KS3 SCIENCE · BIOLOGY

Respiration revision sheet

Name _____

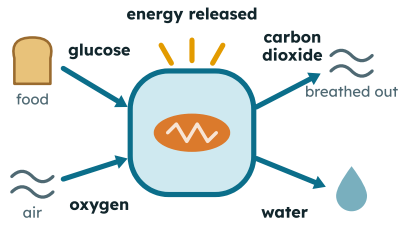


1. What is respiration?

- **Respiration** is a chemical reaction that happens in every living cell. It **releases energy** from glucose.
- Every living cell respires all the time, in plants as well as in animals. Cells need the energy to move, to keep warm and to grow.
- Respiration that uses oxygen happens in the **mitochondria**. The energy is released a little at a time.
- **Breathing is not respiration.** Breathing moves air into and out of the lungs. Respiration is a chemical reaction inside cells.

Watch out: respiration *releases* energy. Never write that it "makes" energy.

2. Aerobic respiration

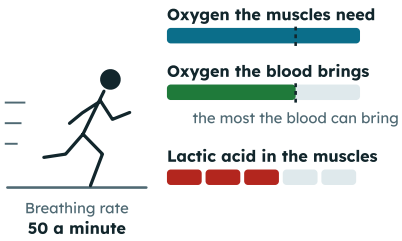


What goes into a cell and what comes out

glucose + oxygen → carbon dioxide + water Energy is released.

- **Aerobic** respiration uses oxygen. **Reactants:** glucose, from digested food, and oxygen, from the air you breathe in. The blood carries both to the cells.
- **Products:** carbon dioxide and water. The blood carries the carbon dioxide to the lungs, and you breathe it out.
- Energy is not a substance, so it is not a reactant or a product.
- **Pearson Edexcel only:** respiration produces a substance called ATP, which provides the energy that the cell uses. The balanced symbol equation is $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$.

3. Running out of oxygen

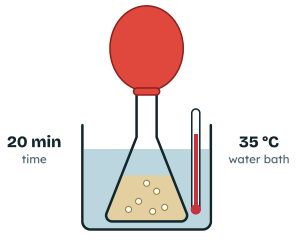


In a sprint, the muscles need more oxygen than the blood can bring

glucose → lactic acid A little energy is released.

- **Anaerobic** means without oxygen. In hard exercise, such as a sprint, muscle cells respire anaerobically as well as aerobically.
- **Lactic acid** is the product. It builds up in the muscles, which ache and tire.
- **Less energy** is released from each glucose molecule than in aerobic respiration.
- **Oxygen debt:** after the exercise you keep breathing hard. The extra oxygen breaks down the lactic acid.

4. Fermentation



Yeast and glucose solution after 20 minutes at 35 °C

glucose → ethanol + carbon dioxide A little energy is released.

- **Fermentation** is anaerobic respiration in **yeast**, a fungus made of single cells.
- **Making bread:** bubbles of carbon dioxide make the dough rise. Nearly all the ethanol evaporates in the hot oven.
- **Brewing:** yeast ferments the sugar in grape juice or in barley. The ethanol is the alcohol in wine and beer.
- **Warmth speeds fermentation up**, but too much heat kills the yeast. With no glucose, hardly any gas is made.

Flask	Glucose, 5 °C	Glucose, 20 °C	Glucose, 35 °C	No glucose, 35 °C
Balloon after 20 min	1 cm	4 cm	9 cm	flat

5. Aerobic or anaerobic?

	AEROBIC RESPIRATION	ANAEROBIC RESPIRATION IN MUSCLES	FERMENTATION IN YEAST
Needs oxygen?	Yes	No	No
Reactants	Glucose and oxygen	Glucose	Glucose
Products	Carbon dioxide and water	Lactic acid	Ethanol and carbon dioxide
Energy released from each glucose molecule	A lot	A little	A little
When?	Most of the time	In hard exercise, when the blood cannot bring oxygen fast enough	When the yeast has no oxygen

- **The same:** all three happen in living cells, use glucose and release energy.

Aerobic respiration

Anaerobic respiration

The energy released from one glucose molecule



A long, steady ride
Aerobic: the blood brings enough oxygen.



A sprint
Anaerobic as well: oxygen cannot arrive fast enough.



Bread dough
Fermentation: carbon dioxide makes it rise.



Brewing
Fermentation: the ethanol stays in the drink.

Key words

Respiration: a chemical reaction in cells that releases energy from glucose

Aerobic respiration: respiration that uses oxygen

Glucose: the sugar that cells break down in respiration

Carbon dioxide: the gas made in aerobic respiration and in fermentation

Lactic acid: the product of anaerobic respiration in muscles

Fermentation: anaerobic respiration in yeast

Ethanol: the alcohol made in fermentation

Reactant: a substance that is used up in a chemical reaction

Word equation: shows the reactants and products of a reaction in words

Breathing: moving air into and out of the lungs

Anaerobic respiration: respiration without oxygen

Oxygen: the gas that aerobic respiration uses up

Mitochondria: the parts of a cell where aerobic respiration happens

Oxygen debt: the extra oxygen needed after hard exercise to break down lactic acid

Yeast: a fungus made of single cells, used to make bread and beer

Microorganism: a living thing too small to see without a microscope

Product: a substance that is made in a chemical reaction

Pictures are illustrations made for this sheet, not real photographs.