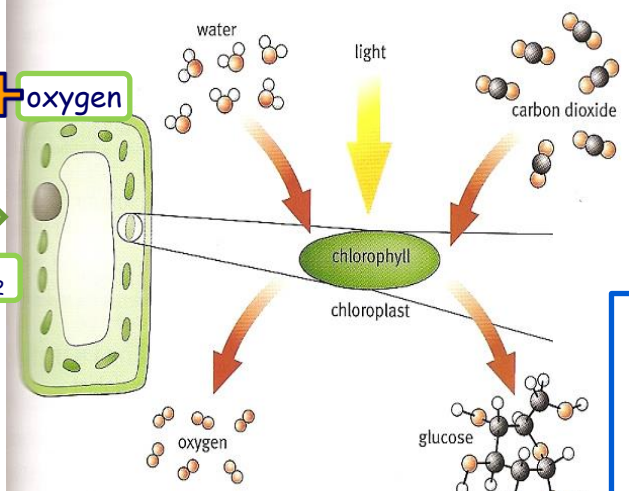
Y8 4.4 Bioenergetics - 1

START

carbon dioxide + water → (light energy, chlorophyll) → glucose + oxygen

Photosynthesis

$6CO_2 + 6H_2O \rightarrow (\text{energy, chlorophyll}) \rightarrow C_6H_{12}O_6 + 6O_2$



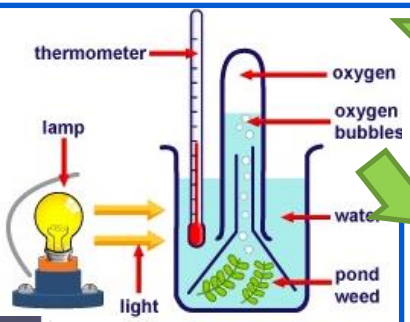
The light energy absorbed by chlorophyll is used to re-arrange atoms!

Chlorophyll
- Chlorophyll is a green substance found in the chloroplasts of light cells.
- **Chlorophyll absorbs light energy** for photosynthesis

Uses of glucose in a plant
A plant uses the glucose from photosynthesis to increase biomass by:
- Making **starch** for **storage**
- Making **fats** and **oils** for **storage**
- Making **cellulose** for **cell walls**
- Using it for **respiration** to provide **energy** for all its living processes

Exercise:
- Uses a combination of aerobic and anaerobic respiration in order to supply energy, quick enough to cells.
- After we exercise we must get rid of lactic acid by reacting it with oxygen = oxygen debt.
- This is why we are out of breath after exercise.

Investigating Photosynthesis
- Count the number of oxygen bubbles in a set amount of time.
- As oxygen is a product of photosynthesis, the more oxygen produced = the quicker the rate of photosynthesis



Anaerobic Respiration in yeast

glucose → Ethanol + Carbon dioxide + energy

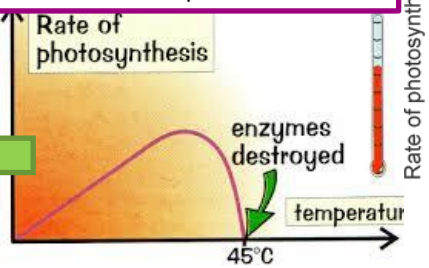
Anaerobic respiration takes place when there is no oxygen available.
GOOD: Can produce some energy when there is no oxygen
GOOD: Can produce energy very quickly
BAD: Produces very small amount of energy
BAD: produces lactic acid which is toxic

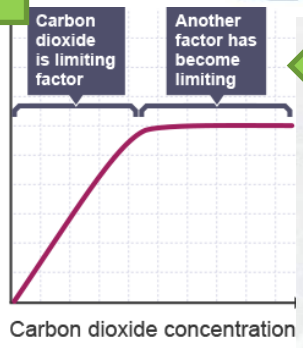
Key words:
1. **Photosynthesis:** Using light energy to split water and carbon dioxide to make glucose and oxygen
2. **Limiting factor:** A factor that affects the rate of reaction. When the factor is increased the rate of reaction goes up
3. **Aerobic respiration:** Respiration using oxygen to release energy in the form of ATP to cells
4. **Anaerobic respiration:** Respiration with **no** oxygen to release energy in the form of ATP to cells

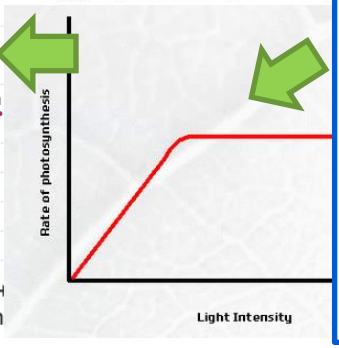
Anaerobic Respiration in animals

glucose → lactic acid + energy

At the start temperature is a limiting factor, once the enzymes have been destroyed no photosynthesis can take place at all







At the start light intensity is the limiting factor. Once the graph levels out temperature and carbon dioxide concentration becomes limiting factors

Aerobic Respiration

glucose + oxygen → carbon dioxide + water

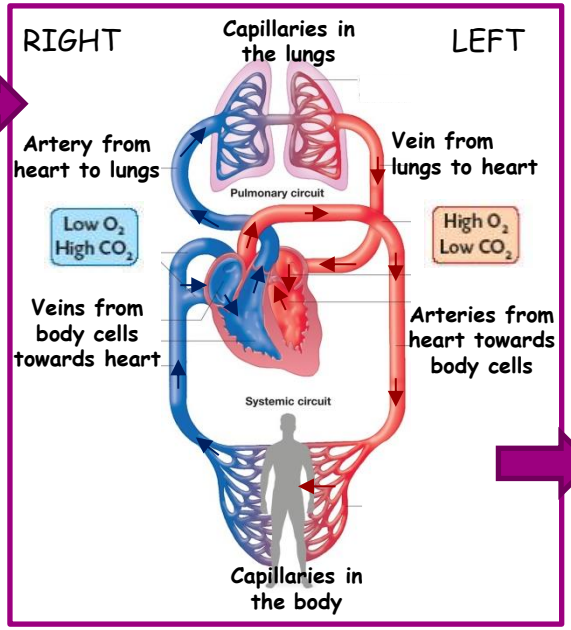
$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

Y8 4.4 Bioenergetics - 2

START

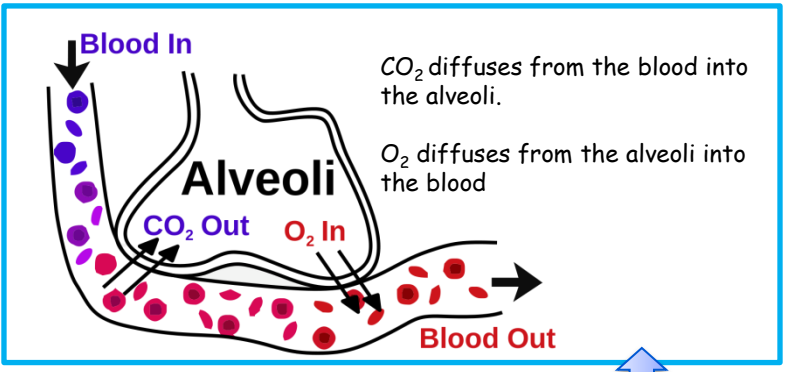
Circulatory System

- The circulatory system consists of the heart and blood vessels (arteries, veins and capillaries)
- Arteries carry blood away from the heart to your cells, and mostly carry oxygenated blood, except for the pulmonary artery to the lungs which carries deoxygenated blood.
- Veins carry blood towards the heart from your cells, and mostly carry deoxygenated blood, except for the pulmonary vein from the lungs which carries oxygenated blood.
- Capillaries are tiny blood vessels. Capillaries weave through all your cells and exchange substances with them.
- The heart pumps blood through the blood vessels



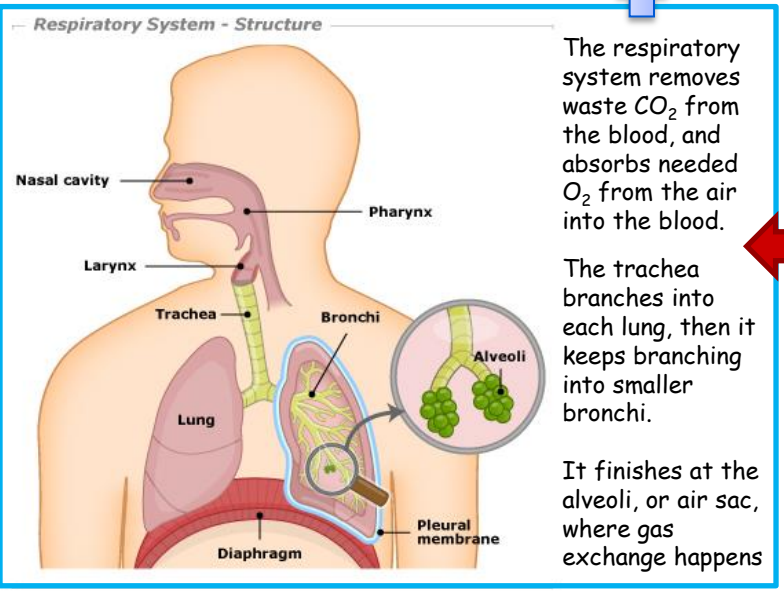
Double Circulatory System

- Humans have a double circulatory system.
- The heart is actually two separate pumps, and there are 2 circuits that your blood travels around:
  1. The right side of your heart pumps deoxygenated blood to the lungs, and oxygenated blood returns from the lungs to the left side
  2. The left side then pumps the oxygenated blood around your body to your cells, and the deoxygenated blood returns to the right side again.
- This happens so that oxygenated blood doesn't mix with deoxygenated blood
- Also the left side of the heart is more powerful to pump blood round the whole body – this would be too powerful and would damage the lung tissue.



CO_2 diffuses from the blood into the alveoli.

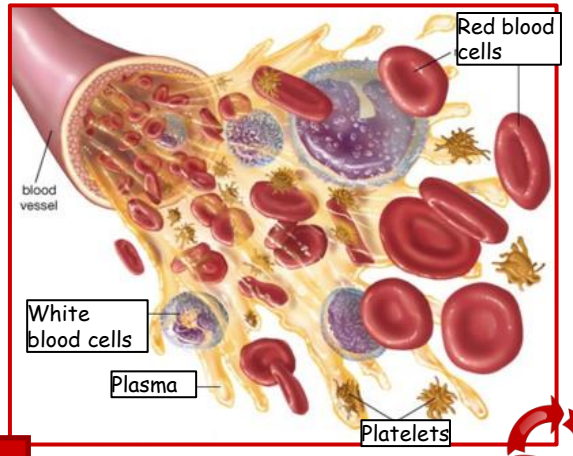
O_2 diffuses from the alveoli into the blood



The respiratory system removes waste CO_2 from the blood, and absorbs needed O_2 from the air into the blood.

The trachea branches into each lung, then it keeps branching into smaller bronchi.

It finishes at the alveoli, or air sac, where gas exchange happens

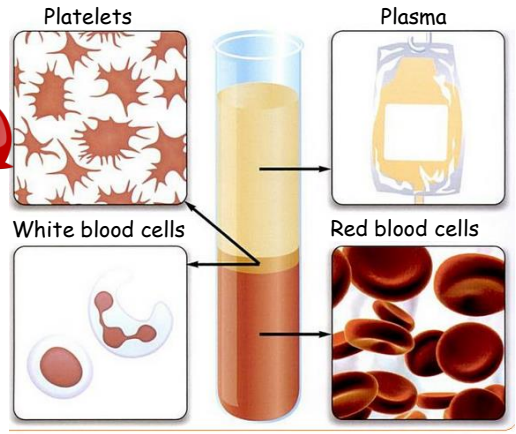


- **PLATELETS** form blood clots to heal wounds.
- **WHITE BLOOD CELLS** kill disease causing microbes
- **PLASMA** is the straw coloured liquid everything is suspended in
- **RED BLOOD CELLS** carry oxygen, attached to a molecule called haemoglobin. Red blood cells have no nucleus to give more space, and a 'biconcave disc' shape for more surface area

THE BLOOD

The blood is a mixture. It transports substances around the body.

It has four important parts



Y8 4.4 Bioenergetics - 3

Investigating the energy content of food

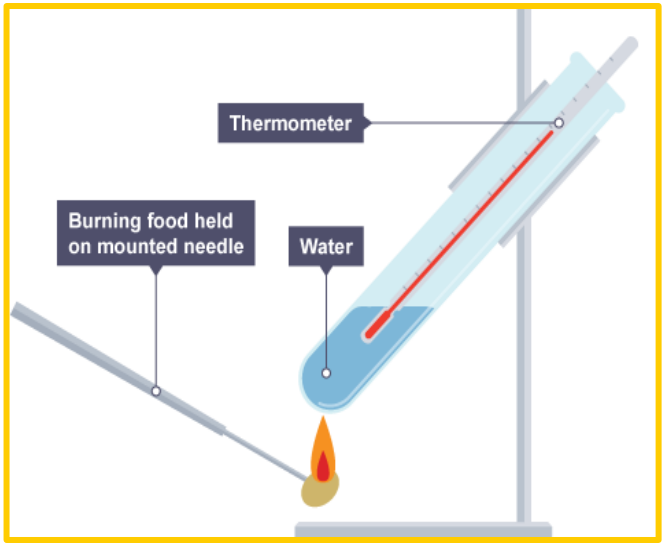
To measure how much energy is in different foods you burn the food under a test tube and measure the temperature change of the water using a thermometer.

The chemical energy in the food in transferred into heat energy in the water.

Independent variable: Type of food
Dependent variable: Temperature change of water (^{O}C)
Control Variables: Volume of water, mass of food, starting temperature of water, distance of burning food from test tube.

Taking repeat readings is useful to spot and discard any anomalous results, and then calculate a mean average temperature change.

The biggest source of error is that a lot of the heat energy from the flame isn't transferred to the water – it ends up being transferred to the air around the test tube!



PAGE 1 QUESTIONS

1. Write out the word equation for photosynthesis
2. Write out the symbol equation for photosynthesis
3. Where does photosynthesis happen
4. What does the chlorophyll do?
5. What is the glucose used for in plants?
6. How can I use Elodea pondweed to measure photosynthesis?
7. What is a limiting factor?
8. What are the limiting factors of photosynthesis?
9. What would happen to the rate of photosynthesis if I increased light intensity?
10. Write out the word equation for respiration
11. Write out the symbol equation for respiration
12. What are the similarities and differences between aerobic respiration and anaerobic respiration in animals?
13. How is anaerobic respiration in plants different to in animals
14. What happens to our heart rate and breathing rate when we exercise?
15. Why?
16. What is oxygen debt?

PAGE 2 QUESTIONS

1. What is the circulatory system
2. What are the 3 different types of blood vessel and what do they do?
3. Describe the double circulatory system
4. Why do we need it?
5. What is the difference between arteries and veins in terms of blood flow?
6. What are the four components of blood and what are they for?
7. Why do red blood cells have no nucleus?
8. Why do red blood cells need a large surface area (from their biconcave disc shape)?
9. Name the parts of the breathing system in order that air would pass through as you breathe in.
10. What are the alveoli?
11. Describe what happens during gas exchange

PAGE 3 QUESTIONS

1. Describe how we could investigate the energy content of a range of foods.
2. Why is this investigation not very precise or accurate?
3. How can obtaining repeat results be helpful?
4. Why does burning the food under the test tube allow you to measure the energy in the food?

HOMEOSTASIS AND RESPONSE QUESTIONS

1. What is homeostasis?
2. Describe a reflex arc
3. Explain what a reflex is and why it is important
4. Describe how the body reduces its temperature if too hot.
5. Describe how the body increases its temperature if it is too cold.
6. Describe how a neuron is adapted to send messages.

Y8 Homeostasis & Response

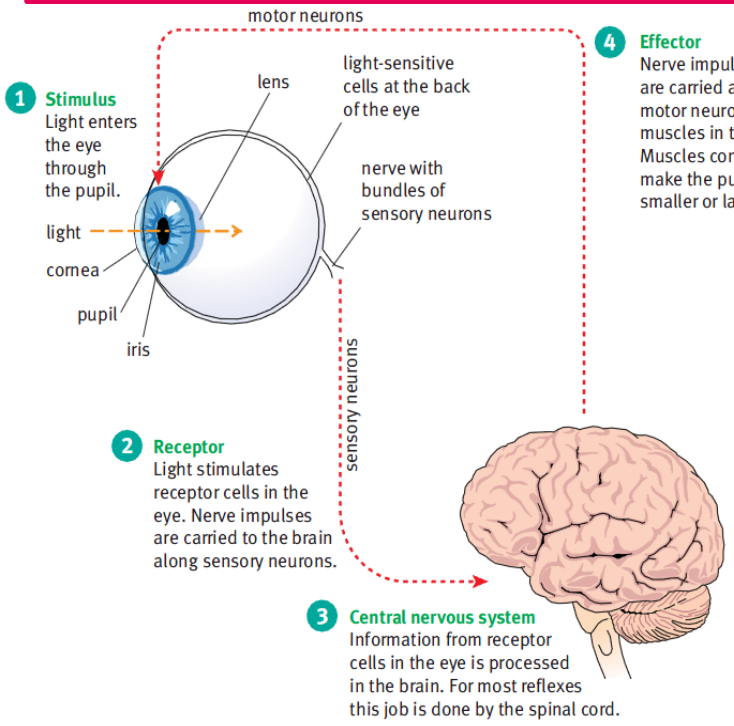
Key words:

1. **Homeostasis:** Maintaining a constant internal environment
2. **Receptor:** Detect a change in the environment
3. **Effector:** Muscle or gland that carries out a response
4. **Stimulus:** A change in the environment
5. **Sensory neurone:** Carries an electrical impulse from the receptor to the CNS
6. **Relay neurone:** Carries the impulse from the sensory neurone to the motor neurone
7. **Motor neurone:** Carries the impulse from the CNS to the effector
8. **Synapse:** A tiny gap between 2 neurones
9. **Reflex:** An automatic response that does not require processing, helps an organism survive

START

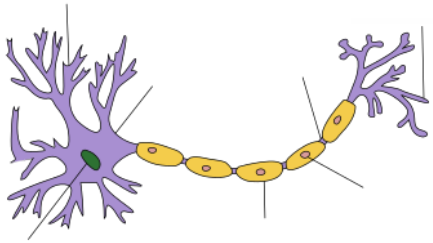
Homeostasis: Maintaining a constant internal environment e.g. temperature control and blood glucose control.

1. Receptor detects a stimulus
2. A nervous impulse is sent along the sensory neurone to the spine.
3. A relay neurone then sends the message to a motor neurone
4. The motor neurone carries the nervous impulse to the effector
5. The effector carries out a response



Reflex Actions: Automatic responses that protect the body from harm. They are unconscious actions – require no thought

Receptors: Detect stimuli e.g. smell, taste, temperature, pressure, light, sound



Neurons: Send messages by electrical impulses. Long and thin to carry messages long distances. Branches to connect to other neurons by gaps called synapses.