Exercise walk-through

4.2
Respiration and exercise (4.4.2)

AQA · GCSE · Biology

Respiration

- In muscles: glucose $\rightarrow$ **lactic acid** .
- In plant cells and **yeast** : glucose $\rightarrow$ **ethanol** + carbon dioxide.
- Days 0 to 5: the carbon dioxide level stays steady. The **pondweed** takes in carbon dioxide for photosynthesis as fast as both organisms release it by respiration.

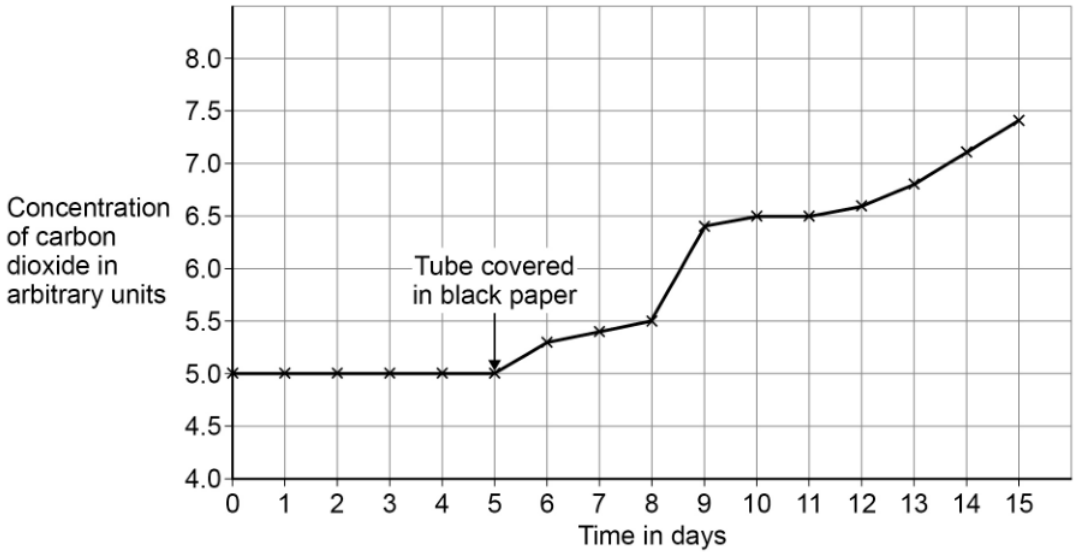
$$\text{glucose} + \text{oxygen} \rightarrow \text{carbon dioxide} + \text{water}$$

Respiration (2)

- Days 5 to 10: the level rises. In the dark there is no photosynthesis, but both organisms keep respiring.
- After day 10: the level keeps rising, because **decomposers** such as bacteria feed on the dead snail and respire.

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$$

Figure: Respiration

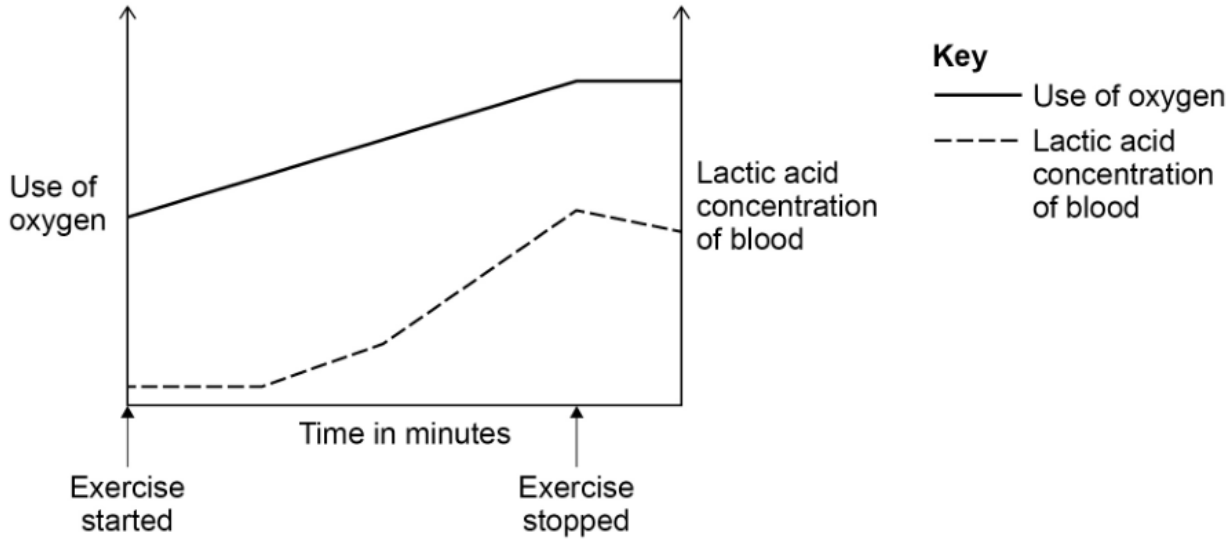


- Carbon dioxide concentration in the sealed tube over 15 days (AQA GCSE Biology Paper 1H, June 2021, Figure 7)
- Match each part of the diagram to the text.

Response to exercise

- During exercise, muscles need more energy, so they respire faster and need more oxygen and glucose.
- To supply them, the **heart rate** , the **breathing rate** and the **breath volume** all increase.
- During hard exercise the muscles may not get enough oxygen, so they respire anaerobically as well.
- **Lactic acid** builds up, and the muscles become **fatigued** : they stop contracting efficiently.

Figure: Response to exercise



- Oxygen use and blood **lactic acid** during and after exercise; each line has its own vertical scale (AQA GCSE Biology Paper 1H, June 2025, Figure 7)
- Match each part of the diagram to the text.

Metabolism

- glucose is joined into **starch**, **glycogen** (in animals) or **cellulose**;
- one molecule of **glycerol** and three **fatty acids** make a **lipid** molecule;
- glucose and **nitrate ions** make amino acids, which are joined into proteins;

Metabolism (2)

- respiration breaks down glucose;
- excess proteins are broken down to make **urea** , which is removed from the body by **excretion** in urine.

Exercises 2.1·2.2

2.1 Complete the word equation for aerobic respiration. [2]

glucose + ☐ → carbon dioxide + ☐

2.2 Yeast respires anaerobically in a sugar solution. Name the **two** products. [2]



yeast and sugar

Exercises 2.1·2.2

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2.1

- oxygen; water

2.2 Yeast respires anaerobically in a sugar solution. Name the **two** products. [2]



yeast and sugar

2.2

- ethanol; carbon dioxide

Exercise 2.3

2.3 Give **two** differences between aerobic and anaerobic respiration in human muscles. [2]



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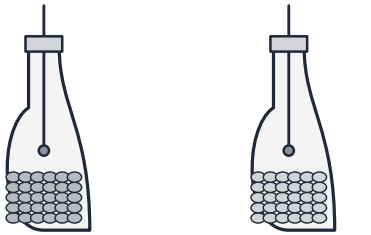


2.3

- any two: aerobic needs oxygen, anaerobic does not; aerobic transfers much more energy; aerobic makes carbon dioxide and water, anaerobic makes lactic acid

Exercise 3.1

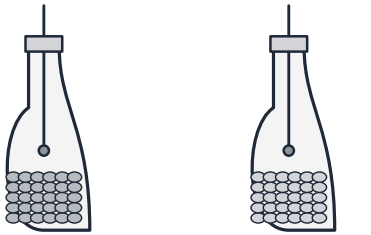
3.1 Flask A has germinating peas. Flask B has peas that have been boiled. After two days the thermometer in flask A reads higher. Explain why. [3]



A: germinating peas B: boiled peas

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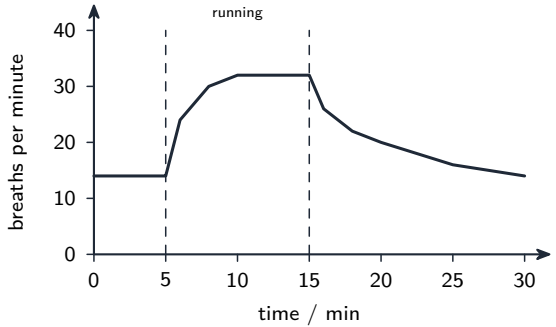
- the germinating peas in A are alive and respire
- respiration is exothermic: it transfers energy to the surroundings as heat
- the boiled peas in B are dead, so they do not respire; B is the control

Exercise 3.2 (a)

3.2 A student measures her breathing at rest, during 10 minutes of running, and after she stops.

	at rest	**running**	**5 min after**
breaths per minute	14	32	20
volume of each breath / dm^3	0.5	1.5	0.8

(a) Calculate the volume of air breathed each minute at rest and while running. [2]

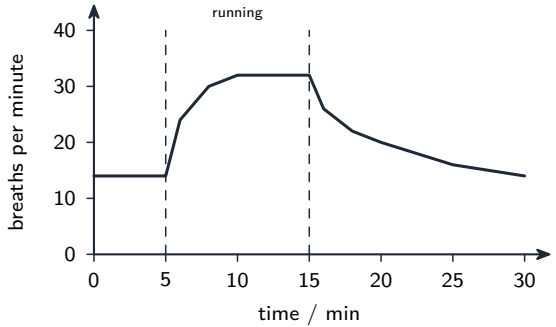


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(a) Calculate the volume of air breathed each minute at rest and while running. [2]



(a) rest: $14 \times 0.5 = \mathbf{7}$ dm^3/min; running: $32 \times 1.5 = \mathbf{48}$ dm^3/min

Exercise 3.2 (b)

3.2 A student measures her breathing at rest, during 10 minutes of running, and after she stops.

	at rest	**running**	**5 min after**
breaths per minute	14	32	20
volume of each breath / dm^3	0.5	1.5	0.8

(b) Explain why the volume of air breathed increases during exercise. [3]

Exercise 3.2 (b)

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(b) Explain why the volume of air breathed increases during exercise. [3]

(b) the muscles contract more, so they need more energy; so they respire faster and need more oxygen; and must get rid of more carbon dioxide

Exercise 3.2 (c)

3.2 A student measures her breathing at rest, during 10 minutes of running, and after she stops.

	at rest	**running**	**5 min after**
breaths per minute	14	32	20
volume of each breath / dm^3	0.5	1.5	0.8

(c) Explain why her breathing rate stays high after she stops running. [2]

Exercise 3.2 (c)

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(c) Explain why her breathing rate stays high after she stops running. [2]

(c) the muscles respired anaerobically and made lactic acid; extra oxygen is needed to react with the lactic acid (oxygen debt)

Exercise 3.2 (d)

3.2 A student measures her breathing at rest, during 10 minutes of running, and after she stops.

	at rest	**running**	**5 min after**
breaths per minute	14	32	20
volume of each breath / dm^3	0.5	1.5	0.8

(d) Compare aerobic respiration and anaerobic respiration in humans and in yeast. [6]

Exercise 3.2 (d)

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	at rest	**running**	**5 min after**
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(d) Compare aerobic respiration and anaerobic respiration in humans and in yeast. [6]

(d) points to include:

- aerobic respiration uses oxygen; anaerobic does not
- aerobic: glucose to carbon dioxide and water, in the mitochondria
- anaerobic in human muscles: glucose to lactic acid, e.g. in a sprint
- anaerobic in yeast: glucose to ethanol and carbon dioxide (fermentation), used for bread and beer
- aerobic transfers much more energy, because glucose is fully oxidised
- lactic acid causes an oxygen debt; yeast products are useful

Levels: **5–6** a full, logical answer with correct biology and correct terms; **3–4** several correct points, partly linked; **1–2** one or two relevant points.