

Exercise walk-through

12.3

Anaerobic respiration

IGCSE Biology

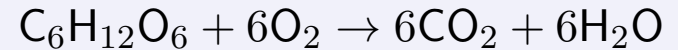
Aerobic respiration



Aerobic respiration releases energy steadily for sustained exercise.

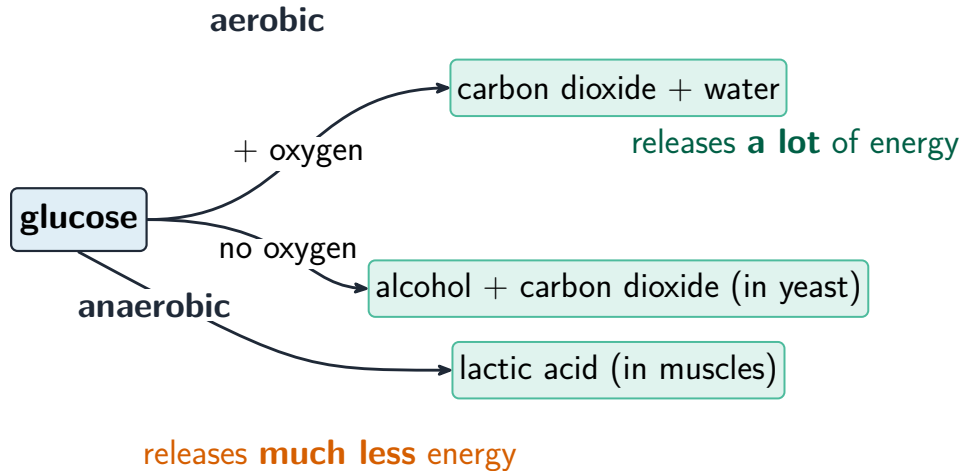
Word equation:

glucose + oxygen → carbon dioxide + water



Aerobic respiration releases far more energy per glucose molecule than anaerobic respiration.

Anaerobic respiration



Anaerobic respiration

works **without** oxygen, giving **much less** energy.

- yeast: glucose $\rightarrow$ **alcohol** + CO₂
- muscle: glucose $\rightarrow$ **lactic acid**

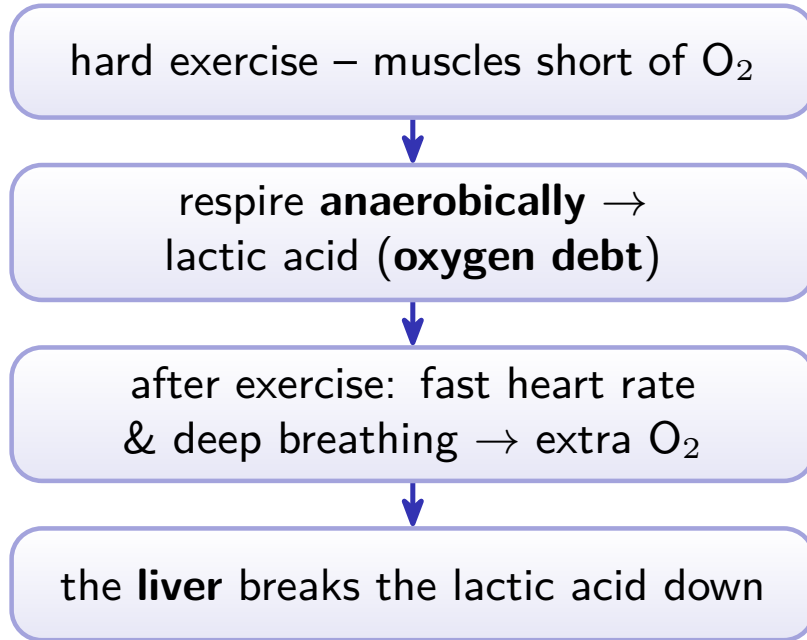
Both yeast products are used: the CO₂ makes **bread** rise, and the alcohol is what **brewing** is for.

In muscles (Supplement)

During hard exercise your muscles cannot get enough oxygen, so they respire anaerobically:

- your **heart rate** stays high, carrying the lactic acid in the blood from the muscles to the **liver** .
- you keep breathing deeply and quickly, taking in extra oxygen.
- the liver uses this oxygen to break the lactic acid down by aerobic respiration.

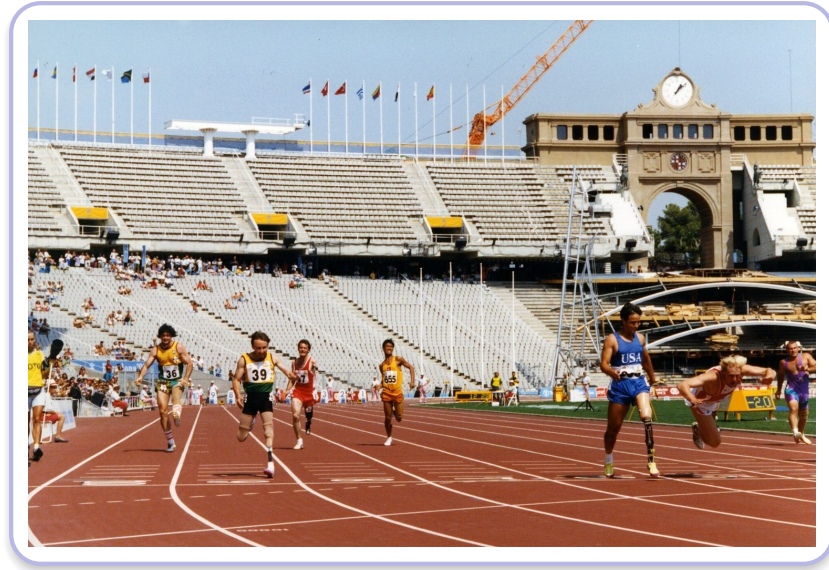
Oxygen debt



Lactic acid builds up – the **oxygen debt**

After exercise: a fast heart rate & deep breathing bring extra O₂, so the **liver** breaks the lactic acid down.

Anaerobic respiration, continued



A hard sprint relies on anaerobic respiration, building up lactic acid.

Exercises 2.1·2.2

2.1 Write the word equation for anaerobic respiration in yeast. [2]

2.2 Name the substance that builds up in muscles during hard exercise. [1]

Exercises 2.1·2.2

2.1 Write the word equation for anaerobic respiration in yeast. [2]

2.1

- yeast: **glucose** → **alcohol** + **carbon dioxide**
-

2.2 Name the substance that builds up in muscles during hard exercise. [1]

2.2

- hard exercise builds up **lactic acid** in muscles

Exercise 3.1

3.1 Compared with aerobic respiration, anaerobic respiration releases:

[1]

☐

A more energy

B much less energy

C the same energy

D no energy

Exercise 3.1

3.1 Compared with aerobic respiration, anaerobic respiration releases:

[1]

☐

A more energy

B much less energy

C the same energy

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3.1 B

- anaerobic respiration releases **much less energy**
- A is the opposite; C and D are false

Exercise 3.2 (a)

3.2 During a sprint the muscles respire anaerobically.

(a) Write the equation for anaerobic respiration in muscle.

[1]

Exercise 3.2 (a)

3.2 During a sprint the muscles respire anaerobically.

(a) Write the equation for anaerobic respiration in muscle.

[1]

(a)

- muscle: **glucose $\rightarrow$ lactic acid**

Exercise 3.2 (b)

3.2 During a sprint the muscles respire anaerobically.

(b) Explain what is meant by an oxygen debt.

[2]

Exercise 3.2 (b)

3.2 During a sprint the muscles respire anaerobically.

(b) Explain what is meant by an oxygen debt.

[2]

(b)

- the **extra oxygen needed after exercise**
- to **break down the lactic acid** that built up

Exercise 3.3

3.3 Describe how the oxygen debt is repaid after exercise.

[2]

Exercise 3.3

3.3 Describe how the oxygen debt is repaid after exercise.

[2]

3.3

- heart rate and breathing stay high, bringing **extra oxygen**
- the **liver** uses it to break down the lactic acid

Exercise 3.4 (a)

3.4 A runner sprints 400 m. For several minutes after finishing, she continues to breathe deeply and quickly.

(a) Write the word equation for anaerobic respiration in muscle, and the word equation for anaerobic respiration in yeast. [2]

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(a) Write the word equation for anaerobic respiration in muscle, and the word equation for anaerobic respiration in yeast. [2]

(a)

- muscle: glucose → **lactic acid**
- yeast: glucose → **alcohol + carbon dioxide**

Exercise 3.4 (b)

3.4 A runner sprints 400 m. For several minutes after finishing, she continues to breathe deeply and quickly.

(b) Explain why her muscles respire anaerobically during the sprint.

[3]

Exercise 3.4 (b)

3.4 A runner sprints 400 m. For several minutes after finishing, she continues to breathe deeply and quickly.

(b) Explain why her muscles respire anaerobically during the sprint. [3]

(b)

- muscles need energy **very quickly**
- the heart and lungs cannot deliver oxygen **fast enough**
- so muscles respire **without oxygen**, releasing far less energy per glucose

Exercise 3.4 (c)

3.4 A runner sprints 400 m. For several minutes after finishing, she continues to breathe deeply and quickly.

(c) Explain what the oxygen debt is and why she keeps breathing deeply after stopping. [4]

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3.4 A runner sprints 400 m. For several minutes after finishing, she continues to breathe deeply and quickly.

(c) Explain what the oxygen debt is and why she keeps breathing deeply after stopping. [4]

(c)

- oxygen debt: extra oxygen taken in **after** exercise
- to **break down lactic acid**
- lactic acid is oxidised in the **liver**
- she keeps breathing hard until enough oxygen has been taken in

Exercise 3.4 (d)

3.4 A runner sprints 400 m. For several minutes after finishing, she continues to breathe deeply and quickly.

(d) State **two** reasons why anaerobic respiration cannot replace aerobic respiration in the long term. [2]

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(d) State **two** reasons why anaerobic respiration cannot replace aerobic respiration in the long term. [2]

(d)

- it releases **far less energy** per glucose, so it cannot last
- lactic acid **lowers pH**, causes cramp, and would damage cells