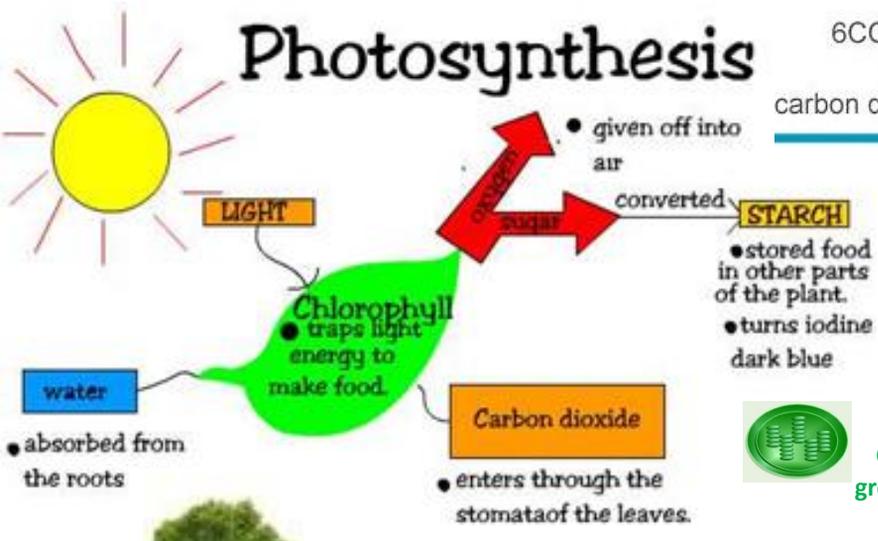


# 4.4 Bioenergetics (Trilogy and Biology)

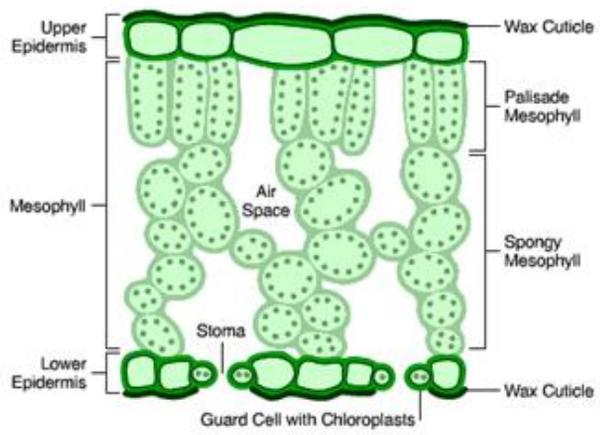
## Photosynthesis



**This is an endothermic reaction**  
 The energy is transferred from the environment to the chloroplasts by light.  
**It makes the surroundings colder.**

**Chloroplasts** are found in the green parts of plants and contain the **chlorophyll**

### Leaves are adapted for photosynthesis



Leaves have a **big surface area** to absorb as much light as possible

The **Xylem** brings **water** to the leaves from the roots. The **Phloem** transports the **sugars** made in photosynthesis to the rest of the plant.

- For waterproofing
- Cells with loads of chloroplast for photosynthesis
- Lots of air spaces for gaseous exchange
- Stomata to allow gases in and out

## Glucose is used in;

Cellulose cell walls

Respiration

Oil and Fat Production

Protein Production for growth

Stored as insoluble **Starch**

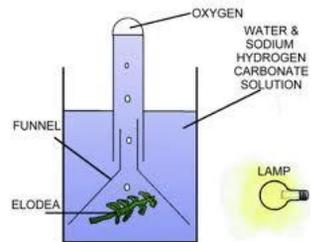
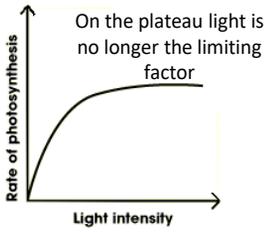
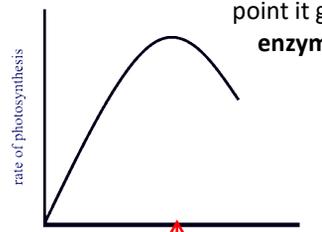
Increasing the temperature will speed up photosynthesis to the point it gets too hot and **enzymes denature.**

To make **proteins** plants also need to absorb **Nitrates** from the soil to build amino acids.  
**No nitrates will lead to stunted growth**

Plants also use Magnesium to make chlorophyll **No Magnesium = Yellow leaves**

## Limiting Factors

The rate of photosynthesis may be slowed by a lack of **light, CO<sub>2</sub>** or if its too cold.  
 Greenhouses can use our knowledge of limiting factors to maximise production, making plants grow faster.



**Remember photosynthesis will increase with the limiting factors.**  
**Once you get to a maximum for that factor another one will be limiting.**



# Respiration

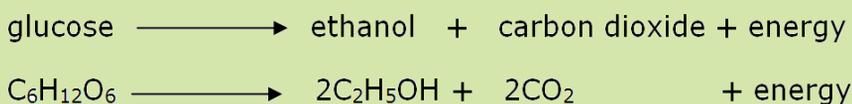
Cellular respiration is an exothermic reaction which is constantly happening in all of your cells.

Aerobic	Anaerobic
Using Oxygen	Without Oxygen
Glucose + Oxygen → Carbon Dioxide + Water (+ Energy)	Glucose → Lactic Acid (+ Energy)
Lots of energy transferred	Little energy transferred

The energy TRANSFERRED supplies all the energy needed for living processes.

**Why respire?** Energy to build big molecules from small ones (in chemical reactions), move muscles and keep you warm.

Yeast is a microorganism that can also respire **anaerobically** (this is used to make ethanol and bread in the process of fermentation)



## Metabolism

Metabolism is the sum of all the reactions in a cell or the body.

Metabolism includes:

- Conversion of glucose to starch, glycogen and cellulose
- The formation of lipid molecules from a molecule of glycerol and 3 fatty acids.
- The use of glucose and nitrate ions to form amino acids which in turn are used to synthesis proteins.
- Respiration
- Breakdown of excess proteins to form urea for excretion

If you're using your muscle you'll need more glucose and oxygen, you'll produce more  $\text{CO}_2$ .

After long periods of exercise muscles will begin to fatigue.

**Without** sufficient oxygen **anaerobic respiration** takes place.

Once exercise is over the **oxygen debt** will have to be repaid to break down the **lactic acid** made.



As I exercise my heart rate, breathing rate and breath volume will increase.  
Glycogen stores will be broken down into glucose.  
My blood will pump faster to supply more oxygenated blood to my muscles.

Remember when answering data analysis questions;

Describe = Say what you see and include data.

Explain = Say why the graph looks the way it does, show your scientific understanding.

HIGHER ONLY – Blood flowing through the muscles transports lactic acid to the liver where it is converted back into glucose. The oxygen debt is the amount of extra oxygen needed after exercise to breakdown the lactic acid and remove it from cells.