

Photosynthesis:

- Plants take energy from the sunlight and turn it into chemical form (which is stored in glucose) by photosynthesis.
- It happens in the leaves of all green plants, more specifically in chloroplasts.
- Chloroplasts capture the energy, and chlorophyll (in chloroplasts) absorbs the light.
- The product are Glucose and Oxygen.
- The reactants are Carbon Dioxide and Water.

Word Equation



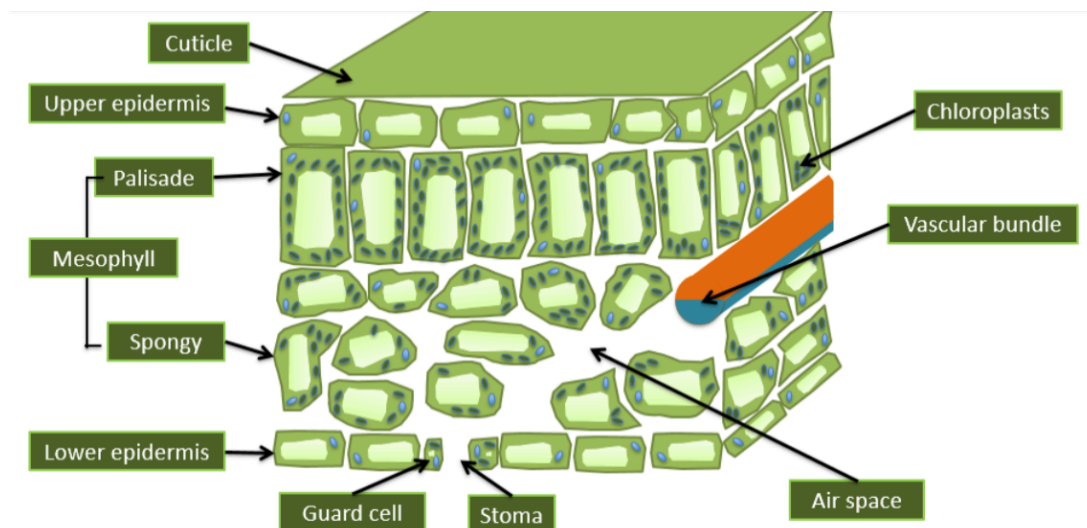
Chemical Equation



Uses of Glucose:

- Stored as starch.
- Used in respiration to release energy.
- Turned into cellulose to make cell walls.
- Stored in fruit as sucrose.
- Turned into proteins with the addition of nitrogen so the plant can grow.

Structure of a Leaf:



How leaves are adapted for efficient photosynthesis:

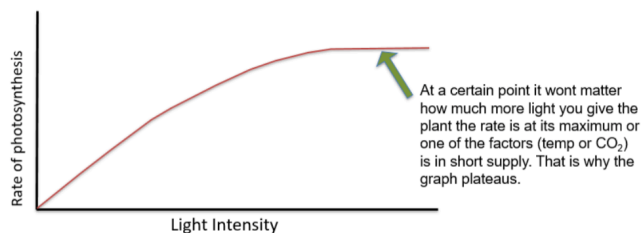
- Most chloroplasts are found in the palisade mesophyll layer, closer to surface for light.
- They have a network of vascular bundles (xylem and phloem) to deliver water and other nutrients to every part of the leaf, and take away glucose produced by photosynthesis. It also helps support the leaf structure.
- Has a transparent upper epidermis to let light through the palisade layer.
- The leaf has a broad shape to increase surface area exposed to catch more light.
- The leaf is thin to allow rapid diffusion of gaseous exchange.
- Has air spaces in the spongy mesophyll layer to allow for gaseous exchange.
- Has lots of stomata to allow for gaseous exchange.
- Has guard cells to control if the stomata is open or closed - less transpiration at night.
- The waxy cuticle reduces water loss by evaporation.

The Limiting Factors:

- The factor at the lowest level will be the limiting factor (limit the rate of reaction).
- As the limiting factor is increased, rate of photosynthesis increases until the next limiting factor.

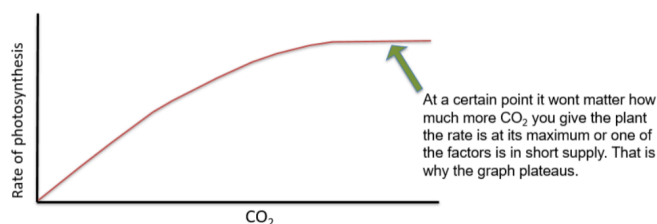
1 Light intensity

- The higher the light intensity, the faster the rate of photosynthesis – provided that there is lots of carbon dioxide and the temperature is warm enough.



2 Amount of CO_2

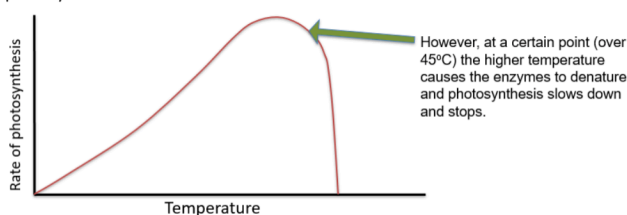
- The higher the carbon dioxide level, the faster the rate of photosynthesis – again, provided there is plenty of light and a suitable temperature.



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3 Temperature

- As the temperature rises, the rate of photosynthesis increases – provided there is plenty of carbon dioxide and light. This is because the temperature affects the enzymes controlling photosynthesis.



Minerals for Growth:

- Plants need elements to produce, and get them from mineral ions in soil.
- If not enough of them are in the soil, plants suffer deficiency symptoms.

- Nitrates

- Contain nitrogen - make amino acids and proteins.
- Needed for cell growth.
- If not enough, will be stunted, and older leaves turn yellow.

- Phosphates

- Contain phosphorous - make DNA and cell membrane.
- Needed for respiration and growth.
- If not enough, poor root growth, and older leaves turn purple.

- Potassium

- To help the enzymes.
- Needed for photosynthesis and respiration.
- If not enough, poor flower and fruit growth, discoloured leaves.

- Magnesium

- Needed in smaller amount compared to others.
- Needed for making chlorophyll (for photosynthesis).
- If not enough, plants will have yellow leaves.

Transport Systems:

- Plant cells need water, minerals, and sugars.
- Multicellular organisms (like plants) cannot have direct diffusion from the outer surface, as it would be too slow - the substances would have to travel large distances to reach all cells.
- Therefore, plants would need transport systems to move substances to and from cells quickly.
- Two systems, xylem and phloem, both go to every part of the plant.

- Xylem

- Transport water and minerals.
- From roots to the leaves in the transpiration stream (only one direction up the plant)

- Phloem

- Transport sucrose and amino acids.
- From leaves to other parts of plant.
- Movement known as translocation.

Root Hairs:

- Root cells grow into long 'hairs' that stick into the soil.
- Each branch of root is covered with lots of root hair cells.
- These increase surface area for absorbing water from the soil
- They also take in minerals through active transport.
- Water is taken in by osmosis - often a higher concentration of water in soil.

Transpiration:

- Transpiration caused by evaporation and diffusion of water from plant's surface.
- Most transpiration happen on leaves - creates a slight shortage of water in leaf, and more water is drawn up from rest of the plant through the xylem vessels to replace shortage.
- Therefore, more water is drawn from the roots, and cause a constant transpiration stream of water through plant.
- This process requires stomata, so gas can be exchanged easily. There is more water inside than the outside of the plant, and so the water escapes through stomata by diffusion.

Factors that affect rate of Transpiration:**- Light Intensity**

- The higher the light intensity, the greater the transpiration rate.
- Stomata close as it gets darker - photosynthesis doesn't occur at night, and don't need to take in CO₂. Very little water escapes when stomata are closed.

- Temperature

- The higher the temperature, the greater the transpiration rate.
- Water particles have more energy to evaporate and diffuse under warmer conditions.

- Wind Speed

- The higher the wind speed around leaf, the greater the transpiration rate.
- If wind speed is low, water vapor surrounds leaf, and therefore there is a high concentration of water both outside and inside the leaf so diffusion happens slowly.
- If it is windy, the water vapor is swept, and therefore there is a lower concentration of water outside the leaf so diffusion happens faster (from in the leaf to the outside)

- Humidity

- The lower the humidity around leaf, the great the transpiration rate.
- If air is humid, there is a high concentration of water, and little difference in concentration inside and outside the leaf. Diffusion of water happens faster if there is a lower concentration of water (low humidity) outside the leaf.