

12.3 Anaerobic respiration

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

KEY WORDS anaerobic respiration 无氧呼吸 • lactic acid 乳酸 • oxygen debt 氧债 • liver 肝脏
• heart rate 心率

Objective

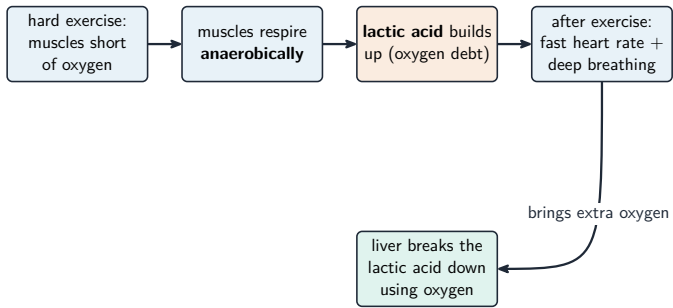
Build the skills to answer exam questions on **anaerobic respiration** 无氧呼吸 — the equations in yeast and muscle, and the **oxygen debt** 氧债.

You must be able to:

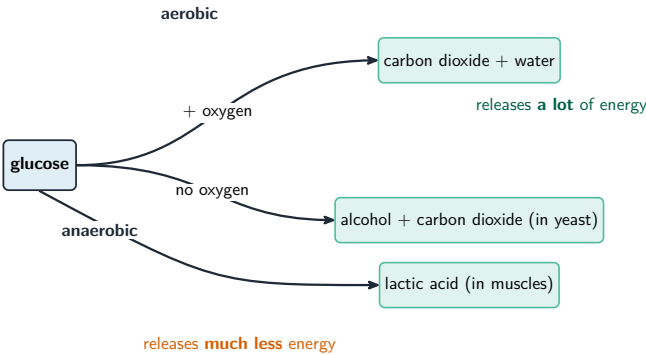
- write the anaerobic equations for yeast and for muscle
- compare the energy released with aerobic respiration
- explain the oxygen debt and how it is repaid

1 Worked examples

■ Anaerobic respiration & oxygen debt



Anaerobic respiration: no oxygen, much less energy



Anaerobic respiration compared with aerobic

- **yeast:** glucose → alcohol + carbon dioxide.
- **muscle:** glucose → lactic acid → an **oxygen debt** (extra O₂ needed later).

2 Practice

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]

3 Exam-style questions

3.1 Compared with aerobic respiration, anaerobic respiration releases: [1]

- A more energy
- B much less energy
- C the same energy
- D no energy

3.2 During a sprint the muscles respire anaerobically.

(a) Write the equation for anaerobic respiration in muscle. [1]

(b) Explain what is meant by an oxygen debt. [2]

3.3 Describe how the oxygen debt is repaid after exercise. [2]

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]

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

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

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

Solutions

2.1 glucose $\rightarrow$ alcohol + carbon dioxide.

2.2 lactic acid.

3.1 B. Anaerobic respiration releases much less energy.

3.2 (a) glucose $\rightarrow$ lactic acid.

(b) it is the extra oxygen needed after exercise to break down the lactic acid that built up.

3.3 the heart rate stays high and breathing stays deep, bringing extra oxygen; the liver uses it to break down the lactic acid.

3.4 (a) Muscle: glucose $\rightarrow$ lactic acid. Yeast: glucose $\rightarrow$ alcohol (ethanol) + carbon dioxide.

(b) During a sprint the muscles need energy very quickly; the heart and lungs cannot deliver oxygen fast enough to keep up with the demand; so the muscles release some energy without oxygen, even though this releases far less per glucose molecule.

(c) The oxygen debt is the extra oxygen the body must take in **after** exercise to break down the lactic acid that built up. The lactic acid is carried in the blood to the liver, where it is oxidised to carbon dioxide and water; she keeps breathing hard until enough oxygen has been taken in to remove it all.

(d) It releases far less energy from each glucose molecule, so it cannot meet the body's needs for long; the lactic acid that builds up lowers the pH, causes cramp and fatigue, and would damage cells if it were not removed.