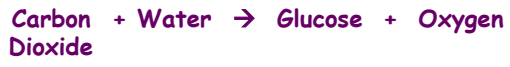
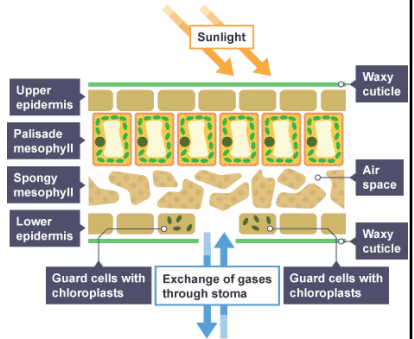


**Photosynthesis**



- Gases diffuse through stomata
- Palisade cells have lots of chloroplasts
- Xylem brings water
- Spongy to allow gases to move through leaf.



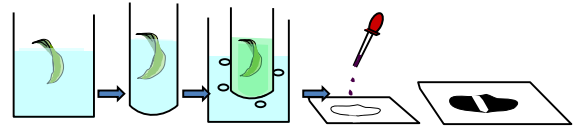
**Uses of glucose:**

- Respiration - energy - growth
- Starch - storage
- Protein - glucose + nutrients from the soil
- Fats - stored in seeds
- Cellulose - cell walls

**Starch Testing a Variegated Leaf**

We test for the presence of **starch** in leaves in order to determine that photosynthesis has occurred. Glucose is rapidly converted into starch for **storage** in the chloroplast and cytoplasm.

**De-starching** is the process by which the starch reserves in a plant are depleted by depriving the plant of either light or carbon dioxide. We need to **remove all traces of starch** in leaves so that we can provide evidence that photosynthesis takes place during the experiment.

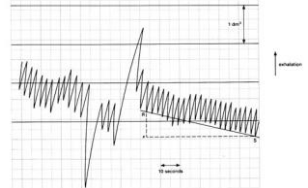


- Boiling ethanol breaks down cellulose and removes chlorophyll.
- Iodine solution turns blue/black where starch is present i.e. where photosynthesis has taken place.

**Measuring HR and BR**

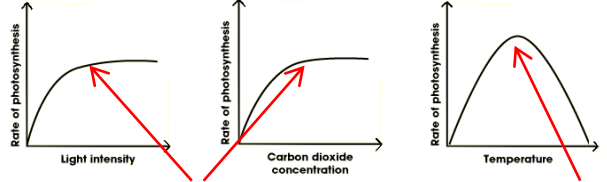
HR - heart rate monitor  
BR - spirometer

**Tidal volume** - normal volume breathed in and out.



**Limiting factors**

- Light
- Carbon dioxide concentration
- Temperature



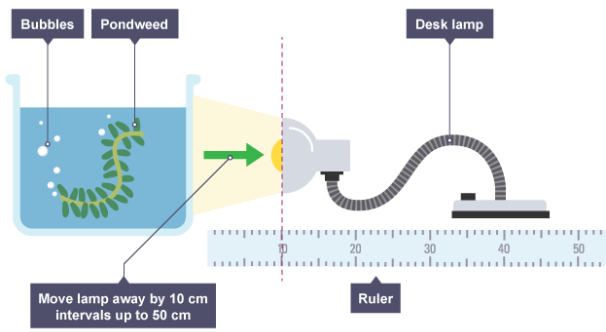
Something else limits the rate (temperature, CO<sub>2</sub>, amount of chlorophyll) Controlled by **enzymes** that are too slow when cold and **denature** when too hot

**Greenhouses**

- + Control the conditions (heat, CO<sub>2</sub>, water, light, pests, weeds)
- + Grow plants all year round
- + Grow plants not native to certain countries
- + Increased crop yields
- Costs to maintain conditions
- Conditions need to be monitored

**Hydroponics:** Plants grown in mineral solution rather than water - control nutrients, no fungal infections from soil.

**REQUIRED PRACTICAL: Photosynthesis**

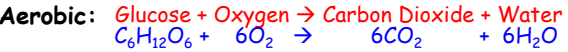


In the experiment above:

1. Pondweed is in water with sodium carbonate solution (to provide CO<sub>2</sub> for photosynthesis)
2. Move light bulb different distances and count the bubbles of oxygen that are produced per minute.

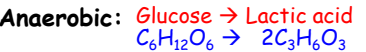
The closer the light, the more oxygen is made because the rate of photosynthesis increases.

**Respiration - energy RELEASE not made (exothermic)**



- Occurs in mitochondria
- Needs oxygen
- Releases a lot of energy (ATP)

Some microorganisms (e.g. yeast) respire anaerobically producing ethanol and CO<sub>2</sub>. This is called **fermentation** and is used to make bread and alcohol.



- Occurs in mitochondria
- No oxygen
- Leads to **oxygen debt** (which is why you breathe heavily after sport to pay it back)
- Very little energy is released.

**Exercise effect on HR and BR**

Heart Rate increases - more oxygen to muscle  
- more glucose to muscle  
- more CO<sub>2</sub> and water to lungs

Breathing Rate increases - more oxygen into blood  
- more CO<sub>2</sub> and water out of the blood

Stored glycogen in muscle turned into glucose.

**Metabolic Rate:** The speed of chemical reactions in the body.

- Older = slower
- Female = slower
- High fat to muscle ratio = slower
- Could be inherited

**Metabolic reactions:**

- Respiration - catabolic (big → smaller molecules)
- Photosynthesis - anabolic (small → bigger molecules)
- Break down of proteins to urea in **liver** - catabolic
- Enzymes breaking down food - catabolic
- Combining glucose with nitrate ions to form amino acids and then protein - anabolic

Anabolic reactions require **energy** from cellular respiration.

Carbohydrates	Energy
Protein	Cell repair, growth and replacement
Fat	Energy and insulation
Fibre	Digestion
Minerals	Calcium - Bones, Iron - Blood
Vitamins	Immune system