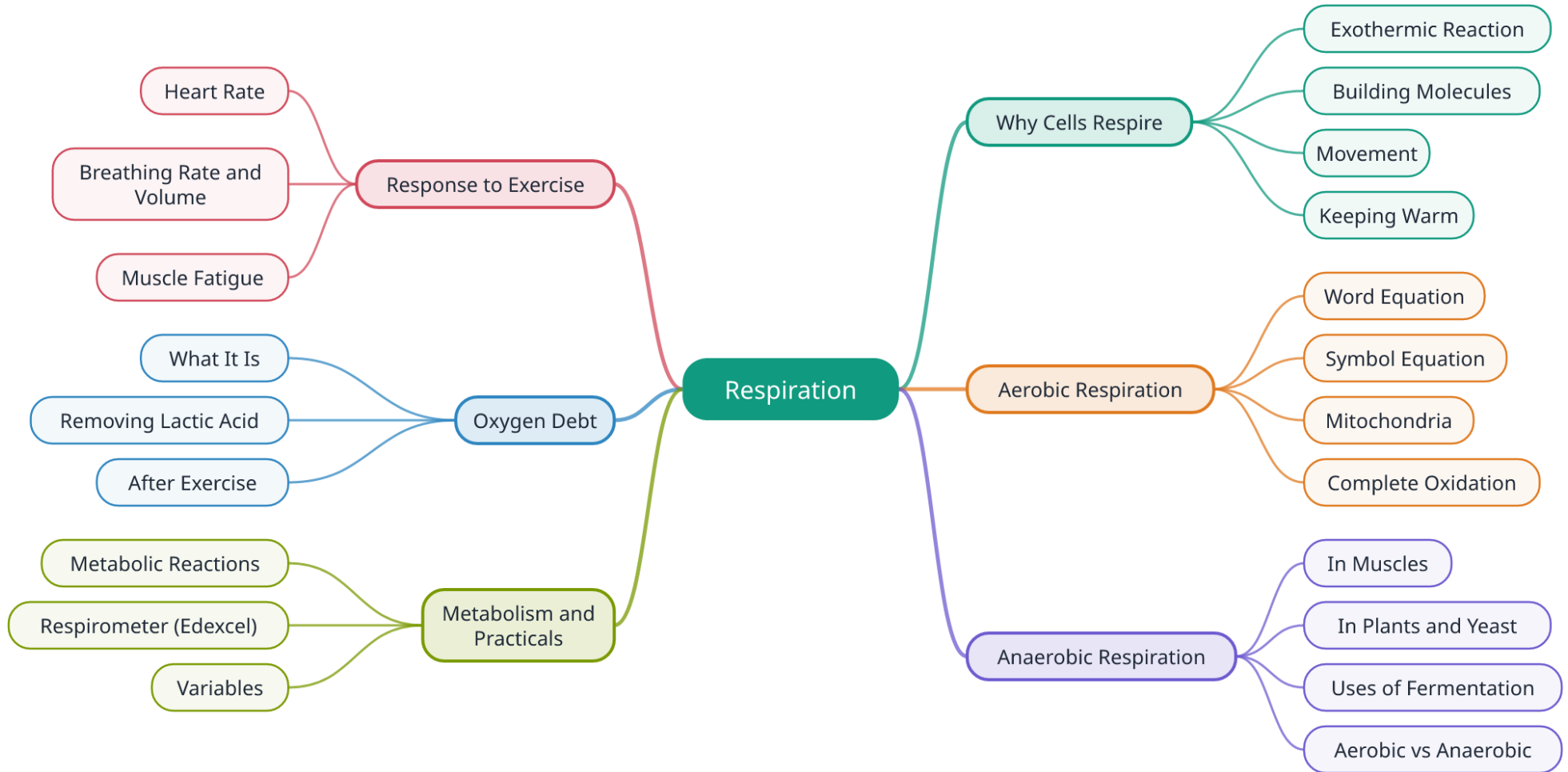


Respiration Mind Map (GCSE)

GCSE · Biology · mindmap.ai/mind-maps/respiration



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Respiration mind map explained

Why Cells Respire

Respiration is a chemical reaction that transfers energy from glucose. It happens continuously in every living cell.

Exothermic Reaction

Respiration transfers energy to the environment, so it is exothermic. It is not the same as breathing, which only moves air in and out of the lungs.

Building Molecules

Energy is used for chemical reactions that build larger molecules, such as proteins from amino acids.

Movement

Energy is needed for muscles to contract.

Keeping Warm

Mammals and birds use energy to keep their body temperature steady.

Aerobic Respiration

Respiration using oxygen. It releases far more energy than anaerobic respiration.

Word Equation

glucose + oxygen → carbon dioxide + water

Symbol Equation

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$. It is the photosynthesis equation in reverse.

Mitochondria

Aerobic respiration happens in the mitochondria. Cells that need a lot of energy, such as muscle and sperm cells, have many of them.

Complete Oxidation

Glucose is fully broken down, so all the energy that can be released is released.

Anaerobic Respiration

Respiration without oxygen. The oxidation of glucose is incomplete, so much less energy is released than in aerobic respiration.

In Muscles

glucose → lactic acid. Happens during hard exercise, when the muscles cannot get enough oxygen.

In Plants and Yeast

glucose → ethanol + carbon dioxide. In yeast this is called fermentation.

Uses of Fermentation

The carbon dioxide makes bread rise, and the ethanol is the alcohol in beer and wine.

Aerobic vs Anaerobic

- Aerobic needs oxygen; anaerobic does not
- Aerobic makes carbon dioxide and water; anaerobic makes lactic acid, or ethanol and carbon dioxide
- Aerobic releases much more energy

Response to Exercise

During exercise the muscles need more energy, so the body supplies them with more oxygen and glucose.

Heart Rate

Increases, so blood carries oxygen and glucose to the muscles faster and removes carbon dioxide.

Breathing Rate and Volume

Both increase, so more oxygen enters the blood and more carbon dioxide is breathed out.

Muscle Fatigue

In long periods of hard exercise, muscles become tired and stop contracting efficiently. Lactic acid builds up as they respire anaerobically.

Oxygen Debt

Mainly AQA, higher tier. Why you keep breathing hard after exercise has stopped.

What It Is

The amount of extra oxygen the body needs after exercise to react with the lactic acid that has built up and remove it from the cells.

Removing Lactic Acid

Blood carries lactic acid from the muscles to the liver, where it is converted back into glucose.

After Exercise

Heart rate and breathing stay high until the oxygen debt is repaid.

Metabolism and Practicals

Metabolism is the sum of all the reactions in a cell or the body. Respiration supplies the energy for many of them.

Metabolic Reactions

AQA lists:

- Glucose into starch, glycogen and cellulose
- One glycerol and three fatty acids into a lipid
- Glucose and nitrate ions into amino acids, then proteins
- Respiration
- Excess proteins broken down to urea for excretion

Respirometer (Edexcel)

Edexcel core practical. Small organisms such as woodlice or germinating seeds are sealed in a tube with soda lime, which absorbs carbon dioxide. As they use oxygen, a drop of coloured liquid moves along a scale, showing the rate of respiration.

Variables

- Independent: usually temperature
- Dependent: distance the liquid moves in a set time
- Control: the number and mass of organisms, and the time

How to revise with this mind map

1. Learn both equations for aerobic respiration, and the two anaerobic ones. A common exam slip is giving lactic acid for yeast, or carbon dioxide for muscles.
2. Keep respiration and breathing separate. Respiration is a chemical reaction in every cell; breathing is moving air in and out of the lungs. Mixing them up costs marks.
3. Compare aerobic and anaerobic respiration in a table: whether oxygen is needed, the products, how much energy is released and where each happens.
4. For exercise questions, link each change to a reason. Heart rate rises so that more oxygen and glucose reach the muscles, not just because you are working hard.
5. Make it yours. Build your own respiration map in Mindmapai from your class notes, and ask the AI about any branch you are unsure of. The answer is saved into that branch's notes for next time.