

WJEC (England) Biology GCSE

Topic 5: Photosynthesis

Notes

(‘Higher Tier only’ in **bold**)

This work by [PMT Education](https://www.pmt.education) is licensed under [CC BY-NC-ND 4.0](https://creativecommons.org/licenses/by-nc-nd/4.0/)



5.1 Photosynthesis

Photosynthesis is a metabolic reaction occurring in green plants and some other photosynthetic organisms, during which **light energy** converts raw materials into **carbohydrates** such as glucose. This can then be stored in cells and used as an energy source via respiration. Photosynthesis occurs in the **chloroplasts** of plant cells. Chloroplasts contain **chlorophyll** that **transfers light energy into chemical energy**.

Photosynthesis involves a series of **endothermic chemical reactions** catalysed by **enzymes**. Carbon dioxide and water are converted to glucose and oxygen (waste product) in the presence of light.

This reaction can be described in the word equation:



Factors affecting the rate of photosynthesis

The rate of photosynthesis is determined by the **limiting factor**. This is the **factor which is least available** to the plant. For example, at night the light intensity is very low, hence the rate of photosynthesis is also very low, regardless of the carbon dioxide concentration and temperature.

There are three main limiting factors of photosynthesis:

- **Carbon dioxide concentration** - As CO₂ concentration increases, the rate of photosynthesis also increases.
- **Temperature** - Photosynthesis requires enzymes to carry out the reaction. As these enzymes have an optimum temperature, photosynthesis also has an optimum temperature. This is usually about 25°C. At low temperatures, for example in the winter, plants photosynthesise slowly as the enzymes have little kinetic energy, thus few enzyme-substrate complexes are made. At very high temperatures, these enzymes denature, also slowing the rate of photosynthesis.
- **Light intensity** - As the light intensity increases, the rate of photosynthesis increases. **This obeys the inverse square law, meaning that light intensity is inversely proportional to the square of the distance between the plant and light source: ($I \propto \frac{1}{d^2}$), where I is the light intensity and d is the distance between the plant and the light source.**

These factors can **interact**, for example a high light intensity can sometimes lead to the plant heating up above the optimum temperature, thus temperature would become the limiting factor and the rate of photosynthesis would not be increased by a further increase in light intensity.

