Your notes

GCSE Biology: revision notes

Respiration and metabolism

Contents

1. Start here: where your energy comes from
2. Aerobic respiration
3. Anaerobic respiration
4. Response to exercise
5. Metabolism
6. Exam tip
7. Common mistakes
8. Key terms
9. Quick questions
10. What to do next

Start here: where your energy comes from

- Every cell needs a constant supply of energy: to move, to build big molecules and to keep warm. It gets it from **respiration**.
- **Respiration** is a chemical reaction that releases energy from glucose. It happens all the time in every living cell; it is not the same as breathing.
- With oxygen, it is **aerobic respiration**, which releases a lot of energy. Without enough oxygen, cells use **anaerobic respiration**, which releases much less.

Aerobic respiration

- **Respiration** is an **exothermic** reaction that happens continuously in living cells to release energy for their processes.
- **Aerobic respiration** uses oxygen and happens mostly in **mitochondria**.
- Word equation: glucose + oxygen → carbon dioxide + water.
- Symbol equation: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$.
- Organisms need energy for chemical reactions that build larger molecules, for movement and, in mammals and birds, to keep warm.

Anaerobic respiration

- **Anaerobic respiration** happens without oxygen and releases much less energy than **aerobic respiration**, because glucose is only partly broken down.
- In muscles: glucose → **lactic acid**.
- In plant and yeast cells: glucose → ethanol + carbon dioxide. In yeast this is called **fermentation**.
- **Fermentation** is used to make bread (the CO_2 makes dough rise) and alcoholic drinks (ethanol).

Response to exercise

- During exercise, heart rate, breathing rate and breath volume increase to supply the muscles with more oxygenated blood and remove carbon dioxide.
- If muscles don't get enough oxygen, they respire anaerobically and **lactic acid** builds up. Muscles become fatigued and stop contracting efficiently.
- The **oxygen debt** is the amount of extra oxygen the body needs after exercise to react with the **lactic acid** and remove it from the cells.
- (Higher) Blood carries **lactic acid** to the liver, where it is converted back into glucose.

Metabolism

- **Metabolism** is the sum of all the reactions in a cell or the body. Energy from **respiration** is used for many of them.
- Examples: glucose is converted to starch, **glycogen** and cellulose; one glycerol and three fatty acids form a lipid molecule.
- Glucose and nitrate ions make amino acids, which are used to make proteins.
- Excess proteins are broken down to form urea for excretion.

Exam tip

- Know both types: aerobic gives carbon dioxide and water; anaerobic in muscles gives **lactic acid**; anaerobic in yeast gives ethanol and carbon dioxide.
- After exercise, use the words '**oxygen debt**' when you explain why you keep breathing hard.

Common mistakes

- Mixing up **respiration** with breathing.
- Saying **respiration** makes energy. It releases it.
- Saying **anaerobic respiration** in muscles makes carbon dioxide.

Key terms

Respiration	An exothermic reaction in cells that releases energy from glucose.
Aerobic respiration	Respiration using oxygen: glucose + oxygen → carbon dioxide + water.
Anaerobic respiration	Respiration without oxygen, releasing less energy.
Lactic acid	The product of anaerobic respiration in muscles.
Fermentation	Anaerobic respiration in yeast, producing ethanol and carbon dioxide.

Your notes

Oxygen debt	The extra oxygen needed after exercise to react with lactic acid and remove it from cells.
Exothermic	A reaction that transfers energy to the surroundings.
Metabolism	The sum of all the reactions in a cell or the body.
Mitochondria	The organelles where aerobic respiration happens.
Glycogen	A carbohydrate that stores glucose in the liver and muscles.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What are the products of aerobic respiration?
2. Where does aerobic respiration mostly happen?
3. What is the product of anaerobic respiration in muscles?
4. What are the products of anaerobic respiration in yeast?
5. Why does anaerobic respiration release less energy than aerobic?
6. Why does bread dough rise?
7. What is oxygen debt? (Higher)
8. Why does heart rate increase during exercise?

Answers

1. Carbon dioxide and water
2. Mitochondria
3. Lactic acid
4. Ethanol and carbon dioxide
5. Glucose is only partly broken down
6. Yeast makes carbon dioxide by fermentation
7. The extra oxygen needed after exercise to remove lactic acid
8. To deliver more oxygen and glucose to the muscles

What to do next

Practise 13 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

Free revision for GCSE and KS3 at lycolearn.co.uk. Some notes are for one exam board only, and say so in brackets.

Your notes