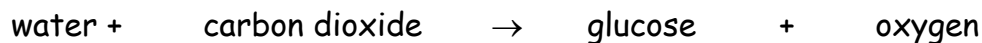


## Living Cells

### Part E Photosynthesis

**Photosynthesis** is a series of **enzyme** controlled reactions that allow green plants to capture light energy and use it to manufacture glucose.

During photosynthesis:

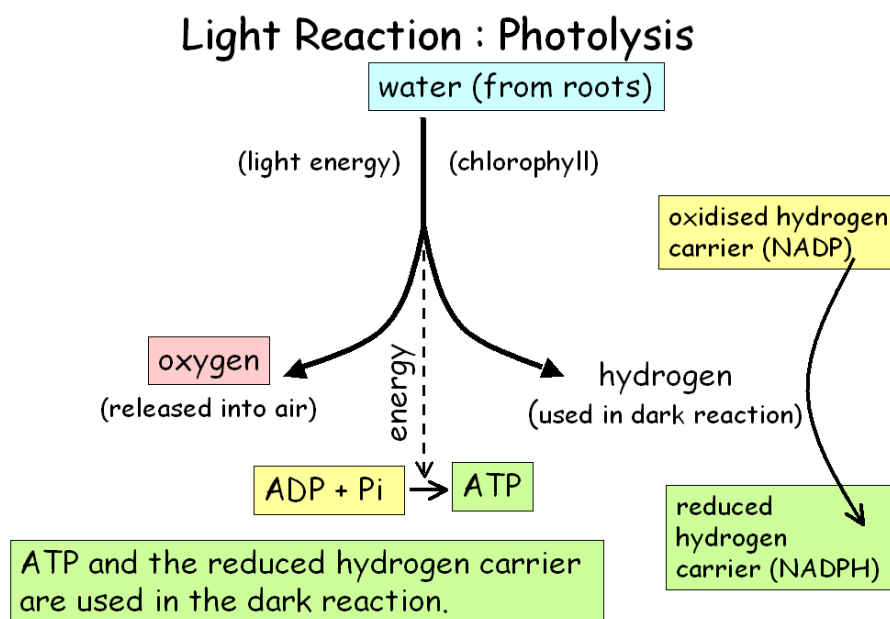


For the above reaction to occur **light** energy must also be present.

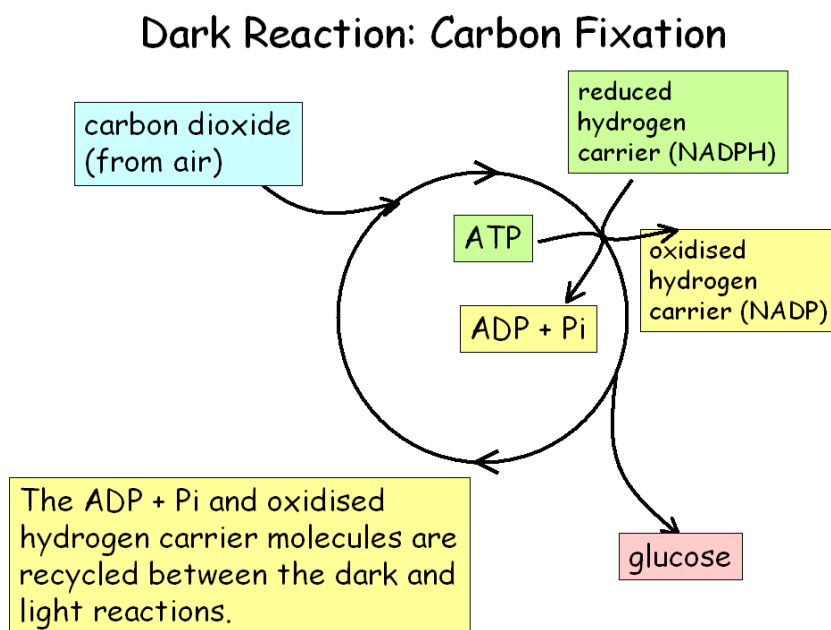
Photosynthesis occurs as two main stages or groups of reactions - **Photolysis** and **Carbon Fixation**.

**Photolysis** - This is also known as the light reaction of photosynthesis. The pigment **chlorophyll** absorbs light energy and uses it to split water molecules ( $\text{H}_2\text{O}$ ) into **hydrogen** and **oxygen** atoms. During this series of reactions, **ATP** (adenosine triphosphate) molecules are generated. The hydrogen atoms and ATP molecules are used in the next stage of photosynthesis. Oxygen is released as a **waste** product.

A summary of the light reaction or photolysis can be seen below.



**Carbon Fixation** - This is also known as the dark reaction of photosynthesis. **Hydrogen** atoms from the light reaction and **carbon dioxide** from the air join together. The energy necessary to allow these reactions to occur comes from the **ATP** molecules generated during the light reaction of photosynthesis. By a series of enzyme controlled reactions, carbon dioxide and water molecules join together to produce a **glucose** molecule.



The plant will either use the glucose molecules straight away as a food source for **respiration**, or combine glucose molecules together as a **starch** molecule for **storage**.

A variety of factors can affect the rate of photosynthesis. We can measure the rate of photosynthesis by:

- Volume of **oxygen** produced per unit time.
- Volume of **carbon dioxide** consumed per unit time.
- Concentration of **glucose** produced per unit time.

The factors that can affect the rate of photosynthesis include:

- **Temperature** : Photosynthesis is a series of enzyme controlled reactions. Enzymes are very sensitive to temperature.

- **Carbon dioxide** concentration : Carbon dioxide is a raw material of photosynthesis. If we limit the concentration of a raw material we will limit the rate at which the reaction proceeds.
- **Water** availability: Water is a raw material of photosynthesis. If we limit the availability of a raw material we will limit the rate at which the reaction proceeds.
- **Light** intensity: Limit the rate of the light dependent stage of photosynthesis and we will limit the overall rate of photosynthesis.

Farmers and growers can utilise knowledge of the limiting factors to promote a greater **yield** of crops. As with any commercial enterprise, they must ensure that the improved yield will provide a **profit**. The grower must ensure that the increased **costs** do not cancel any increased profit they may make. If increased costs, due to additional heating and lighting, are greater than any potential profit then it is not **economically viable** to consider attempting to increase the yield of crops by these methods.