

CIE Biology GCSE

12: Respiration

Notes





Respiration is a **chemical reaction** which happens in almost all cells in the body to **produce energy from nutrient molecules**. This energy can be used in a variety of processes including:

- Muscle contraction
- Protein synthesis
- Cell division
- Active transport
- Growth
- Nerve impulses
- Maintaining body temperature

Respiration usually occurs with the presence of oxygen (**aerobic respiration**), although it can occur in the absence of oxygen (**anaerobic respiration**). Anaerobic respiration is **less efficient** and leads to **fatigue** in humans. Both types of respiration are **catalysed by enzymes**. This means that the **rate of respiration** can be influenced by factors such as **temperature and pH**.

Aerobic Respiration:

Aerobic respiration occurs in the presence of **oxygen**. **Glucose** is broken down into **carbon dioxide, water and energy** with the help of oxygen. This occurs in the cell **mitochondria**. Cells which require lots of energy, such as muscle cells, therefore have high amounts of mitochondria.

Equations for aerobic respiration:

- glucose + oxygen → carbon dioxide + water
- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

Anaerobic respiration:

Anaerobic respiration occurs when **oxygen is not present**. It is **less efficient** than aerobic respiration and **produces less energy** per glucose molecule. It occurs in the cell **cytoplasm** and thus does not require mitochondria.

Animal cells undergo anaerobic respiration during **vigorous exercise** as not enough oxygen is delivered to muscles. In this reaction, glucose is broken down to produce **lactic acid**, as well as releasing energy. This lactic acid builds up in muscles and causes muscle fatigue. Anaerobic respiration also produces an '**oxygen debt**'. To repay this, the lactic acid must be transported to the **liver** where it is broken down into carbon dioxide and water **using oxygen**. This is the reason why the **breathing and heart rates remain high** after exercise.



Microorganisms, such as **yeast**, also undergo anaerobic respiration. Yeast breaks down anaerobically to form **alcohol and carbon dioxide** instead of lactic acid.

Equations for anaerobic respiration in yeast:

- glucose → alcohol + carbon dioxide
- $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

Equation for anaerobic respiration in animal cells:

- glucose → lactic acid

