....

.....

[1 mark]

0 5 . 3

Explain why an increased tidal volume is useful during exercise.

.....

.....

.....

.....

[2 marks]

0 6

At high altitude, the concentration of oxygen in the air is lower than at sea level. Athletes training at high altitude often notice their heart rate and breathing rate are higher than usual for the same amount of exercise.

0 6 . 1

Explain why breathing rate and heart rate are higher than usual for the same exercise at high altitude.

.....

.....

.....

.....

[2 marks]

0 6 . 2

Explain why an athlete's muscles might rely more on anaerobic respiration during exercise at high altitude than at sea level.

.....

.....

.....

.....

[2 marks]

0 6 . 3

Suggest **one** reason why athletes who train at high altitude for several weeks may then perform better at sea level.

.....

.....

[1 mark]

0 7

Cardiac output is the volume of blood pumped by the heart each minute. It can be calculated using:

cardiac output = heart rate $\times$ stroke volume

where the stroke volume is the volume of blood pumped by the heart with each beat.

At rest, a person’s heart rate is 80 beats per minute and their stroke volume is 70 cm³.

0 7 . 1

Calculate the person’s cardiac output in dm³ per minute.
Give your answer to 3 significant figures. (1 dm³ = 1000 cm³)

.....

.....

.....

.....

Cardiac output = dm³ per minute

[2 marks]

0 7 . 2

Explain why cardiac output increases during exercise.

.....

.....

.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Response to exercise · 32 marks

Question 1 (2 marks)

01.1 [2 marks]

Answer: 90%

- $(152 - 80) \div 80 \times 100$ (1)
 - 90 (%) (1)
-

Question 2 (6 marks)

02.1 [3 marks]

Correct: Breathing rate increases; Breath volume increases; Heart rate increases

02.2 [2 marks]

- to supply the muscles with more oxygenated blood / more oxygen (and glucose) (1)
- for faster (aerobic) respiration, to transfer more energy for muscle contraction (1)
- to remove more carbon dioxide (1)

Any 2 of the points above.

02.3 [1 mark]

Answer: Lactic acid

- lactic acid (1)
-

Question 3 (4 marks)

03.1 [1 mark]

Correct: It increases, to deliver blood to the muscles faster.

03.2 [2 marks]

- the muscles need more oxygen for (aerobic) respiration (1)
 - more carbon dioxide, produced by the faster respiration, must also be removed from the body (1)
-

03.3 [1 mark]

Answer: Lactic acid

- lactic acid (1)
-

Question 4 (6 marks)

04.1 [1 mark]

Answer: 7 dm³ per minute

- 7 (dm³ per minute) (1)
-

04.2 [2 marks]

Answer: 11.3 times

- $36 \times 2.2 = 79.2$ (dm³ per minute) (1)
 - $79.2 \div 7 = 11.3$ (1)
-

Notes: Allow ECF from the previous part.

04.3 [2 marks]

- to take in more oxygen for (aerobic) respiration in the muscles (1)
 - to remove more carbon dioxide (produced by respiration) (1)
-

04.4 [1 mark]

- the athlete has a larger breath volume / lung capacity / stronger breathing muscles (1)
 - the athlete's heart pumps more blood with each beat, so oxygen is delivered more efficiently (1)
 - the athlete's muscles have a better blood supply (more capillaries), so they take in oxygen more efficiently (1)
-

Any 1 of the points above.

Question 5 (5 marks)

05.1 [2 marks]

Answer: 380%

- $(2.4 - 0.5) \div 0.5 \times 100$ (1)
 - 380 (%) (1)
-

05.2 [1 mark]

- as exercise intensity increases, tidal volume increases (1)
-

05.3 [2 marks]

- a larger volume of air is exchanged with each breath (1)
 - so more oxygen can be taken in, and more carbon dioxide removed, in a given time (1)
-

Question 6 (5 marks)

06.1 [2 marks]

- less oxygen is available in each breath of air (1)
 - the body increases breathing rate and heart rate to try to take in and deliver enough oxygen to the muscles (1)
-

06.2 [2 marks]

- even with faster breathing and heart rate, less oxygen reaches the muscles than at sea level (1)
 - if the muscles cannot get enough oxygen for aerobic respiration alone, they respire anaerobically as well (1)
-

06.3 [1 mark]

- the body may adapt by producing more red blood cells / more haemoglobin, so the blood can carry more oxygen to the muscles (1)
- the heart and the breathing muscles may become stronger, so more oxygen is delivered to the muscles (1)

Any 1 of the points above.

Question 7 (4 marks)

07.1 [2 marks]

Answer: 5.60 dm³ per minute

- $80 \times 70 = 5600$ (cm³ per minute) (1)
- 5.60 (dm³ per minute) (1)

Notes: An answer of 5600 (not converted to dm³) scores 1 mark.

07.2 [2 marks]

- the muscles need more oxygen (and glucose) for faster respiration, to transfer more energy for contraction (1)
 - so more blood is pumped to the muscles each minute, delivering more oxygen and removing more carbon dioxide (1)
-