Name:_____

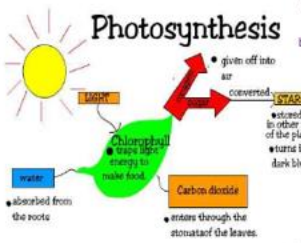
GCSE Bioenergetics Booklet

Lesson	Title	Completed
1	Plant and leaf structure revision and Photosynthesis equation	
2	Uses of Glucose and testing a leaf for starch	
3	Limiting Factors of photosynthesis	
4	Required Practical: the effect of light intensity	
5	Required Practical: the effect of Light intensity	
6	Aerobic respiration	
7	Anaerobic respiration in humans and oxygen debt	
8	Fermentation in yeast	
9	Response to exercise	
10	Metabolism	

Bioenergetics

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

Photosynthesis



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

Greenhouses can use our knowledge of limiting factors to maximise production, making plants grow faster.

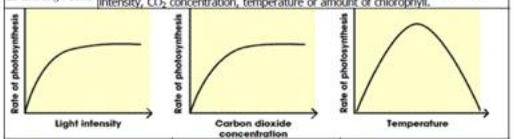
The rate of photosynthesis may be slowed by a lack of **light**, CO_2 or if its too cold. (temperature is a limiting factor as enzymes are effected)

Section 1: Photosynthesis Equation

1 Carbon dioxide + water $\xrightarrow{\text{light}}$ glucose + oxygen

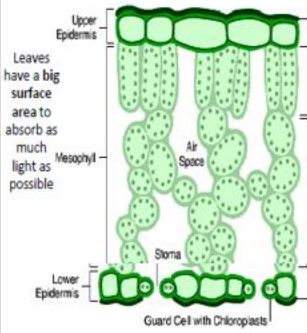
2 $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

12 Limiting Factor	The factor that stops the rate of photosynthesis from increasing, could be: light intensity, CO_2 concentration, temperature or amount of chlorophyll.



13 Light Intensity	14 CO_2 concentration	15 Temperature
Initially light is the limiting factor. When the graph plateaus something else (e.g. CO_2 concentration, temperature) is limiting the rate.	Initially CO_2 concentration is the limiting factor. When the graph plateaus something else (e.g. light intensity, temperature) is limiting the rate.	As temperature increases, the rate of photosynthesis increases. Above the optimum there is a decrease in photosynthesis. Enzymes needed for photosynthesis become denatured.

Leaves are adapted for photosynthesis

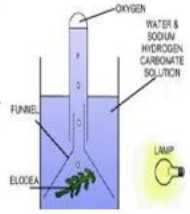


Chloroplasts are found in the green parts of plants and contain the chlorophyll

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

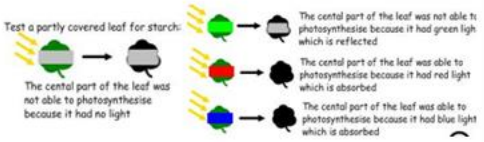
How can you tell whether photosynthesis has occurred or not?

By testing for starch using iodine solution.



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

Test a partly covered leaf for starch:



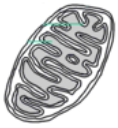
The central part of the leaf was not able to photosynthesise because it had no light

The central part of the leaf was not able to photosynthesise because it had green light which is reflected

The central part of the leaf was able to photosynthesise because it had red light which is absorbed

The central part of the leaf was able to photosynthesise because it had blue light which is absorbed

Cellular respiration:
A series of enzyme controlled reactions that **release energy** from organic molecules, like glucose.
Animals store sugar as glycogen in the liver and muscles. This is broken down during exercise to release glucose
There are two types



The mitochondria are organelles in plant and animal cells. It has a folded inner membrane; this gives it a large surface area for the chemical reactions to take place so it can **release more energy**.

Exhaled air has
- Less oxygen (used in respiration)
- More CO2 (released in respiration)
- More water

Aerobic respiration
Most steps take place in the mitochondria (an organelle found in plant and animal cells)
This releases a lot of energy. The energy is used in many ways

How aerobic respiration differs to anaerobic….
Aerobic uses oxygen
Aerobic does not produce lactic acid
Aerobic produces carbon dioxide and water

Used in many ways……..
- Muscle contraction
- Building large molecules form smaller ones in animals, like amino acids into proteins, of simple sugars into large carbohydrates
- Building proteins form glucose and nitrates in plants
- Keeping a constant body temperature in mammals and birds.

aerobic respiration

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + energy

Glucose + Oxygen → Carbon Dioxide + Water + energy (energy out)

Glucose comes from the breakdown of starch. Starch Digestion begins in the mouth, with amylase enzymes, this produces maltose. Maltose is then broken down by maltase enzymes in the small intestine to form glucose, which is soluble, and is absorbed into the blood stream.

Carried by red blood cells. Diffuses into the blood at the alveoli. There are many alveoli to give a large surface area for rapid diffusion, and they have thin wall to speed up diffusion. Ventilation and circulation keeps the concentration gradient steep so diffusion is fast. Red blood cells have no nucleus so they can carry more

This is carried in the blood to the lungs where it diffuses into the alveoli and is exhaled

Water levels in the body are maintained as part of homeostasis, this is the concept where the body keeps a constant internal environment

A fit person
Has a low resting heart rate
During exercise their heart rate does not increase as much
They recover quickly to rest after exercise

Yeast Cell
Bigger than Bacteria

Can respire aerobically and anaerobically (this will make ethanol and is also called fermentation)

Anaerobic Respiration

Glucose ⇒ Lactic Acid + ENERGY

Anaerobic respiration: this occurs during sustained periods of exercise or short intervals of high intensity. The muscles cannot get sufficient energy from aerobic respiration and so use anaerobic respiration to release energy without oxygen. Lactic acid is produced and builds up causing muscle fatigue. After exercise the lactic acid is removed by the blood and broken down by oxygen to carbon dioxide and water. **So even after exercise we have a high oxygen demand to break down the lactic acid, this is called the oxygen debt.**

During exercise our heart rate and breathing rate and depth of breathing increase because…. Our muscles are contracting more, so they require more energy; so more respiration must take place. We breathe faster and deeper to take in more oxygen and to exhale the excess carbon dioxide, and our heart beats faster to deliver more oxygen and glucose to the muscles faster, the fast hear rate also removes lactic acid/carbon dioxide quicker

Aerobic	Anaerobic
Glucose + O_2 = CO_2 + H_2O + Energy	Just Glucose (No Oxygen) = Lactic Acid+ Energy (less energy)
Occurs in Mitochondria	Occurs in Cytoplasm

Why respire? Energy to build big molecules from small ones, move muscles and keep you warm.