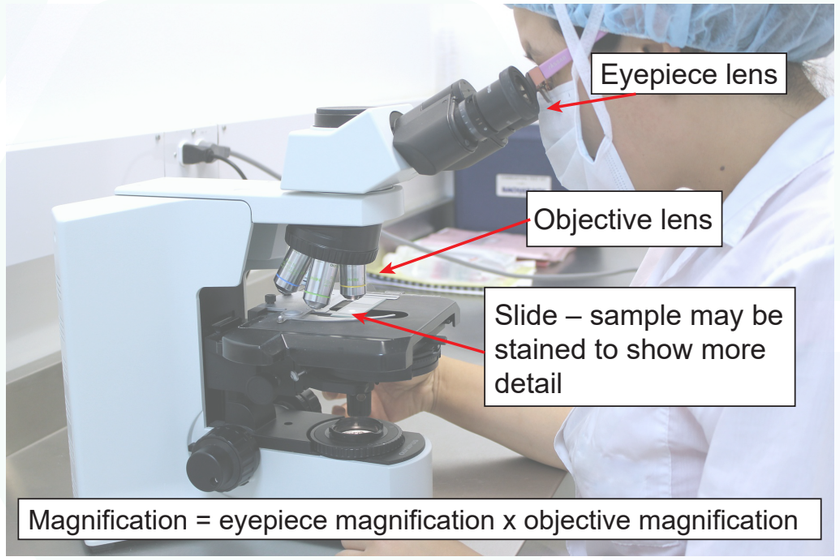
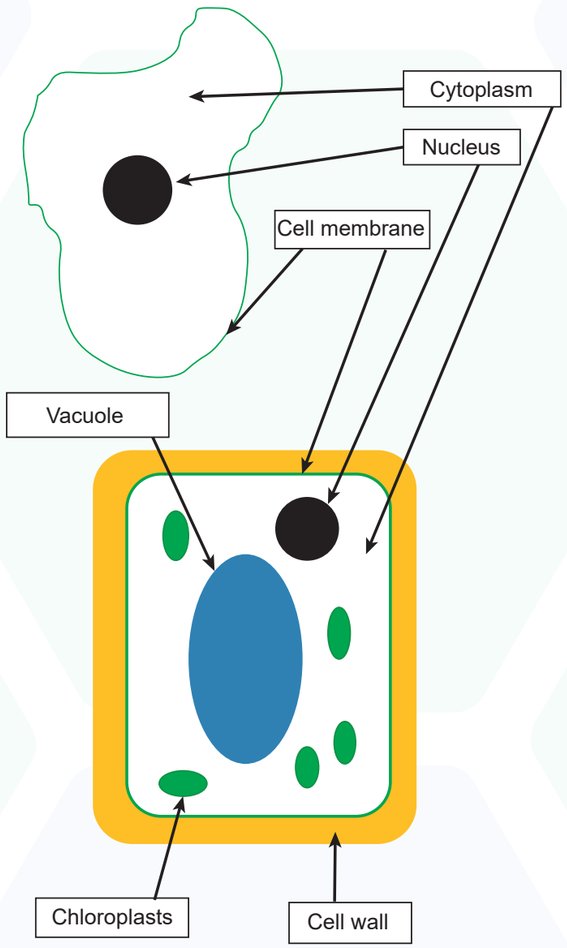
GCSE Biology 1.1 Cells Knowledge organiser



Magnification

A light microscope can only be used up to a magnification of x2000. To look at things at a higher magnification and in more detail an electron microscope can be used. However, an electron microscope can only view dead material.

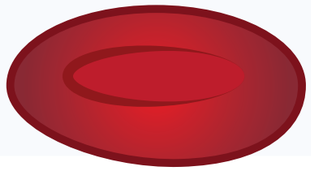
Animal cells and plant cells



Specialised Cells

Cells can **differentiate** into **specialised** cells.

Specialised cells are **adapted** to specific functions and so are more **efficient** in carrying them out.



Red blood cells contain haemoglobin and are biconcave in shape to maximise efficiency in carrying oxygen.

Sperm cells have tails so they can swim to the egg cell.

Cell Structure	Function	Animal cells contain:	Plant cells contain:
Nucleus	Contains chromosomes which carry genetic information and controls actions of the cell.		
Cell membrane	Controls the entry and exit of substances		
Cytoplasm	Site of most cell reactions.		
Vacuole	Contains a watery sugar solution called sap. When full the vacuole pushes the cytoplasm against the cell wall.		
Chloroplasts	Site of photosynthesis.		
Cell wall	Contains cellulose and provides structural support for cells.		
Mitochondria	Site of aerobic respiration.		

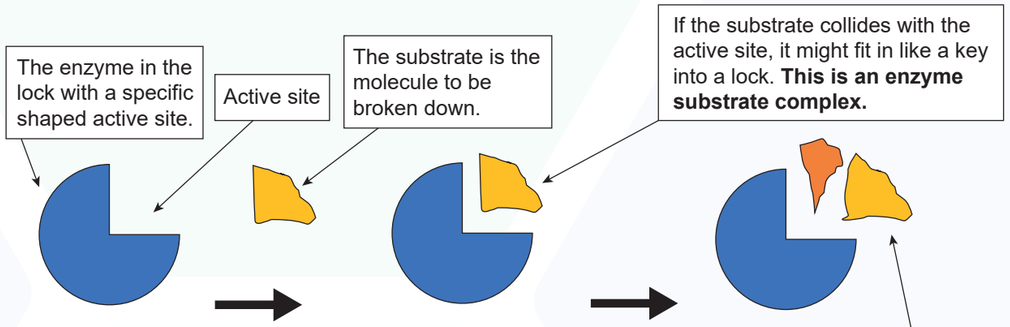
Organisation

Level	Description
Cells	Smallest unit of life
Tissues	A group of similar cells performing a specific function
Organs	Different tissues working together for a specific function
Organ system	Organs working together
Organism	A living thing

GCSE Biology 1.1 Enzymes Knowledge organiser

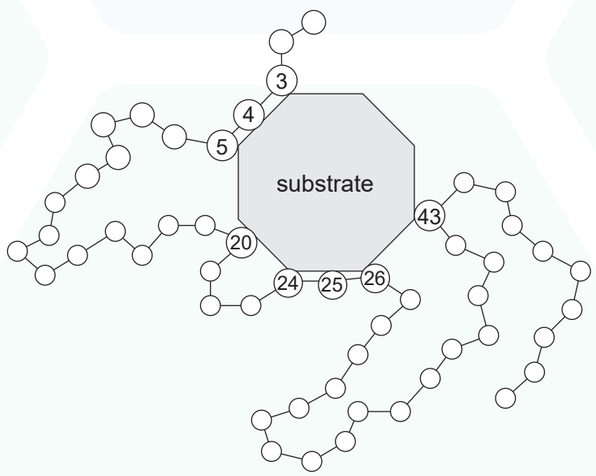
Enzymes - Lock and key Theory

- An enzyme made of protein.
- It catalyses/ speeds up reactions in cells.
- Enzymes can help break down molecules (digestion/ respiration).
- Enzymes can help build up molecules (Protein synthesis).
- Enzymes rely on collisions of molecules with a specific region of the enzyme called the active site to work.

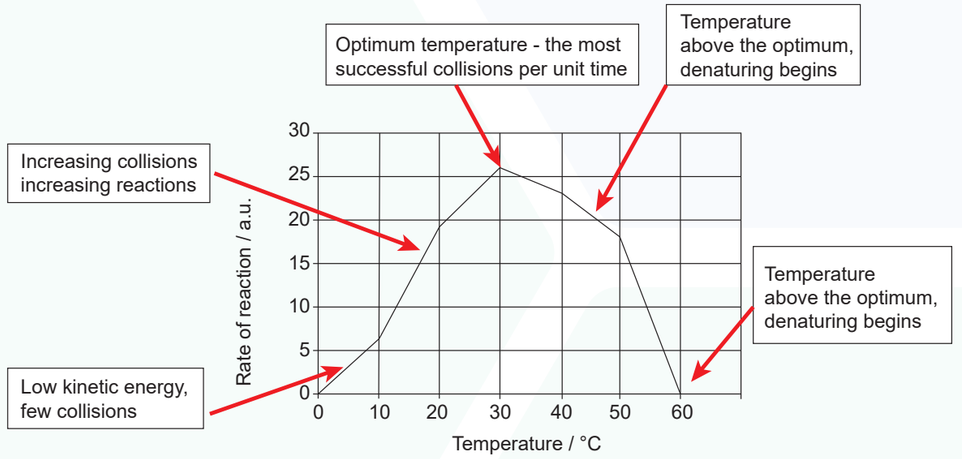


How to make an enzyme - Higher tier only

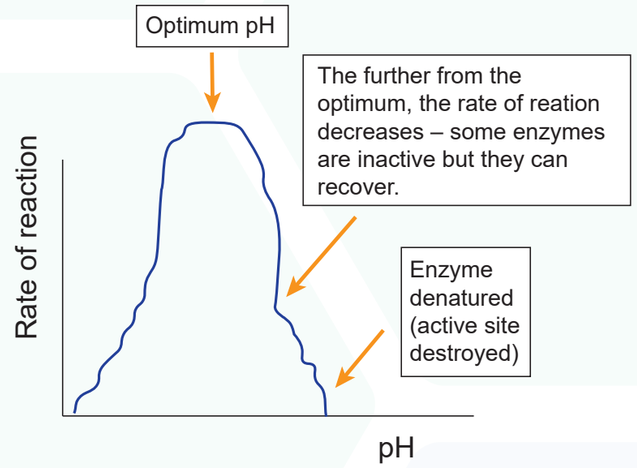
- The instructions to make enzymes are written in the DNA.
- Genes are sections of DNA made of many bases, every 3 DNA bases codes for an amino acid.
- Amino acids are linked in chains and interact to fold into enzymes with specific active sites.
- So different genes code different order of amino acids which fold differently to form active sites specific to each substrate.



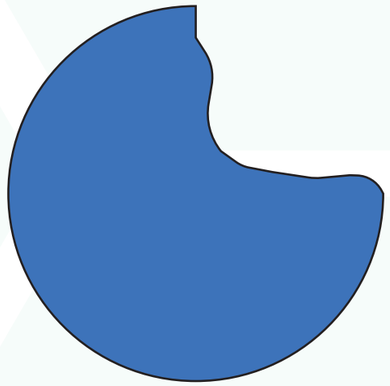
Enzymes and temperature



Enzymes and pH



Denatured

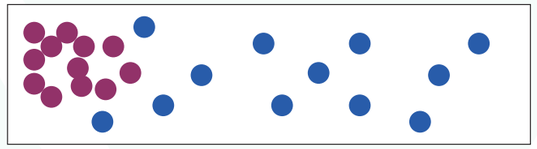


High temperatures or extremes of pH change the shape of the active site of the enzyme. The substrate can no longer fit into the active site and so no reaction occurs.

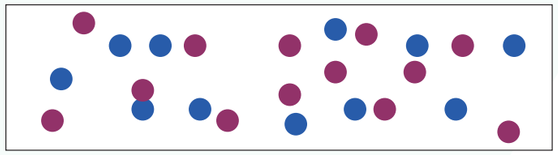
GCSE Biology 1.1 Movement across cell membranes knowledge organiser

Diffusion

Constantly moving liquid and gas molecules tend to move from an area of **high concentration to an area of lower concentration:**

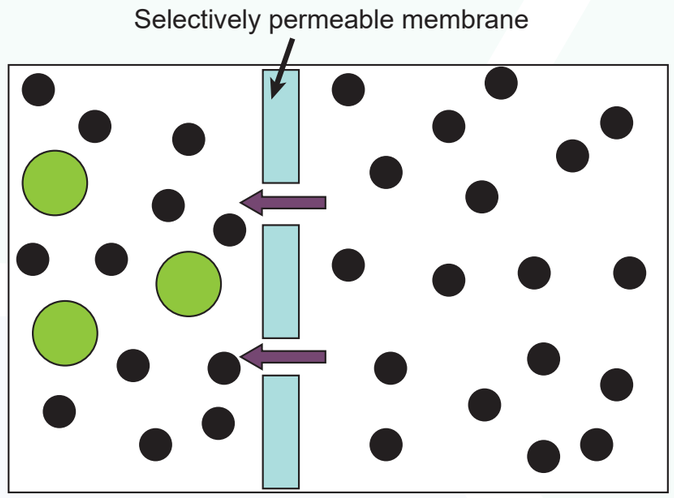


until evenly distributed :



- This is a **passive** process – it does not require energy.
- Molecules move **down a concentration gradient**.
- This process is called **diffusion**.

Factors that affect diffusion include:	
Concentration	The greater the concentration gradient the greater the diffusion rate.
Temperature	At higher temperatures molecules have more kinetic energy and so move and diffuse faster.
Pressure	Molecules move quickly from an area of higher to lower pressure.

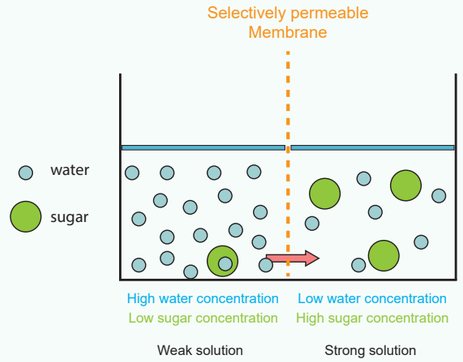


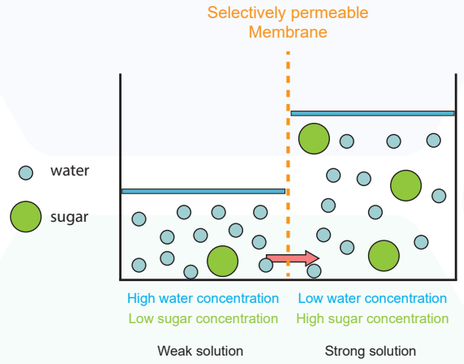
Visking tubing can be used to model a cell membrane as it is selectively permeable.

Only molecules small enough can diffuse through the pores.

Osmosis

Osmosis is the diffusion of water from **high water concentration** (dilute solute solution) to **low water concentration** (concentrated solute solution) across a **selectively permeable membrane**.





When answering exam questions on osmosis consider the data given and describe using the following statements:

Do	Do not
Do state in which direction the water is moving in the example.	Do NOT talk about the solution moving. Large solute molecules do not cross the membrane, only water does.
Do state that water moves from a high to low water concentration.	Do not suggest salt or sugar can cross cell membranes, they cannot.
Do state that water is moving by osmosis and that the net movement is in the direction stated.	Do not suggest molecules only move in one direction, they will cross the membrane in both directions but the NET movement will be in one direction if osmosis is occurring.
Do state that water moves across a semi-permeable membrane.	Do not call the membrane permeable, if it were osmosis would not occur.
Then give the result e.g. animal cells burst if too much water goes in but plant cells become turgid, they are held together by the cell wall. Plants will wilt if their cells become flaccid (lose too much water) and animal cells will shrink.	Do not describe animal cells as turgid and flaccid, these terms apply to plant cells.

Active Transport- Higher tier only

Active transport moves molecules **against a concentration gradient.**

This process **uses energy in the form of ATP** provided by **respiration. Glucose and oxygen** are required for respiration.

GCSE Biology 1.2 Respiration and the respiratory system knowledge organiser

Aerobic respiration

A series of **enzyme-controlled** chemical reactions in the mitochondria of cells. Blood carries **glucose and oxygen** to the cells, they **diffuse** in and react releasing the stored energy from the glucose.

GLUCOSE + **OXYGEN** → **CARBON DIOXIDE** + **WATER** + **ENERGY**

- **Released as ATP**
- **Released as Heat**

- Thermometer to record temperature changes
- Thermos flask to reduce heat lost through the sides

Investigating respiration in germinating peas

1	Peas respire releasing heat and recorded temperature goes up.
2	Peas are boiled (respiratory enzymes are denatured) no respiration by peas but recorded temperature still increases slightly as peas are covered in respiring microbes.
3	Boiled and disinfected peas. Temperature does not increase as no respiration occurs.

Anaerobic respiration

A **shorter series of enzyme-controlled reactions** that partially breaks down glucose releasing only some of the energy stored. This reaction can occur in the **absence of oxygen**.

GLUCOSE → **LACTIC ACID** + **ENERGY** → **Less ATP produced**

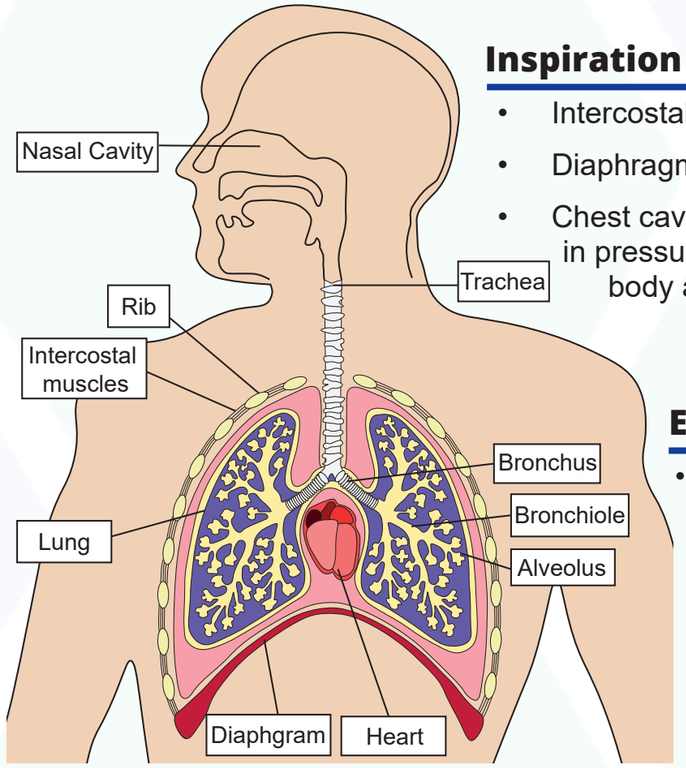
Partial breakdown of glucose as **no oxygen** available

Toxic lactic acid produced which needs oxygen to be broken down.

The amount of oxygen needed to remove the toxic lactic acid is the **oxygen debt** and must be paid back when oxygen is readily available.

The respiratory system

The function of the respiratory system is to obtain sufficient oxygen for respiration and to remove the equivalent volume of waste gases carbon dioxide and water.



Inspiration

- Intercostal muscles contract lifting ribs up and out
- Diaphragm contracts and flattens
- Chest cavity increases in volume and decreases in pressure below the pressure outside the body and so air is sucked in to equalize the pressure.

Expiration

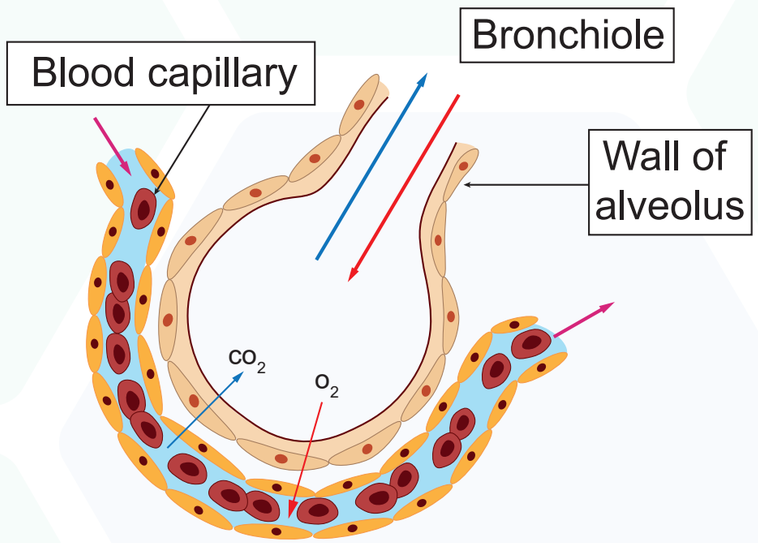
- Intercostal muscles relax and ribs move down and in.
- Diaphragm relaxes and domes up.
- Chest cavity decreases in volume and increases in pressure, air is forced out.

Gas exchange

The alveoli are adapted for gas exchange by:

- Good blood supply
- Large surface area
- Thin walls
- Moist lining

As the red blood cells and plasma in the blood capillary flow around the alveolus oxygen diffuses into the capillary and carbon dioxide diffuses out.



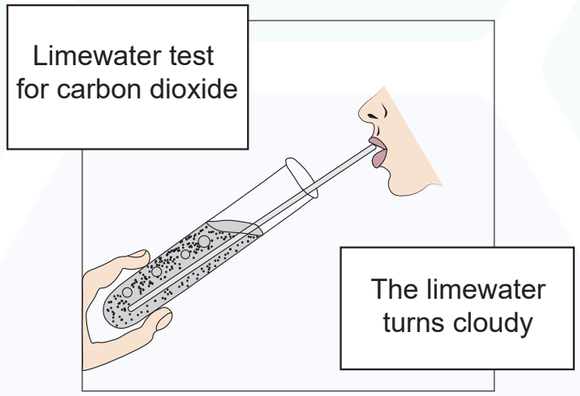
GCSE Biology 1.2 Smoking knowledge organiser

The air we breathe

The air we breathe contains particles and bacteria that are potentially dangerous if they get into the delicate alveoli of the lungs.

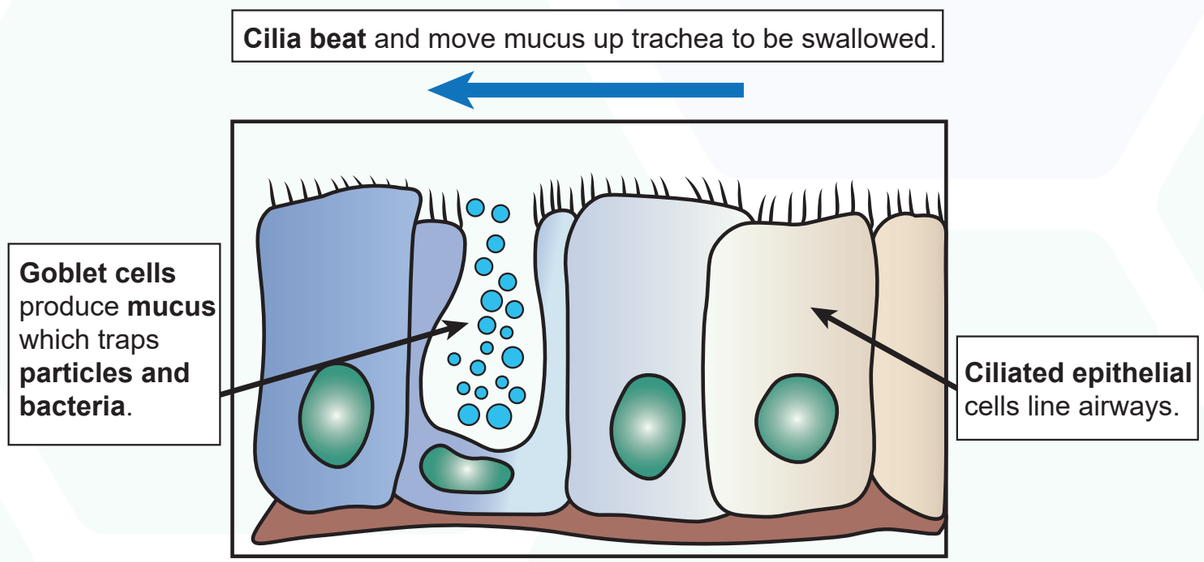
The air we breathe in (inspired air) and out (expired air) contain different proportions of gases because we **use up oxygen** and **produce carbon dioxide and water.**

Proportion of gases in air (%)		
Gas	Inspired air	Expired air
Oxygen	21	16
Carbon dioxide	0.04	4
Water	Variable	Saturated
Nitrogen	78	78



We can test expired air for carbon dioxide using limewater:

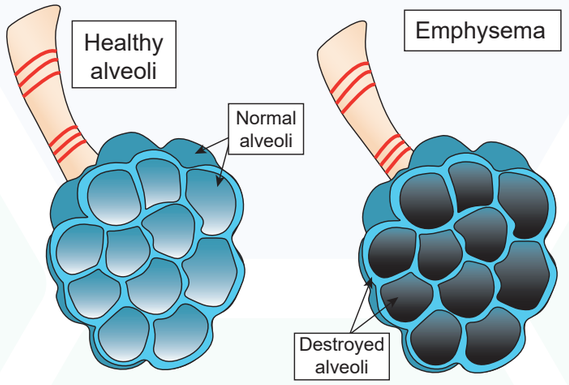
Keeping the lungs clean



As well as other things smoking paralyses the cilia and the smoke contains particles that clog mucus.

Smoking

Chemical in cigarette smoke	Effect on the body
Tar	Contains carcinogens that cause lung cancer
Nicotine	Addictive



Smoking destroys lung tissue leading to:

Emphysema

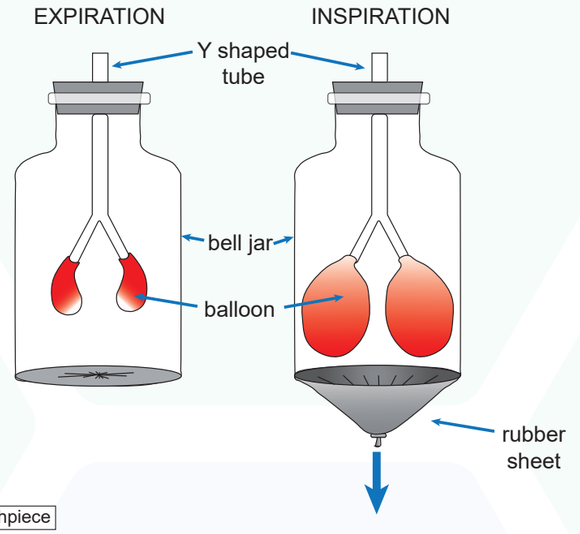
This disease is caused by the alveolar walls breaking down, reducing the surface area for gas exchange. A patient would struggle to get enough oxygen for normal activities.

Modelling the respiratory system

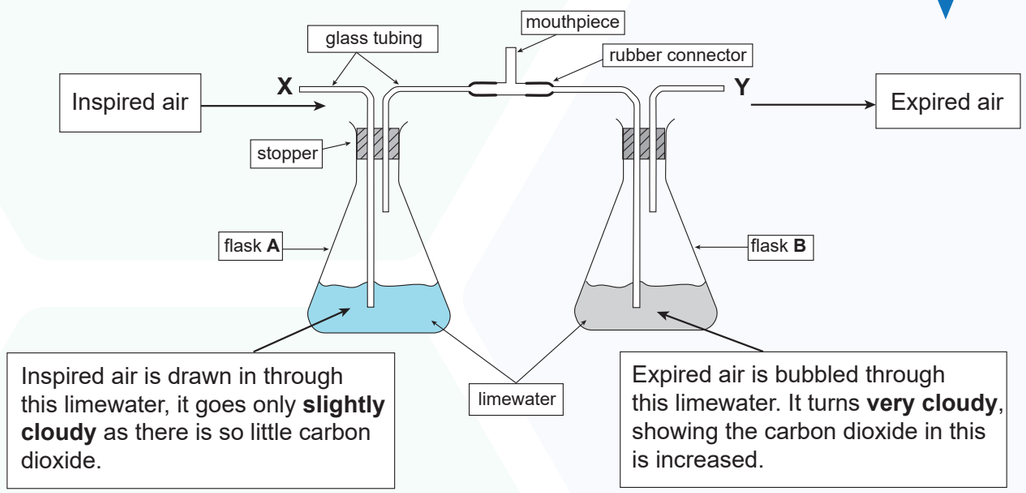
1. The bell jar model

limitations:

- Balloons for lungs but do not fill the jar
- Bell jar for ribs but does not move as ribs do
- Rubber sheet pulls down further than flat.



2. Huff and puff apparatus



GCSE Biology 1.3 Digestion knowledge organiser

Why digest food?

The food we eat is made from large insoluble molecules. We need to be able to break these down in our digestive system into small soluble molecules which can move through the wall of the small intestine and into the blood to be carried around the body and to the cells.

Food	Structure	Broken down by:	Enzymes produced by:
Carbohydrates	Starch → Glucose	**Carbohydrase** enzymes	Mouth, pancreas and small intestine
Proteins	Protein → Amino acids	**Protease** enzymes	Stomach, pancreas and small intestine
Lipids (fats)	Fat → Glycerol + fatty acids	**Lipase** enzymes	Lipase enzymes

A balanced diet

A balanced diet contains

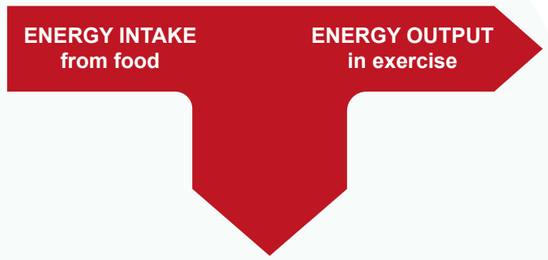
- Proteins - Build bodies
- Carbohydrates - for energy
- Fats - provide energy
- Minerals – iron- for haemoglobin in blood
- Vitamins - vit C- maintains healthy tissues
- Fibre - provides bulk
- Water- essential for body processes and functions.

Excess amounts of any of these can cause health problems.

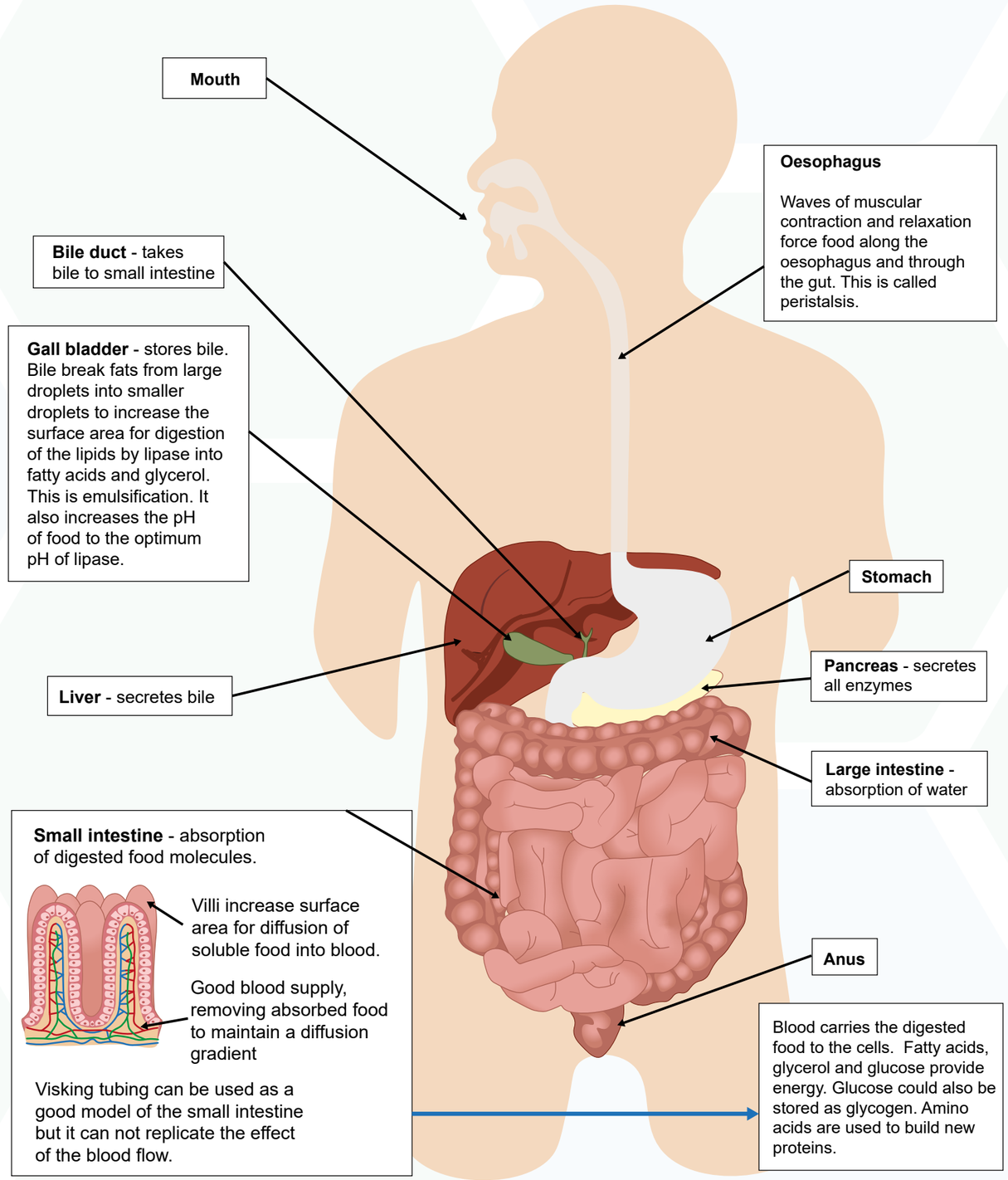
- Excess high energy foods will be stored as fat leading to obesity.
- Excess sugar can lead to type II diabetes, tooth decay and obesity
- Excess fat can lead to obesity, heart disease and circulatory disease.
- Excess salt can lead to high blood pressure.

Food tests

Food	Chemical used	Colour change
Starch	Iodine	Brown to blue/black
Glucose	Benedict's	Blue to brick red
Protein	Biuret	Blue to violet

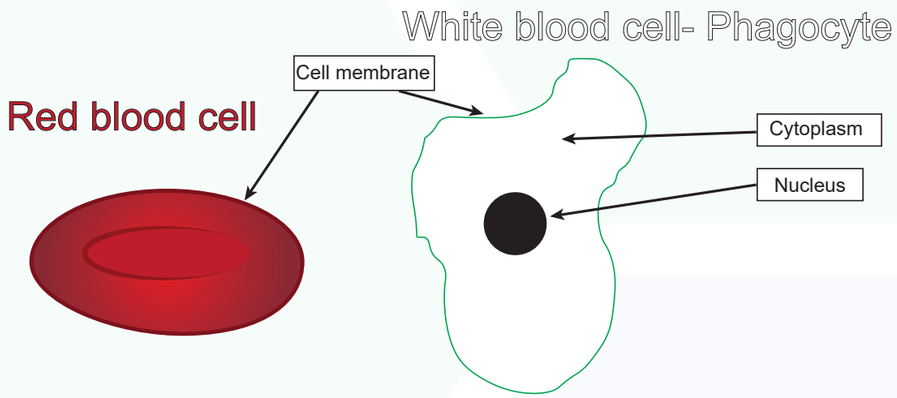


The digestive system



GCSE Biology 1.4 The circulatory system knowledge organiser

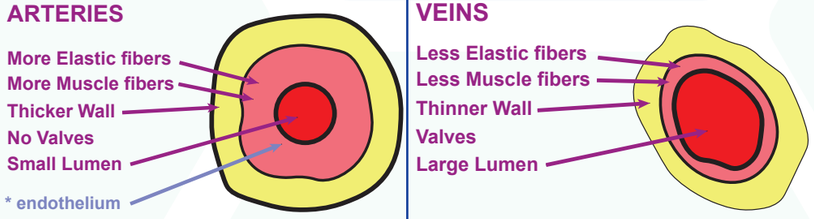
Blood



Parts of the Blood

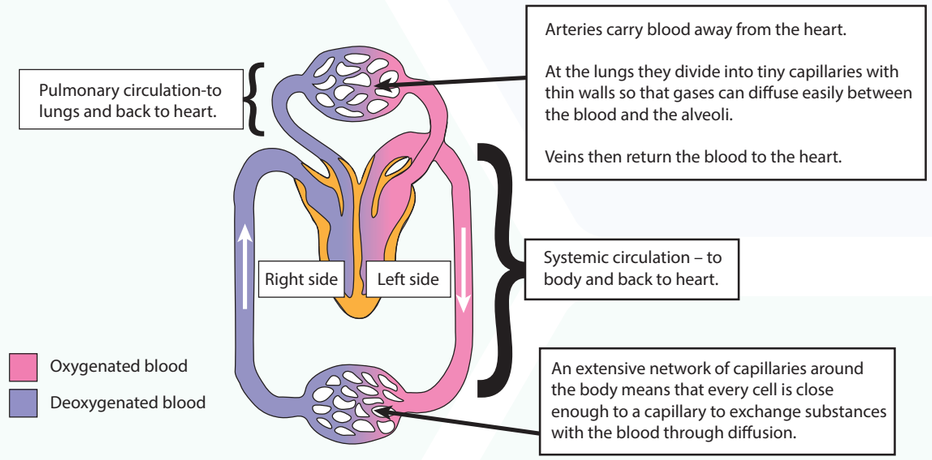
Structure	Function
Red blood cells	Contain haemoglobin for transport of oxygen
White blood cells	Defend against infectious disease
Platelets	Clot the blood
Plasma	Carries dissolved substances e.g. Urea, carbon dioxide, soluble food and distributes heat

Arteries and veins - Separate science only

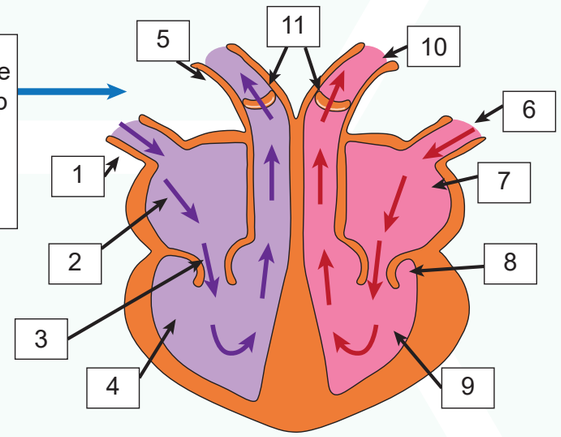


Type of Blood	Oxygenated	Deoxygenated
Direction	Away from heart	Towards heart
Pressure	Higher	Lower
Size of Hole (lumen)	Smaller	Larger
Wall Thickness	Thicker	Narrower
Valves?	No	Yes

Circulation and the Heart



The heart is the muscular pump that pushes blood around the body.



1. Vena cava- returns deoxygenated blood to the heart from the body.
2. The right atrium contracts to force blood …
3. through the tricuspid valve…
4. into the right ventricle which then contracts pushing blood up the …
5. pulmonary artery to the lungs.
6. The pulmonary vein returns blood to the heart.
7. The left atrium receives the oxygenated blood and contracts…
8. forcing blood through the bicuspid valve…
9. into the left ventricle. The left ventricle contracts, it has a much thicker muscular wall than the right ventricle to provide enough pressure to push blood all around the body.
10. The aorta carries this blood under high pressure out of the heart and to the body.
11. The valves in the heart prevent the back flow of blood. These are the semi lunar valves.

Coronary heart disease

- Risk factors
- High fat diet
- High salt diet
- High blood pressure
- High blood cholesterol
- Smoking
- Genetic factors
- Lack of exercise

Treatments separate science only

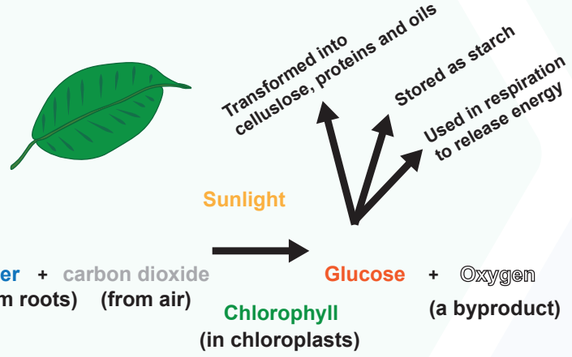
- Statins
- Angioplasty
- Change of lifestyle

Coronary arteries can be seen on the outside of the heart, they supply the heart with glucose and oxygen for respiration. The heart needs to respire to get the energy for the muscular contractions needed to push blood. An atheroma (fatty deposit) may block these arteries leading to a heart attack.

GCSE Biology 1.5 Plants and photosynthesis knowledge organiser

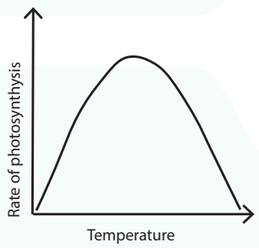
Photosynthesis

A series of enzyme-controlled reactions in plant cells. Chlorophyll absorbs light energy for the reaction. The leaf is the organ of photosynthesis.



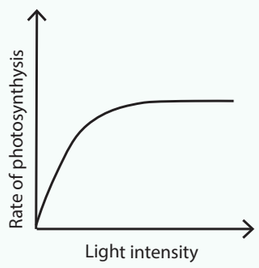
Factors affecting photosynthesis - Limiting factors

Temperature - Rate of photosynthesis is usually measured by recording the volume of oxygen produced.



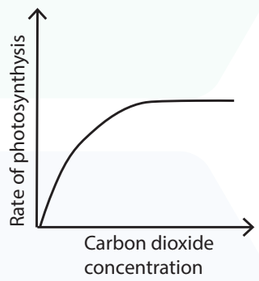
As photosynthesis is controlled by enzymes as the temperature increases the rate of photosynthesis increases to an optimum then decreases.

Light intensity - Usually investigated by moving a plant closer to a light source and recording the O_2 produced.



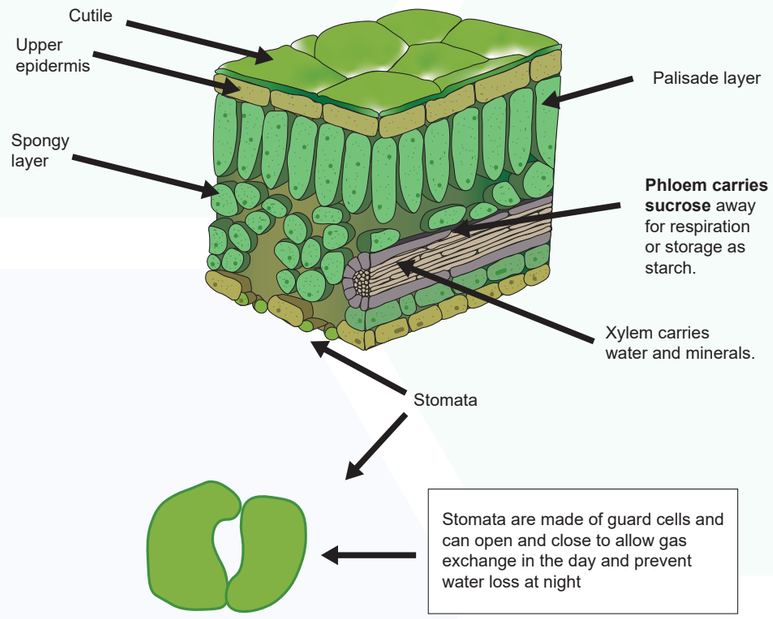
As light intensity increases so does the rate of photosynthesis until lack of another factor e.g. CO_2 limits any further increase.

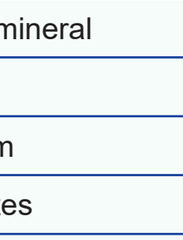
Carbon dioxide - When investigating the effect of CO_2 on photosynthesis scientists enclose the leaf in a transparent bag/jar with **sodium hydroxide, this chemical absorbs CO_2.**



As CO_2 increases the rate of photosynthesis increases until another factor limits the increases e.g. light intensity.

The leaf separate science only





Stomata are made of guard cells and can open and close to allow gas exchange in the day and prevent water loss at night

Testing a leaf for starch

Leaves kept in the dark for 24 hrs are **destarched**. They can the be used to investigate photosynthesis in different conditions. If a plant has been photosynthesising its leaf will contain starch.

The test:

1. **Boil** the leaf to **kill it**
2. **Decolourise** using **ethanol**
3. Wash to soften
4. **Test with iodine**- a blue/black colour shows the presence of starch.

Minerals - separate science only

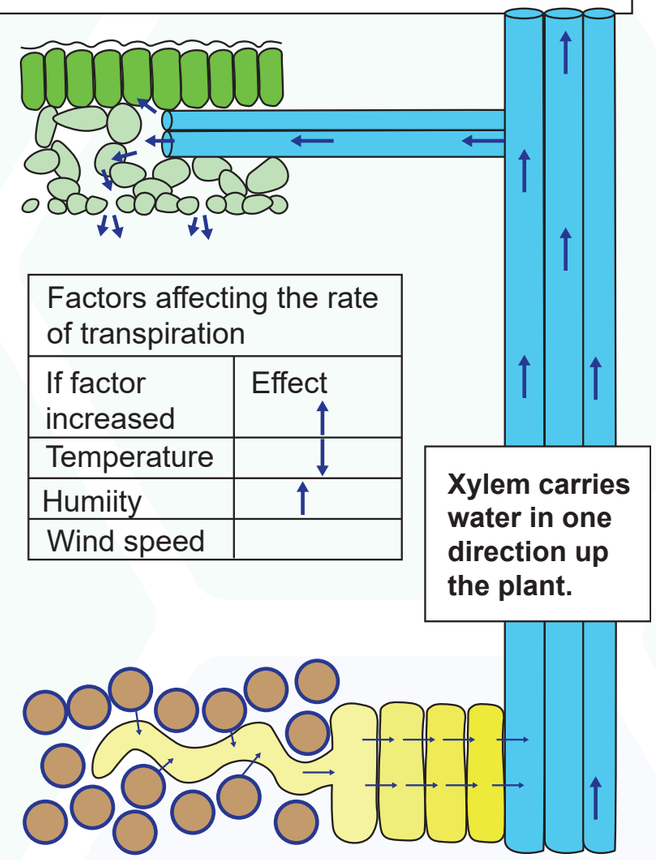
Plants need certain minerals for healthy growth. A deficiency of certain mineral cause specific growth problems.

Deficient mineral	Growth problem
Nitrates	Poor growth
Potassium	Yellowing of leaf
Phosphates	Poor root growth

The importance of water - separate science only

Water is used in photosynthesis, transport of minerals and provides support by filling the cell vacuoles which push against cell walls. This keeps cells turgid and prevents cells becoming flaccid and wilting.

Leaf Water from the xylem evapotates into air spaces. Some water vapur is lost from the stoma. This is transpitration.



Factors affecting the rate of transpiration	
If factor increased	Effect
Temperature	↕
Humiity	↑
Wind speed	

Xylem carries water in one direction up the plant.

Roots

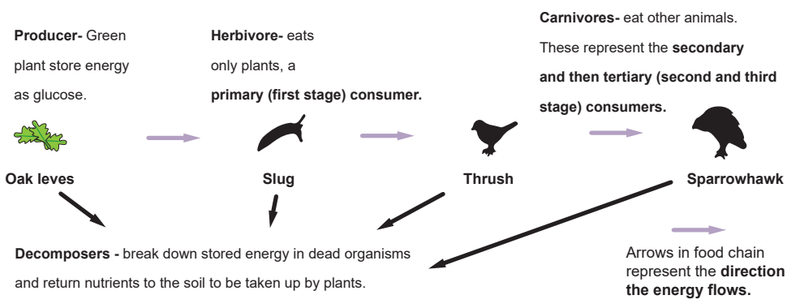
The root hairs **increase the surface** area for absorption of water. Minerals are **actively transported into** the cells which allows water to be drawn by osmosis into the root cells and then to the xylem.

The active transport means that root cells are actively respiring requiring lots of oxygen.

GCSE Biology 1.6 Ecosystems, nutrient cycles and human impact on the environment knowledge organiser

Energy flow

Energy from the sun is the source of energy for all life on earth. Green plants absorb about 1% of this energy during **photosynthesis**.



As energy is lost at each trophic level it is more energy efficient to eat the organisms nearer the start of the food chain.

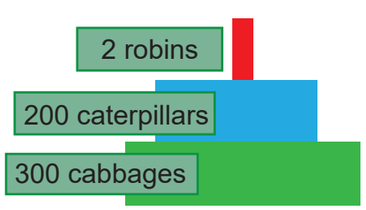
Energy is used at each trophic (feeding) level in the chain (only around 10% in passed on) This limits the number of organisms in the chain.

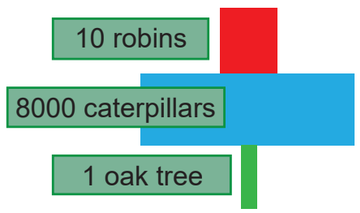
$$\text{Trophic efficiency} = \frac{\text{energy in later stage}}{\text{energy in earlier stage}} \times 100\%$$

Energy is used in repair and in the maintenance and growth of cells. Energy is lost in waste materials and respiration. Efficiency of each stage can be calculated by:

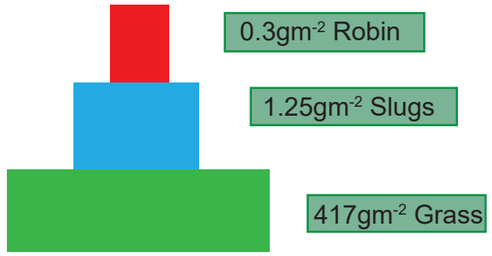
Pyramids of number/biomass

To build either pyramid start at the bottom with the producer and continue up the pyramid following the food chain.
Pyramids of number - show **how many** organisms are in each trophic level.





Pyramids of biomass show the **dry weight** of organisms at each trophic level.



Intensive farming

The increasing population means farming has changed to increase the yields of crops and meat produced.
This is done by:

- Using fertilisers and pesticides
- Battery farming
- Disease control

The disadvantages of these methods include:

- Excess use of antibiotics in farm animals for disease control could increase bacterial resistance and still be present in meat we eat.
- Battery methods show poor animal welfare and the duty of care to treat animals humanely.
- Other disadvantages

Eutrophication - Caused by:

- Fertilisers
- Untreated Sewage

If either of these substances is washed from the crops where farmers have placed them to increase growth of plants then:

- They can be washed into rivers, lakes, ponds.
- The nitrates in the sewage and fertilisers increase the growth of algae and water plants.
- When these die they are broken down by microbes, the increase in food for the microbes allows them to increase in number.
- Respiration of the now huge numbers of microbes use up the oxygen in the water and fish and other aquatic organisms suffocate and die.

Bioaccumulation - caused by:

- Pesticides
- Heavy metals (industrial waste)

These substances can be washed into soils and rivers. If they enter the food chain:

- They are persistent: do not break down in animal tissues and so
- They accumulate along the food chain until they reach toxic levels
- Causing reduced fertility or death in top predators.

Indicator species

A growing population means that more space is needed for:

- Housing
- Industry
- Agriculture
- These will have an environmental impact polluting and endangering species. Government agencies have an important role in monitoring, protecting and improving the environment.

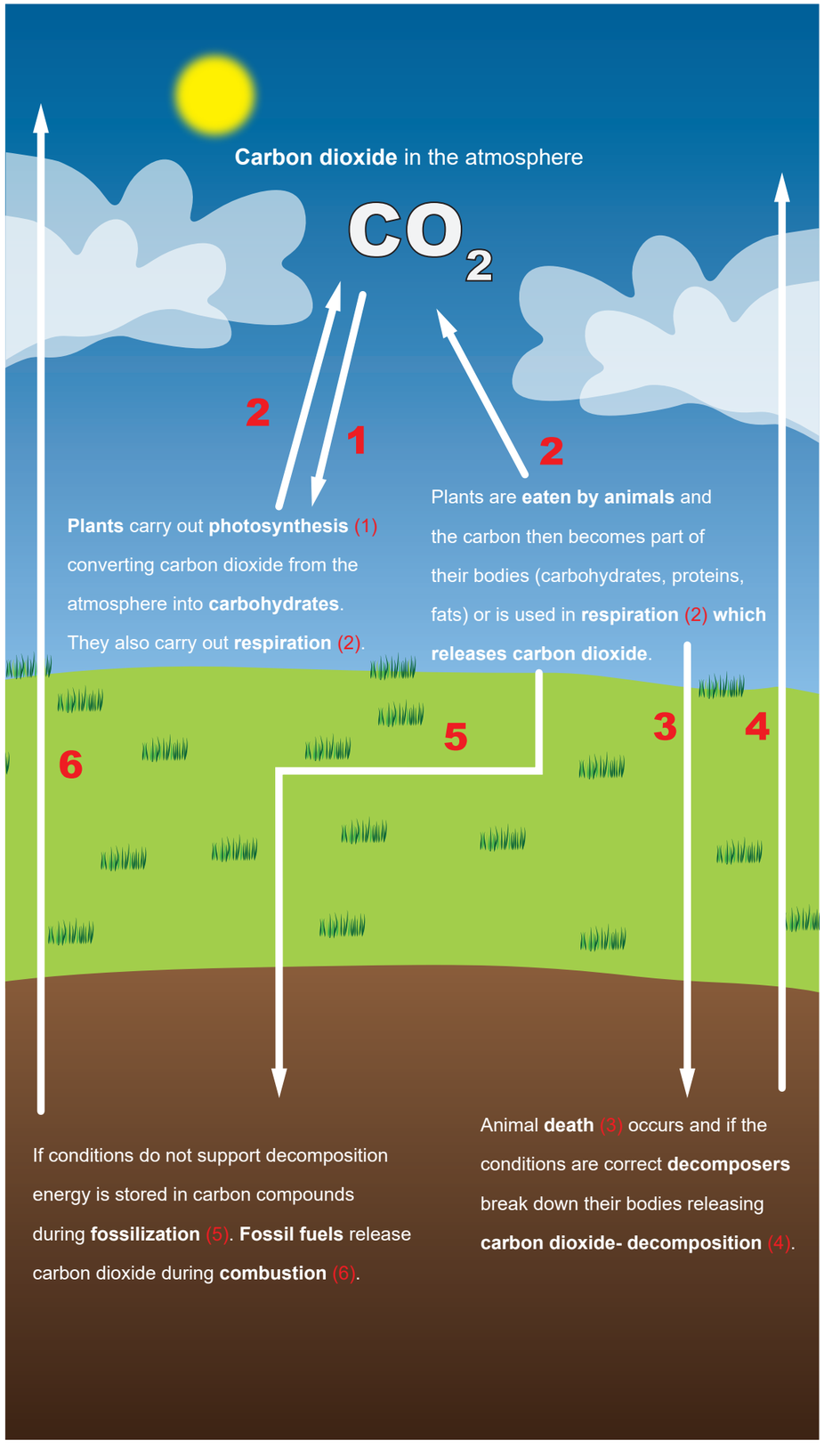
Pollution can be measured in a few ways

- Measure **oxygen levels** (less oxygen -more pollution)
- Measure **pH** levels

Lichens are used to indicate **air pollution** (sulphur dioxide in air). Some species will only grow in clean air, others can tolerate higher levels of pollution. Very high levels of pollution no species will grow.

Freshwater invertebrates – Some invertebrates can only live in very clean water; others can tolerate more pollution. Collecting samples of water and recording the invertebrates found can indicate the level of pollution.

GCSE Biology 1.6 Ecosystems, nutrient cycles and human impact on the environment knowledge organiser - Separate Science Only



Decomposition

Waste and dead organisms are broken down into useful substances by the action of decomposers e.g. microbes (bacteria and fungi).

In a stable community the process which decomposes organic material returning nutrients (nitrates and phosphates) to the soil are balanced by those that remove these substances for use (plants).

During decomposition microbes respire (an enzyme dependent reaction) producing carbon dioxide. They therefore require:

- Adequate temperature
- Oxygen

They are also sensitive to:

- pH
- Heavy metals

When conditions prevent decay occurring energy remains locked in carbon compounds such as fossil fuels.

- Coal
- Oil
- Gas

The cycling of two useful substances in nature are shown here.