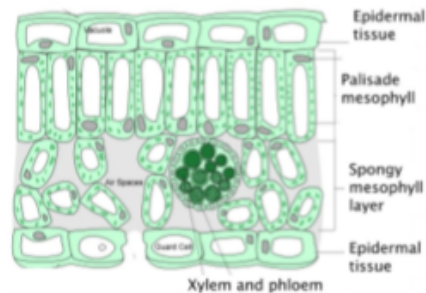


Key term	Definition	Key term	Definition
aerobic respiration	Breaking down glucose with oxygen to release energy and producing carbon dioxide and water.	nitrates (biology)	Minerals containing nitrogen for healthy growth.
algae	Green uni-cellular or multi-cellular organisms that perform photosynthesis and live underwater.	oxygen debt	Extra oxygen required after anaerobic respiration to break down lactic acid.
anaerobic respiration	Releasing energy from the breakdown of glucose without oxygen, producing lactic acid (in animals) and ethanol and carbon dioxide (in plants and microorganisms).	phosphates	Mineral containing phosphorus for healthy roots.
biotechnology	The use of biological processes or organisms to create useful products.	photosynthesis	The process plants and algae use to make their own food, glucose. In photosynthesis, carbon dioxide and water react together to make glucose and oxygen.
chlorophyll	Green pigment in plants and algae which absorbs light energy.	plasma	Liquid that transports blood cells and other materials around the body.
deficiency	A lack of minerals that causes poor growth.	potassium	A mineral needed by plants for healthy leaves and flowers.
fermentation	A type of anaerobic respiration in which glucose is converted into ethanol, carbon dioxide, and energy.	producer	Organism that makes its own food using photosynthesis.
fertiliser	Chemicals containing minerals that plants need to build new tissues.	stomata	Pores in the bottom of a leaf which open and close to let gases in and out.
haemoglobin	The substance in blood that carries oxygen around the body.		
iodine	Indicator used to test for the presence of starch.		
magnesium	A mineral needed by plants for making chlorophyll. It is an element in group 2 of the Periodic Table.		

Photosynthesis is the process of plants producing **glucose** and the waste product **oxygen** from **carbon dioxide** and **water**:



Photosynthesis is an **endothermic** reaction; plants need to take in **light energy** from the surroundings for the **chloroplasts** to carry out the photosynthesis reaction.

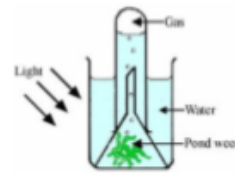


Leaves are well-adapted for photosynthesis:



- they are broad and flat providing a large surface area for absorbing light
- they are thin so gases do not need to diffuse far
- they contain **chlorophyll** in **chloroplasts** to absorb light
- they have veins to transport water to the leaves and glucose from them
- they have air spaces in the **mesophyll layer** for gas movement
- they have **stomata** and **guard cells** to allow O_2 and CO_2 into and out of the leaf.

The rate of photosynthesis can be measured by measuring the amount of oxygen produced or counting the number of bubbles.



The rate of photosynthesis is affected by:

- temperature
- light intensity
- carbon dioxide concentration

The rate of photosynthesis also depends on the amount of chlorophyll in the leaves.

Greenhouses can be used to optimise the conditions for photosynthesis.

Plants have many uses for glucose produced by photosynthesis:

- used for **respiration**
- converted into **starch** for storage (glucose is **soluble**, starch is **insoluble**)
- producing fat or oil for storage
- producing **cellulose** for strengthening cell walls
- producing **amino acids** for **protein synthesis** (plants also need **nitrites** from the soil to do this).

Respiration is the process of releasing energy from glucose. It is an **exothermic** reaction since it releases energy.

Respiration takes place in the **mitochondria** of cells.

Organisms need the energy from respiration for all life processes, including:

- movement
- keeping warm
- chemical reactions

Aerobic respiration (using oxygen):



During exercise, more oxygen needs to be supplied to the muscle cells to carry out aerobic respiration.

The **heart rate** increases to supply more oxygenated blood to the muscles.

The **breathing rate** and **breath volume** increases to take in more oxygen and remove carbon dioxide faster.

Glycogen stored in the body is converted back into glucose for energy. **Anaerobic respiration** (without oxygen):

In animals:



The oxidation of glucose is incomplete, so less energy is released than aerobic respiration.

Lactic acid can cause muscle cramps.

Oxygen is needed to break down the lactic acid:



This is known as the **oxygen debt**.

In plants:



Anaerobic respiration in plants is called **fermentation**, and is used in making bread and alcoholic drinks.