Knowledge organiser – 9.4 Photosynthesis

Plants and algae are called producers. Plants use glucose as an energy source and to build new tissue. Some glucose is stored to use later.

PHOTOSYNTHESIS; A chemical reaction in which plants take in carbon dioxide (from the air) and water (from the soil) and change them into glucose (food) and oxygen (waste product).

Word equation

Carbon dioxide + Water $\xrightarrow{\text{Light, Chlorophyll}}$ Glucose + Oxygen

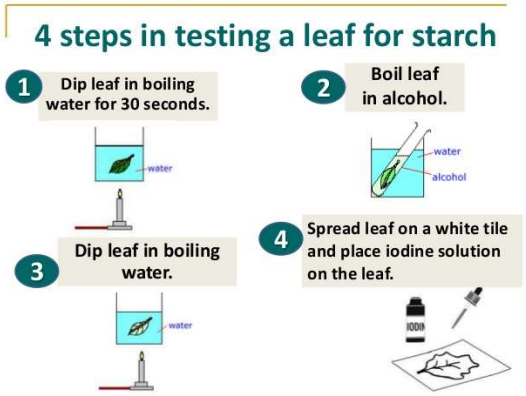
Symbol equation

$6CO_2 + 6H_2O \xrightarrow{\text{Light, Chlorophyll}} C_6H_{12}O_6 + 6O_2$

Plant organs such as leaf, stem and roots are adapted for the plant to carry out photosynthesis.

Photosynthesis takes place in chloroplasts in the leaf cells.

Water diffuses into the root hair cells (provide a large surface area). Water is transported along long, hollow xylem tubes.

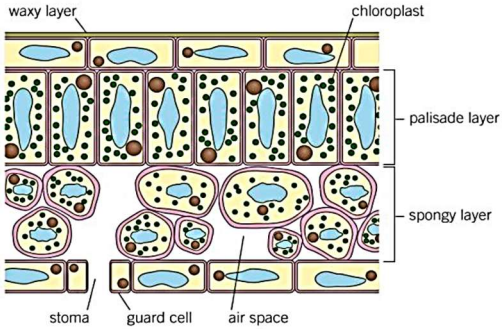


MEASURING THE RATE OF PHOTOSYNTHESIS

The rate of photosynthesis can be measured by measuring the amount of oxygen a plant produces in a specific time. You can count oxygen bubbles or collect the oxygen gas.

The presence of oxygen gas can be tested; it will relight a glowing splint.

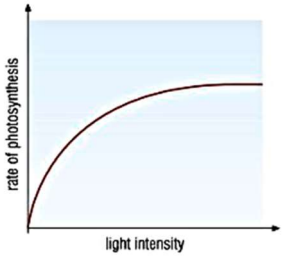
STRUCTURE OF THE LEAF



- Green → chlorophyll absorbs sunlight.
- Thin → short diffusion pathway for gases
- Large surface area (broad and flat) → absorb as much light as possible.
- Veins → xylem vessels transport water and phloem transport glucose (food).
- Waxy layer → reduces evaporation of water.
- Palisade layer → contains cells packed with chloroplasts towards the top of the leaf.
- Spongy layer → contains air spaces, allowing diffusion of gases through the leaf.
- Stomata → tiny pores on the bottom surface to allow diffusion of gases into and out of the leaf.
- Guard cells → open and close stomata.

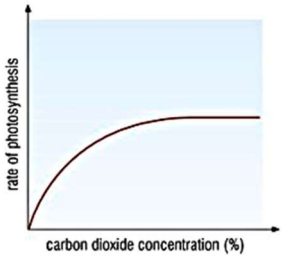
How does light intensity affect the rate of photosynthesis?

The higher the light intensity, the faster the rate of photosynthesis. It will get faster until photosynthesis reaches its maximum rate. In very low light levels, or if there is no light, photosynthesis stops.



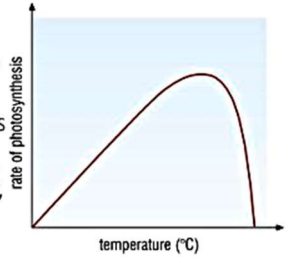
How does carbon dioxide affect the rate of photosynthesis?

Carbon dioxide is one of the reactants of photosynthesis. The greater the concentration of carbon dioxide, the faster the rate of reaction.



How does temperature affect the rate of photosynthesis?

In general, the higher the temperature, the faster the rate of photosynthesis. This is because photosynthesis involves enzymes, which speed up the reaction as the temperature increases. However, at a certain temperature the enzymes stop working, so photosynthesis stops.



KEYWORD	DEFINITION
Algae	Green uni-cellular or multi-cellular organisms that perform photosynthesis and live underwater. They do not have leaves, stems or roots.
Chlorophyll	Green pigment in plants and algae which absorbs light energy.
Deficiency	A lack of minerals that causes poor growth.
Fertilisers	Chemicals containing minerals that plants need to build new tissue.
Iodine	Indicator used to test for the presence of starch. It will turn blue/black.
Magnesium	Mineral needed by plants for making chlorophyll.
Nitrates	Mineral containing nitrogen (N) for healthy growth.
Phosphates	Mineral containing phosphorus (P) for healthy roots.
Photosynthesis	Process plants use to make their own food.
Potassium	Mineral needed by plants for healthy leaves and flowers.
Producer	Organism that makes its own food using photosynthesis.
Stomata	Pores at the bottom of a leaf which open and close to let gases in and out.

PLANT MINERALS

- Plants need four important minerals for growth; nitrates, phosphates, potassium and magnesium.
- Minerals are dissolved in soil water and are absorbed into root hair cells. They are then transported around the plant in the xylem tubes.
- Mineral deficiencies can lead to different symptoms.
  - Nitrate deficiency = poor growth and (old) yellow leaves
  - Phosphorus deficiency = poor root growth and (young) purple leaves
  - Potassium deficiency = yellow leaves with dead patches
  - Magnesium deficiency = leaves turn yellow
- Farmers add fertilisers (NPK) to the soil to replace missing minerals (when crops are harvested minerals are removed from the ground).