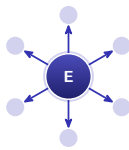


Respiration

IGCSE Biology ■ Topic 12

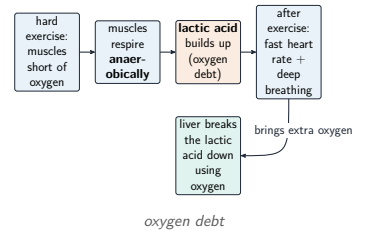
IGCSE Biology



Respiration

What we will cover

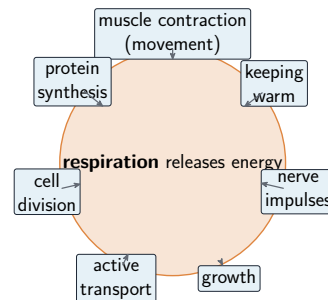
- 1 Respiration & energy
- 2 Aerobic respiration
- 3 Anaerobic respiration
- 4 Oxygen debt



1 Energy

Respiration
└ Energy

Respiration and energy

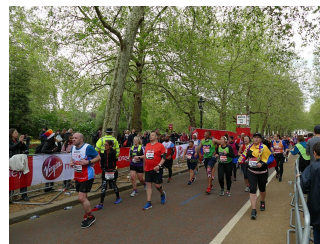


- **muscle** 肌肉 contraction (movement).
- **protein synthesis** 蛋白质合成 (building proteins).
- **cell division** 分裂 (making new cells).
- **active transport** 主动运输.

2 Aerobic and anaerobic

Respiration
└ Aerobic and anaerobic

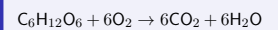
Aerobic respiration



Aerobic respiration releases energy steadily for sustained exercise.

Word equation:

glucose + oxygen → carbon dioxide + water



Aerobic respiration releases a...

Respiration
↳ Aerobic and anaerobic

Anaerobic respiration

glucose

+ oxygen

aerobic

carbon dioxide + water

releases a lot of energy

no oxygen

anaerobic

alcohol + carbon dioxide (in yeast)

lactic acid (in muscles)

releases much less energy

Anaerobic respiration 无氧呼吸 works **without** oxygen, giving **much less** energy.

■ yeast: glucose → **alcohol** 酒精 + CO₂

■ muscle: glucose → **lactic acid** 乳酸

Respiration
↳ Aerobic and anaerobic

Oxygen debt

hard exercise – muscles short of O₂

↓

respire **anaerobically** → lactic acid (**oxygen debt**)

↓

after exercise: fast heart rate & deep breathing → extra O₂

↓

the **liver** breaks the lactic acid down

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

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

3

Recap

Respiration
↳ Recap

Worked example – aerobic or anaerobic?

A sprinter's muscles ache after a 200 m race. Explain what happened.

■ Sprinting needs energy **faster** than the blood can deliver oxygen.

■ So muscles also respire **anaerobically** 无氧地: glucose → **lactic acid** (+ a little energy).

■ Lactic acid **builds up** in the muscle, causing the ache and fatigue.

■ Afterwards you keep panting to repay the **oxygen debt** and break the lactic acid down.

Aerobic: glucose + oxygen → CO₂ + water, **lots** of energy. Anaerobic in muscle: glucose → lactic acid, **little** energy, no oxygen needed.

Respiration
↳ Recap

Topic 12 – key takeaways

1 **Respiration**

releases energy in all cells, all the time

2 **Aerobic**

glucose + O₂ → CO₂ + water; lots of energy

3 **Anaerobic**

no O₂; alcohol (yeast) or lactic acid

4 **Oxygen debt**

repaid; liver breaks down lactic acid

Respiration
↳ Recap

Check yourself

1 Where in the body does respiration happen?

2 What are the products of aerobic respiration?

3 What does anaerobic respiration make in muscles?

4 Which organ breaks down lactic acid?

Answers 1. in every living cell 2. carbon dioxide & water 3. lactic acid 4. the liver