Science Revision Notes

Use this document in conjunction with your topic checklist booklet (Years 7 and 8 only), text book, website (www.bioteacher.weebly.com) and class notes.

Chemistry

1. The variety of materials

What you need to know:

- Know the main properties of and an everyday use for a variety of substances:
- Gold, copper, graphite, mercury, zinc, aluminium, tin, iron, chromium, lead, glass, plastics, ceramics, wood, rubber, fibres.
- Have some idea about why each substance is suited for the use it is put to, eg aluminium is often used for saucepans because it light and does not corrode.
- Know that an alloy is a mixture of two metals. eg brass is an alloy of copper and zincM(e.g. solder is an alloy of lead and tin)

There are many substances around us.
They all have their own properties which is how we recognise them.
Example properties are : colour, strength, malleable or brittle, conductor or insulator

Substance	Property
Aluminium	A pale, silvery metal. Very low density. Often used to make 'alloy' wheels and aircrafts
Lead	A grey metal which is soft and bendy. Often used on roofs although it is rather heavy.
Copper	A pink metal used to make electric wires and water pipes
Graphite	A grey substance that is used to make pencil 'leads'.
Mercury	A grey liquid metal
Sulphur	A yellow crumbly solid that burns to make a smelly gas
Brass	An alloy of copper and zinc
Tin	The substance coated over 'tin' cans to stop the iron going rusty
Zinc	The substance coated over iron to make galvanized iron.
Perspex	A clear plastic often used as a replacement for glass
Gold	A precious metal. It is yellow and very heavy. Used to make jewellery.

Substances can be divided into categories like:
Metals, ceramics (china), plastics, glass - each with their own set of properties

Example questions:

1. What properties of aluminium make it suitable for building planes?
Answer: because it has low density, strong and doesn't corrode
2. Give two advantages of using iron to build a bicycle frame and two disadvantages
Answer:
Advantages: strong and cheap
Disadvantages: Goes rusty and is heavy
3. Which of these would be the best substance to build a washing up bowl: plastic, glass, iron
answer: plastic
Give one advantage and one disadvantage of the substance you have chosen:
advantage: cheap, easy to mould into shape
disadvantage: melts easily. Not very strong

2. The Bunsen Burner

- Safety rules: no flammable liquids near flame, no loose cuffs or hair.

<u>Air hole closed</u>
Flame is yellow, smoky and luminous
Always light the Bunsen burner with the air-hole closed
<u>Air hole open</u>
Flame is hot, blue and roaring
Do not heat things in the pale blue area as it is not so hot
The hottest part of the flame is just above the pale blue cone.

3. Making a solution

- Water, alcohol and petrol are two examples of good solvents.
- The solubility of the solute (ie the mass of solute that can dissolve in 1 litre of solvent) depends on the type of solvent and the temperature of the solvent (eg hot water can dissolve more copper sulphate that cold water).
- Some gases can also dissolve in water (fish obtain their oxygen from the dissolved oxygen in the water) and that the amount of gas that can dissolve decreases as the temperature of the water increases.

Making a solution
A solution is formed when a solid DISSOLVES in a liquid.
The solid that has been dissolved is called the solute.
The liquid used to make the solution is called the solvent.
Example: When salt is dissolved in water then salty water is made
The solute is salt. The solvent is water.

SALT + WATER = SALTY WATER
(SOLUTE) + (SOLVENT) = (SALT SOLUTION)

Not all solids dissolve by the same amount:
Salt dissolves easily so is said to be soluble in cold water.
Lime (calcium hydroxide) is difficult to dissolve so is slightly soluble in cold water.
A substance like sand does not dissolve so is insoluble in water.

<u>Factors (variables) which effect the amount of solid which dissolves:</u>
The quantity of solid being used.
The volume of water
The rate of stirring
The size of the particles in the solid
The temperature of the water

<u>How to speed up the time taken to dissolve a solid:</u>
Use warm water
Stir the solution quicker
Grind the solid to make the particles smaller.
How to tell if a liquid is pure or contains a solute:
Place one or two drops of the filtrate on to a clean watch glass (or microscope slide)
Let the water evaporate and see if there is any residue.
If there is it means that some of the solid did dissolve.

<u>Vocabulary</u>
solute: The solid that has been dissolved when making a solution (eg the SALT in salty water)
solvent: A liquid that has been used to make a solution (eg the WATER in salty water)
solution: The liquid formed when one substance dissolves in another
soluble : is able to dissolve (eg salt is soluble in water)
insoluble: is NOT able to dissolve (eg sand is insoluble in water)
saturated: a solution is saturated when no more of the solid will dissolve in it
Filtrate: The clear liquid that has been filtered.

Filtration: The process used to separate a solid (or suspension) from a liquid. The process used to separate a solid (or suspension) from a liquid.

Mixture: Something that can be SEPARATED into two (or more) different substances. eg air, sea water, earth, orange juice. Something that can be SEPARATED into two (or more) different substances. eg air, sea water, earth, orange juice.

Pure: A material is pure if it contains only one chemical substance and so cannot be separated further A material is pure if it contains only one chemical substance and so cannot be separated further.

Residue: The solid left behind after an experiment (eg the solid left in the filter paper). The solid left behind after an experiment (eg the solid left in the filter paper).

Suspension: Very fine particles of solid mixed with a liquid. If the solid is in suspension the water will often look cloudy. eg flour and water shaken together. Very fine particles of solid mixed with a liquid. If the solid is in suspension the water will often look cloudy. eg flour and water shaken together.
NOTE: in a suspension the solid has not dissolved but in a solution it has.
Soluble: Can dissolve eg Salt is soluble in water
Insoluble: Cannot dissolve eg sand is insoluble in water

4. Separating mixtures

Something is a MIXTURE if it contains two (or more) substances that **are not** chemically joined together. (NOTE: a compound is where two or more substances ARE chemically joined).
The substances in a mixture can often be easily separated from one another.
A PURE substance only contains one material and so cannot be separated in any way (unless a chemical reaction takes place)

Methods of separating mixtures:

1. A magnet can be used to separate IRON from SAND.

How it works: The magnet sticks to the iron but not to the sand

2. Filtering (filtration) can be used to separate a solid (or suspension) from a liquid.

How it works: The liquid (and anything dissolved in the liquid) passes through holes in the filter paper but the solid particles are too big and get stuck.
Example: Filtration would be used to separate the dirt from some salty water.

3. Evaporation can be used to separate a dissolved SOLUTE from a SOLUTION

Example: Evaporation would be used to obtain some pure salt from salty water.
How it works: When salty water is warmed the water evaporates leaving behind crystals of salt.

4. Distillation: used to obtain the solvent from a solution (eg obtain pure water from sea water). The Liebig condenser helps cool down the steam (notice which way the cooling water flows through the Liebig condenser). This helps the steam cool down. You must be able to identify and label the Liebig condenser.
5. Fractional distillation. Used to separate one liquid from a mixture of different liquids that have <u>different boiling points</u>.
   Eg. i. obtaining ALCOHOL (bp78C) from wine.
   ii. Oxygen or nitrogen is obtained from air (a mixture of different gasses) by the fractional distillation of liquid air.
6. Chromatography: used to separate out a mixture of coloured substances (eg obtain the green colour from crushed grass) – substances that have <u>different solubilities</u>

Making Rock Salt Pure

Rock salt is a MIXTURE of several substances.
In order to make pure salt it is necessary to remove the INSOLUBLE dirt from the SOLUBLE salt.
[Note: The method described below could be used to separate any two substances when one of them can dissolve in water and the other cannot]

1. CRUSH the rock salt using a mortar and pestle. This makes the salt dissolve more easily.
2. STIR the crushed salt into a beaker of warm water. The salt will DISSOLVE into the water but the dirt, which is insoluble in water, will not.
3. FILTER the mixture. The dirt will get caught in the filter paper as a residue and the clear SALTY WATER will drip through and form the filtrate.
4. Warm the filtrate in an evaporating basin. The water will EVAPORATE leaving behind pure salt crystals. The heat is stopped BEFORE all of the water has evaporated. This makes the salt more pure and helps prevent the evaporating basin from cracking.

How to tell if a liquid is pure or contains a solute:
Place one or two drops of the filtrate on to a clean watch glass (or microscope slide)
Let the water evaporate and see if there is any residue.
If there is it means that some of the solid did dissolve.

Vocabulary to Learn:
Mixture: Something that can be SEPARATED into two (or more) different substances. eg air, sea water, earth, orange juice.
Pure: A material is pure if it contains only one chemical substance and so cannot be separated further Filtrate: The clear liquid that has been filtered.
Residue: The solid left behind after an experiment (eg the solid left in the filter paper).
Filtration: The process used to separate a solid (or suspension) from a liquid.
Filtrate: The part of the substance that drips through the filter paper during filtration.
Suspension: Very fine particles of solid mixed with a liquid. If the solid is in suspension the water will often look cloudy. eg flour and water shaken together.
NOTE: in a suspension the solid has not dissolved but in a solution it has.
Soluble: Can dissolve
Insoluble: Cannot dissolve
Solvent: The liquid that is used to make a solution
Solute: A substance that has been dissolved in a solution.

5. Acids and alkalis

ACIDS
Have a pH value less than pH 7
Turn blue litmus indicator red
Can neutralise an alkali
Have a sour taste (WARNING: never taste any chemicals)

Examples of common acids:
<u>Weak acids</u>
citric acid (found in lemons and other citrus fruits), tannic acid (found in tea),
acetic (ethanoic) acid (found in vinegar), formic acid (found in ant stings)
<u>Strong acids</u>
sulphuric acid (accumulator acid, found in car batteries)
hydrochloric acid (in our stomach to kill germs)
nitric acid (used in the manufacture of explosives and fertilizers)

NOTE: strong acids are a lot more dangerous than weak acids.
Acids are CORROSIVE which means they will attack and weaken many things including metals, paper, clothing and skin.
A concentrated acid or alkali is more dangerous than a dilute one.
To make something more dilute water needs to be added.
CONCENTRATED means without much or without any water added.
DILUTE means a lot of water added.

ALKALIS
Have a pH value more than pH 7
Turn red litmus indicator blue
Can neutralise an acid
Feel soapy to touch (reacts with fat to form soap)

<u>Examples of common alkalis</u>:
caustic soda (sodium hydroxide): used to clean ovens and drains
washing soda (sodium carbonate)
ammonia solution (often used in household cleaners)
garden lime (calcium oxide): used to neutralise acid in the soil
indigestion powder (often magnesium hydroxide)
Alkalis are caustic which means they will burn skin and eyes.
A strong alkali (like caustic soda) is VERY dangerous.

NEUTRAL LIQUIDS
A neutral liquid is one with a pH value equal to pH 7.
examples: water, salt (sodium chloride) solution, sugar solution

THE pH SCALE
A scale of numbers ranging from 1 to 14
neutral = pH7
acid = less than pH 7

alkali = more than pH7
Table of pH numbers

1	2	3	4	5	6	7	8	9	10	11	12	13	14

Indicators

An indicator is a liquid that is used to show whether we have an acid or an alkali
It is one colour in an acid and another in an alkali
There are two indicators you need to know the names of: Litmus indicator and Universal indicator

a. Litmus Indicator

Litmus can only be two colours
In ACIDS it is RED
In ALKALIS it is BLUE
We use litmus indicator when we want to tell precisely when a liquid is neutral but it can't tell us how strong an acid or an alkali is

b. Universal Indicator

Universal indicator is a mixture and has a whole range of colours
We use universal indicator when we want to know how strong an acid or alkali is but it is difficult to know when a liquid is precisely neutral.

pH values of some common substances

Substance	Colour with universal indicator	pH	Description
Hydrochloric acid	Red	1	Strong acid
Oven cleaner	Purple	14	Strong alkali
Vinegar	Orange	5	Acid
Water	Green	7	Neutral
Lime-water	Blue	9	Alkali
Caustic soda	Purple	13	Strong Alkali
Indigestion powder	Blue-green	8	Mild alkali
Tooth paste	Blue-green	7.5	Mild alkali
Lemon juice	Orange	4	Acid

Neutralisation

When an alkali is added to an acid, a chemical reaction takes place.
This reaction is called neutralisation and makes the pH number rise.
The alkali is 'opposite' to the acid and cancels it out.
An acid always reacts with an alkali to produce a salt and water
ACID + ALKALI = SALT + WATER

Eg. Hydrochloric acid will react with sodium hydroxide to produce a solution of sodium chloride (salty water). If the solution is warmed so the water evaporates crystals of common salt will be left

Hydrochloric acid + sodium hydroxide ----> sodium chloride + water

Other reactions involving acids

1. Acids react with most metals to form a salt and hydrogen gas:
eg zinc + sulphuric acid ----→ zinc sulphate + hydrogen

2. Acids react with any metal carbonate (eg copper carbonate or calcium carbonate) to produce a salt, water and carbon dioxide gas
eg calcium carbonate + hydrochloric acid - - -> calcium chloride + water + carbon dioxide

3. An acid reacts with an alkali to form a salt plus water (neutralisation – above)
eg i. hydrochloric acid + sodium hydroxide ---→ sodium chloride + water

NOTE: A base is any chemical that can neutralise an acid. An alkali is a base that is soluble in water.
A salt is formed whenever a base neutralises an alkali
eg. sulphuric acid + copper oxide - - - - -> copper sulphate + water
[base + acid - - - - -> salt + water]

<u>Some useful applications of neutralisation:</u>

In **agriculture**:

Lime (or quicklime), which is an alkali, is placed on the soil to neutralise acid soil and so raise its pH.

The soil becomes too acid due to the bacteria which help plants and animals decompose.

Why do we need to neutralise soil?

Some plants grow better in less acid soils

Bacteria, which cause plants to decompose and so fertilize the soil, grow better in less acid soils.

In **medicine**:

Indigestion is often caused by too much acid in your stomach.

Indigestion mixture contains a mild alkali which neutralises excess acid in your stomach.

6. The Air

What you need to know:

- Know that the air is a mixture of various gases and know the approximate composition of air: 78% nitrogen, 21% oxygen, 1% argon (and other noble gases eg helium, neon), 0.03% carbon dioxide, water vapour.
- Be able to use anhydrous copper sulphate to show the existence of water vapour in the air.
- Know that rain is slightly acidic due to carbon dioxide dissolving in the rain water.
- Know that rusting is a form of corrosion and be able to say how to prevent rusting.
- Know how to show that both oxygen and water vapour are necessary for rusting to take place.
- Know that oxygen is necessary for combustion and also for respiration, both of which are examples of chemical change.
- Know that air contains various pollutants, like carbon monoxide from car exhausts and sulphur dioxide from burning fossil fuels. Know of the dangers of these pollutants and how to help reduce them.
- Know that air has mass and be able to calculate the density of air.
- Be able to make oxygen by heating potassium permanganate and be able to use the glowing splint test to identify oxygen. Be able to identify the products of combustion eg be able to show that a burning candle forms carbon dioxide (turns lime-water milky)(and water (turns anhydrous cobalt chloride pink).

The air is a mixture of gases, some of which are elements and some compounds.
The approximate composition of air is:
78% nitrogen,
21% oxygen
1% argon and other noble gases
0.03% carbon dioxide
with a varying amount of water vapour
Air also contains a number of pollutants

Identifying gases in the air:
Oxygen Relights a glowing splint
Carbon dioxide Turns limewater cloudy / extinguishes a lit splint
Hydrogen Makes a lit splint 'pop'
Water vapour: Condense it into colourless liquid. This can then be tested with anhydrous cobalt chloride which will turn from blue to pink (or with anhydrous copper sulphate which turns from white to blue)

Separation
Gases in the air are separated industrially by the fractional distillation of liquid air.
Uses:
Oxygen is the most reactive gas in the atmosphere and the only one that supports combustion. Its main use is in the steel industry for the purification of iron. It is used in welding, hospitals and in rocket fuel.
Carbon dioxide Used in fire extinguishers and in fizzy drinks
Nitrogen Used in fertilizers (nitrogen is an important plant food) and in explosives.
Argon Used in light bulbs to stop the filament oxidising

Pollutant	**Where it comes from**	**Dangers/effect**	**How to reduce it**
Sulphur dioxide (SO_2)	Burning fossil fuels eg coal and oil.	Dissolves in rain water to form acid rain which can harm animal and plant life. It also attacks limestone buildings.	1. Use chemical filters in chimneys. 2. Burn less fossil fuels This can be done by using other energy sources eg nuclear energy or solar and wind power.
Carbon Dioxide (CO_2)	Burning coal and wood	Carbon dioxide is a greenhouse gas. It increases global warming due to the greenhouse effect.	Carbon dioxide is naturally present in the atmosphere anyway due to the bi-products of decomposition and respiration but we must do what we can not to increase it unnecessarily. eg Do not clear forests by burning them. Burn less coal.
Carbon Monoxide (CO)	Car exhaust fumes	Very poisonous and it has no smell. It damages the blood by making it not able to carry oxygen around the body so efficiently.	1. Have fewer cars on the road. 2. Fit catalytic converters. 3. Find alternative fuels for cars eg electricity or hydrogen
Nitrogen dioxide (NO_2)	Car exhaust fumes.	Forms acid rain	Fit catalytic converters to cars.
Methane (CH_4)	Mainly from land-fill waste tips.	Methane is a greenhouse gas. It increases global warming due to the	Dispose of rubbish in other ways.

		greenhouse effect.	
Lead compounds	Car exhaust fumes	Poisonous. Can cause brain damage.	Use unleaded petrol.
Soot	Mainly car exhaust fumes also smoke	Looks unsightly on buildings; damages lungs.	Use fewer cars. Fix filters in chimneys.

Experiment to show the composition of air:

Method

100 cm3 of air is put in one syringe. When the copper is heated it reacts with the oxygen in the air inside the syringe.

The syringe plungers are moved in and out so that all of the air is passed over the hot copper.

When there is no further change the apparatus is allowed to cool (to allow the heated air to contract.

Some copper remains unreacted because there is no oxygen left in the syringe.

The gas remaining in the syringe is mostly nitrogen.

Results

Volume of air in syringe at start = 100cm3

Volume of air in syringe after heating = 79 cm3

Volume of air used up by copper = 21cm3

Conclusion

There is 20% oxygen in the air because 20% of the air was used up by the copper 'taking' the oxygen.

Similar results would be expected with anything that reacted with oxygen, eg iron rusting or a candle burning, ie about 20% of the air would be used up.

7. Physical Changes

All of the terms described below are types of physical change because no new substance is made and the changes are all reversible

Getting hotter:

MELTING : When a solid turns to a liquid. This happen as soon as the substance reaches (or goes above) a temperature called its melting point

eg wax melts when heated.

EVAPORATING: When a liquid turns to a vapour

BOILING: This is when a liquid turns to a vapour at its boiling point.

eg water boils when heated.

SUBLIMING : This is when a solid turns to a vapour without becoming a liquid

Getting colder:
CONDENSING: This is when a vapour turns to a liquid when it is cooled down (to below the boiling point)
FREEZING (or solidifying): This is when a liquid turns to a solid. This happens when the liquid cools to below its melting point.
SUBLIMING : This is when a vapour turns to a solid without becoming a liquid
eg Iodine turns from a purple vapour to a black solid when heated
[notice that the same word (subliming) is used for the change from a solid to a vapour and from a vapour to a solid]

<u>The Three States of Matter</u>
The three states, SOLID, LIQUID and GAS are called the three states of matter
The boiling point of a substance is the temperature that causes it to change from a liquid to a gas
At a temperature ABOVE its boiling point a substance will always be a gas
The melting point of a substance is the temperature that causes it to change from a solid to a liquid
At a temperature below its melting point a substance will always be a solid
At a temperature between its melting point and boiling point it will be a liquid

eg

Substance	**Melting Point**	**Boiling point**	**State at room temperature (25^{O}C)**
Lead	327	1740	Solid
Mercury	-39 C	357 C	Liquid
Oxygen	-218	-183	Gas

You don't need to remember the melting points and boiling points but you DO need to know why each substance is a solid, liquid or gas.
You DO need to know the melting point and boiling point of water

Water:
Boiling point = 100 C
Melting point = 0 C

We can make a substance change state by heating it up or cooling it down as described below.

8. Chemical Changes

Examples of chemical change: rusting (oxidation), burning coal (oxidation)

Signs for a chemical change are:
1. A change in colour (eg changes from pink to blue)
2. A change in temperature (eg gets warm or hot)

The following are types of chemical change **because in each case a new substance is formed**

Oxidation
: When a chemical combines (joins up with) oxygen to form an oxide.
eg copper foil will oxidise when heated strongly in air
Word equation: copper + oxygen -------> copper oxide

Combustion (or burning) is a kind of oxidation where a flame is usually produced.
eg Magnesium will burn in air to form magnesium oxide:
Word equation: Magnesium + oxygen -------> magnesium oxide

<u>The Change in Mass when a chemical is heated</u>

When certain elements are heated like magnesium or copper they will gain in mass.
They do this because they combine with oxygen and oxygen actually weighs something (it has a mass).
To find out if there is a change in mass the chemical needs to be weighed before and after heating.

Example 1: Copper foil will gain in mass when heated in air because the copper oxidises (combines with oxygen)
Word equation: copper + oxygen -------> copper oxide

Example 2: Magnesium will gain in mass when it burns because the magnesium combines with oxygen however care must be taken to make sure that the smoke produced all gets weighed (See Burning Magnesium).

Decomposition means the breaking down of something into smaller parts

When compounds that decompose are heated they will often LOSE mass as parts are lost into the air.

Example 1: When copper sulphate is heated it will lose mass because it decompose and give off water vapour. (See experiment to heat copper sulphate)

Example 2: When Copper carbonate is heated it will lose mass because it decomposes and gives off carbon dioxide gas.

9. Elements, Compounds and Mixtures

There are about 100 elements in total, although only about 20 are in everyday use.

An element is the simplest of all chemical substances.
It is made up of only one kind of atom and cannot be decomposed.

A MOLECULE is formed when two or more **atoms** join together.

Two (or more) **elements** can combine together to form a compound.
A compound must be made of at least two elements chemically joined together.

Don't confuse molecules and compounds….
So O_2 is a molecule of oxygen and CO_2 is a compound made up of the elements, oxygen and carbon.

magnesium + oxygen ----> magnesium oxide
(element) (element) (compound)

10 Reactivity Series

Be able to use the reactivity series of metals.
Know that metals higher in the series will burn more rapidly in air, react faster with water and dilute acids and be able to replace a lower metal from one of it's compounds

eg (i) magnesium burns more rapidly than copper, iron corrodes more than copper.

eg (ii) if carbon is heated with copper oxide the carbon will reduce the copper oxide forming copper and carbon dioxide gas.

Carbon + copper oxide --> carbon dioxide + copper

Know that metals like lead and copper are low down in the series and are used for roofing and piping (because of their low reactivity). That precious metals like gold and silver are used for jewellery and electrical contacts because they have very low reactivity.

Know that most metals are not found in their free state (ie form compounds with other elements) and that a chemical reaction is needed to extract them from the ore.

Be able to write word equations for reaction involving the reactivity series

Any element in the list will always be able to reduce (take oxygen away from) the oxide of an element lower down in the list.

Some elements arranged in order of chemical activity. The rate of chemical reactivity increases as you go up the list:

Calcium	
Magnesium	More reactive metals
Zinc	↑
Iron	
Copper	
Lead	↓
Gold	Less reactive metals

Metals nearer the top of the list will:

- Burn more rapidly in air
- React faster with water
- React faster with dilute acids
- Be able to displace a lower metal from one of its compounds
- More likely to be found in a compound

<u>Example 1</u> Reacting metals with dilute hydrochloric acid

Method:

1 spatula each of powdered magnesium, powdered zinc, iron filings and copper turnings are each placed separately in a test tube containing equal volumes of dilute hydrochloric acid. All observations are noted.

Results

Magnesium	Reacted vigorously producing large amounts of gas. The mixture became quite hot
Zinc	Bubbled steadily. The mixture became warm
Iron	Bubbled very slowly.
Copper	No visible reaction

Explanation:
Metals react with an acid to produce hydrogen gas
The reactive metals like magnesium reacted much more vigorously than the less reactive metals like zinc and iron
The test for hydrogen is that it burns with a squeaky 'pop'

Example 2: Heating magnesium powder with copper oxide
Some copper oxide is mixed with powdered magnesium on a crucible lid nd heated strongly
Result:
A violent exothermic reaction. The copper oxide was reduced by the magnesium to leave magnesium oxide and copper.
(The heat of the reaction makes most of the copper turn back to copper oxide)
Word Equation: Magnesium + copper oxide ----> magnesium oxide + copper

The magnesium oxide has been reduced by the copper
The magnesium has been oxidised by the copper oxide
The reaction above shows us that magnesium is MORE reactive than copper.

Example 3: Heating zinc powder with magnesium oxide
Result:
NOTHING will happen.
The zinc cannot reduce the magnesium oxide. This shows us that zinc is LESS reactive then magnesium.

Example 4: A Displacement reaction
Some iron filings are placed in a blue solution of copper sulphate
Result: The copper sulphate loses its colour and the iron goes pink because it gets a coating of pink copper.
the solution also gets warm which shows that a chemical reaction is taking place.
Explanation: The iron is more reactive than copper and displaces (pushes out) the copper from the solution.
Word equation: Copper sulphate + Iron ----> iron sulphate + copper

Example 5
If Some magnesium ribbon is plunged into a gas jar containing carbon dioxide gas the magnesium will reduce the acrbon dioxide to leave black specks of carbon and magnesium oxide
Word equation: Magnesium + carbon dioxide ---> carbon dioxide + carbon

Example 6: Reaction between a metal and water
Certain very reactive metals like calcium and sodium are so reactive that can react with water producing hydrogen gas (burns with a squeaky pop).
Calcium metal will reduce water to form hydrogen gas and leave a white residue of calcium oxide.
This reaction shows us that calcium is more reactive than hydrogen.
(* remember that water is an oxide of hydrogen)
Word equation: Calcium + water ---> calcium oxide + hydrogen

Vocabulary:
Reduce: To take oxygen away from a compound.
Oxidise: When a chemical gets oxygen added to it
Displace: When a metal is pushed out of a solution by another, more reactive metal
Exothermic: A reaction which gives out heat

Examples:
1.When magnesium reacts with copper oxide the magnesium is oxidised and the copper oxide is reduced.
2. When iron is added to copper sulphate solution the copper is displaced by the iron.

11. The Earth

Understand about the water cycle. Know about the domestic water supply; the need for filtration and treatment. Importance of water as a solvent. The differences between tap, sea and distilled water (as shown by evaporating the water from them in watch glasses).
A knowledge of limestone; its chemical composition, the effect of heat (decomposes) and the reaction with dilute acid; use as a building material and for the production of agricultural lime. The effect of weather on limestone, including acid rain.

12. Metals and Non-metals

Metals
Metals conduct electricity and heat, are shiny in appearance, malleable and the oxide, if soluble will dissolve to form an alkaline solution.

Non-metals
Non-metals are usually gases, liquids or brittle solids with a low melting point; do not conduct electricity or heat. The oxides of non-metals usually dissolve to form acids (note: acid rain).

Some differences between a metallic and non-metallic element:

Metal	**Non-metal**
Malleable	Brittle
Conducts electricity	Does not conduct electricity (except carbon)
High melting point (usually solid)	Low melting point (usually gas or liquid)
The oxides of a metal, when soluble, form an alkaline solution	The oxides of a non-metals form acidic solutions

Know the uses for each of the following substances: how they are extracted from their ores (or refined in the case of crude oil), and their major properties: aluminium, copper and iron.

<u>Aluminium</u>: know that aluminium comes from bauxite (an ore containing aluminium oxide). Know that aluminium is high in the reactivity series and therefore has to be extracted from its ore by electrolysis: this process uses a large amount of electricity which makes aluminium expensive. Aluminium is a light metal used a lot for drink cans , aircraft frames or alloys

<u>Copper</u>: Know that copper can be extracted from Malachite (an ore containing copper carbonate. The malachite is heated so it turns into copper oxide which is then reduced by heating it with carbon. The copper formed can be purified by electrolysis. Copper is used for electric wiring and water pipes.

<u>Iron</u>: Know that iron can be extracted from iron ore (iron oxide) by heating the ore with coke (carbon) in a blast furnace. Iron is a strong metal, but quite heavy. It is used items where strength and cheapness is needed eg bridges, girders or bicycle frames.

Physics

1. Measurement

What you need to know:

- How to use a metre rule to measure distance, a balance to measure mass, and a measuring cylinder to measure volume
- The metric units for mass (kilogram), time (second), distance (meter), area (square metre), volume (cubic metre, millilitre), density (grams per cubic centimetre).
- Have an idea of your own height (in metres) and mass (in kilograms). Be able to estimate the size of some common objects (eg the mass of an apple or the length of an exercise book).

2. Particle theory

The **kinetic theory** states that all matter is made up of tiny particles that are constantly moving.

Gas particles are far apart and able to move freely in straight lines.
They have a lot more kinetic energy than the particles in a solid or liquid.
The moving particles are responsible for causing substances to slowly mix together and for causing the pressure in a gas.

If a substance is warmed the particles will vibrate FASTER.
If the particles are smaller they will move faster

The kinetic theory of gases can explain many observations such as **evaporation:**
the particles at the surface of a liquid have enough energy to break free and fly off into the air.

Diffusion

Diffusion is the movement of a substance from an area of high concentration to an area of lower concentrations.
e.g. Diffusion is how smells move away from the source – e.g. from an aerosol.

It happens rapidly in gases but slowly in liquids because the particles are much closer together.
Solids do not diffuse.

3. Forces and Springs

What you need to know:

- How to measure a force using a spring balance and to know the unit for force (Newton).
- Be able to give examples of different forces: eg friction, gravity. Know that the weight of an object is caused by the pull of gravity on it
- That the unit of weight is the Newton. Know the difference between mass and weight: that the mass of an object never changes and that the weight can.
- Know that a force is needed to stretch a spring and that the extension of a spring is proportional to the load applied.
- That the elastic limit of a spring is the furthest it can be stretched and still return to its original length. Know the effect of joining two similar springs in series and in parallel
- How to plot a graph showing how the extension of a spring varies with the load on it.
- Be able to show the forces acting on an object (eg on a flying aeroplane) by marking arrows on the diagram.
- Understand the forces that enable floating and sinking.
- That friction is a force that tries to slow down a moving object.
- Understand how friction can be a useful force (eg the brakes on a bicycle or car) and how it can be a nuisance (the air resistance of a car slows it down and make it use more petrol).
- Be able to measure the speed of a moving object. Know that speed = distance ÷ time. Know how stopping distance is affected by speed. Know how different surfaces will affect stopping distance.

a) Forces

A force is any kind of PUSH or PULL.

The unit of force is the newton (N).

A force will bring about one of the following changes:
i. Make an object move faster (accelerate)
ii. Make a moving object slow down
iii.Make a moving object change direction
iv. Make an object change shape. eg cause a spring to stretch

Examples of different kinds of force:
Magnetism
Gravity (which causes an object to have weight)
Friction that will try to make any moving object to slow down

MASS and WEIGHT:
The mass of an object will never change. Mass is measured in kilograms
Weight depends on the pull of gravity. If the pull of gravity increases or decreases then so will the weight. The Earth's gravity pulls with a force of 10 N on every 1 kg.
Eg:
A block of butter has a mass of 2 kg on the Earth.
What is its weight?

Answer
The pull of the Earth's gravity is 10N/kg
so the weight of the butter is 2 x 10 which = 20N
On the Moon (where the gravity is less than the Earth the mass will still be 2 kg but it's weight will be LESS than before).

Forces will usually work in pairs.
eg. A weight hanging from a spring: gravity is acting on the weight pulling it DOWNWARDS. The spring is acting on the weight pulling it UPWARDS. These two forces will be equal to each other and cancel each other out.

A moving car
The car will remain stationary until a force P pushes it forwards.
If the car is moving at a steady speed then the force P will equal the force F.
The force W (the weight of the car) caused by gravity, must be balanced by the road pushing upwards supporting the car.

Friction

Friction is a force that tries to slow down a moving object.
It always pushes in the OPPOSITE direction to the direction of movement Friction can be reduced in several ways:

- Lubricating the surface between the block and the table. Placing bearings (rollers) between the block and the table.
- Changing the surface of the block (eg coating with PTFE or nylon) Making the block smoother.

Disadvantages of friction: overheating in bearings, increase fuel consumption in cars, lowers the top speed of cars, bicyclists or skiers, tries to slow down any moving object, overheating in objects moving through the air at high speed.

Advantages of friction: Allows cars, bicycles, etc to speed up, slow down or change direction. Without friction we would not be able to walk, run, stop, or change direction. Friction helps to stop things (eg furniture) from sliding around. Air resistance can be used to slow down a fast moving object (eg using a parachute).

b) Springs

If some weights are hung from a spring the spring will stretch.
The amount the spring stretches is called the extension.
There will be two forces on the spring:

R = the ceiling pulling on the spring. This direction of this force is up.
W= the weights pulling on the spring. This force is caused by gravity. The direction of this force is down.

Experiment to stretch a spring:

A spring is clamped near a metre rule.
The position of the unstretched spring is noted.
1N weights are added to the spring, one at a time, and the total extension for the new load is recorded.
A graph is drawn plotting <u>extension</u> (not length) against load.
It is noticed that for small loads, the extension of the spring is proportional to the load. During this time the spring is obeying Hooke's Law, and the line on the graph is straight. Beyond a certain load the spring acquires a permanent stretch. This load is called the elastic limit of the spring. At this point the line on the graph starts to curve as the extension gets longer.

<u>Springs in series</u>
Two springs joined end to end (in series) will have twice as much extension as a single spring.
Eg. if one spring stretches 3cm with a load of 1N then two springs in series will stretch 6 cm. This is because each of the springs stretch 3cm making 6cm all together. If each spring were 10cm long to start (with no load) the total length would be 10cm + 10cm + 6cm = 26cm

<u>Springs in parallel</u>

Two springs joined side by side (in parallel) will have half the extension of a single spring.
Eg. if one spring stretches 3cm with a load of 1N then two springs in parallel will stretch 1.5cm. This is because the load is shared out between the two springs, so each spring is only receiving 0.5N. Half the load means half the stretch.

4. Moments:

LEVERS and PULLEYS can be used to change the magnitude (strength) and direction of a force.
A crow bar is an example of a lever.
The effort is less than the load because the load is NEAR to the fulcrum and the effort is a long way from the fulcrum
Notice how the direction of the force can be represented by an arrow.

Other examples for the application of levers are: pliers, scissors, wheel barrow. These are all examples of simple MACHINES.
The Lever law (The law of moments)

Moment (Nm) = force (N) X distance (m)
Imagine a ruler pivoted at the centre
If the ruler is balanced the lever law states that:
The force on the left x its distance from the pivot = the force on the right x its distance from the pivot
ie 2 x 6 = 3 x 4

5. Pressure

The pressure exerted by a force tells us how concentrated the force is.
Pressure is calculated as : PRESSURE = FORCE ÷ AREA

The UNITS of pressure we use are newtons per square centimetre (N/cm2)
(The normal SI unit of pressure is a newton per square metre (N/m2), also called the pascal)

If the area that a force is acting on INCREASES then the pressure will DECREASE.

Example 1
A wooden brick measures 3cm x 4cm x 6cm
It has a mass of 3.6kg and so exerts a downward force of 36N on the table

(weight in N = mass in kg X 10 – see Forces topic)
What pressure does the brick exert on the table when stood on its end
Answer: First work out the area touching the table:
The area of the shaded end = 3cm x 4cm
= $12cm^2$
Now work out the pressure:
pressure = force ÷ Area
pressure = 36 ÷ 12
pressure = 3 N/cm^2

Example 2
What will happen to the pressure if the brick is stood on its side?
Answer: Area of side B = 3cm x 6cm
= $18cm^2$
Pressure = force / area
pressure = 36 / 18
pressure = 2 N/cm^2
Notice how the pressure gets less when the brick is stood on a larger area.

If the area increases then the force is more spread out making the pressure LESS.
eg Explain how snow shoes work:
A boy wearing snow shoes is less likely to sink into the snow because his weight is more spread out making the pressure on the snow LESS.
If the area decreases the force is more concentrated making the pressure MORE.

eg Why is the wire of a cheese cutter so thin?
With a thin wire the downward force is concentrated on to a very small area. This increases the pressure of the wire on the cheese.

eg How does a syringe 'suck' liquid from a bottle?
As you pull the top part back, the area inside the syringe increases, this lowers it's pressure. The pressure inside the syringe therefore becomes less than the pressure inside the bottle of liquid, causing the liquid to leave the area of high pressure and flow into the syringe.

Pressure in a liquid
The pressure of liquids increases with depth.
Water pressure acts equally in all directions.
Water squirts out of the hole at right angles to the hole, even though gravity is pulling the water downwards

e.g. Why are dam walls thicker near the base?
A dam wall is thicker near the base because the water pressure is greater lower down in the water and the wall might break if it was thinner.

e.g. Why are water tanks placed up as high as possible?
A water tank is placed high up in order to increase the water pressure near the tap. The height of water being supported is sometimes called the head of water

Atmospheric Pressure
Caused by the weight of air pushing down (see also KINETIC THEORY)
Air pressure: the air presses with a force of about 10N on every square centimetre (10 N/cm2)
Air pressure gets LESS as you rise up in the air (which is why a balloon expands as it rises).
Air pressure normally acts on all surfaces of an object which is why we don't notice it.
Atmospheric pressure is responsible for helping us breath, filling a syringe, making a vacuum cleaner suck.

6. Light

Light and sound are made of WAVES. They are both forms of ENERGY.
Light travels much faster than sound. This is why the flash of lightening is seen long before the sound of thunder is heard, even though they are formed at the same instant.
Speed of light 3×10^8 m/s (300,000 km/s)
Speed of sound 330m/s

Light
Light is given out from a luminous source eg the sun or a projector lamp.
Non luminous objects can only reflect light – not give out light
Light travels in straight lines.
In order to see anything light has to be reflected off from it and enter our eye.
Shadows are formed when RAYS of light are stopped by an object that does not TRANSMIT light.
When light hits a rough surface the light gets scattered.

When light hits some coloured paper (eg a red book) some colours are absorbed but the red light is scattered which is why the book looks red.

REFLECTION

When a light ray hits a smooth surface it is reflected in a regular way. A mirror reflects the ray at the same angle that it hits it.
When a light ray hits a mirror it is always reflected by the same angle as it hits the mirror
ie Angle of incidence=angle of reflection
(i=r)

REFRACTION

When light travels from air into water or air into glass it gets bent. This bending is called refraction. Refraction is responsible for making swimming pools look shallower than they really are, and for making a pencil resting half in water appear bent.
Refraction happens because the light rays travel slower through the water or glass than they do through air.

Words you need to know from this topic
REFLECTION When light bounces off a smooth surface (eg a mirror) and forms an image behind it.
REFRACTION When light gets bent by passing from air into water or glass (or passing back again).
ABSORPTION When light hits an object and does not get reflected back (eg when light hits a piece of black paper it is absorbed, this is why the paper looks black)
TRANSMISSION When light passes straight through something like a piece of transparent paper.
DISPERSION The splitting of white light into a SPECTRUM. This is often done by a using a PRISM

Advanced topic: FIBRE OPTICS:
Optical fibres are strands of thin glass. Light can bounce from one end of the strand and come out of the other.
They are used in communications where they are now used to carry telephone or computer messages instead of wires.
More information on this is in the text book

7. Sound

In order to produce a sound something has to vibrate.
The vibrating object causes compressions in the air which in turn cause the ear drum in our ear to vibrate.

Pitch and Volume:

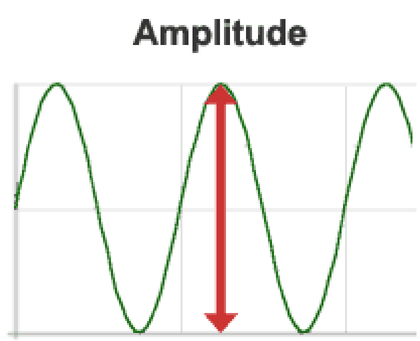
The frequency of the vibrations determine the pitch of the note: faster vibrations produce a note with a higher pitch.
The size (amplitude) of the vibrations determine the volume of the sound: If the amplitude increases then the sound will get louder.

A string can be made to vibrate with a higher note 3 ways:
1. Make the string tighter
2. Make the string shorter
3. Make the string lighter (a heavy object vibrates slower)

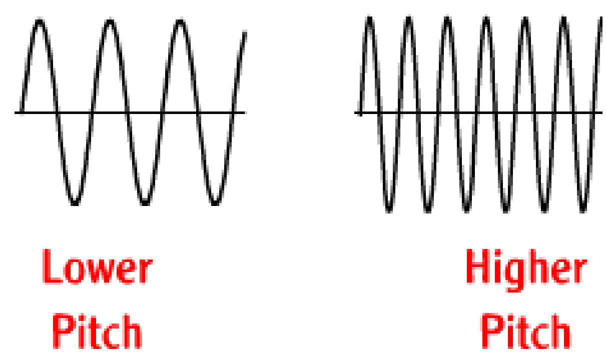
- These things all increase the speed of the vibrations

Pitch and frequency can be shown on a graph:

Amplitude determines volume



Frequency determines pitch



Sound travels faster in solids and liquids than it does in air
Sound will NOT travel through a vacuum.

How sound is produced in different musical instruments:

Instrument	**Part which vibrates**
Trumpet	Lips
Organ	Air
Clarinet	Reed
Guitar	Strings
Piano	Strings
Drum	Drum skin

Echoes
An echo is heard when sound is reflected off a distant object.
Sonar make use of echoes to measure the distance (or shape) of an object (eg the sea floor).
It does this by measuring the length of time it takes to hear the echo
You can then use the equation for speed, distance and time to find the distance

Ultrasound
Ultrasound is too high pitched for us to hear (maybe about 40kHz). It is used to produce pictures of unborn babies, in burglar alarms and also in some cleaning devices.

Words to know:
FREQUENCY: the number of vibrations per second.
PITCH: how high or low a note sounds.
AMPLITUDE: the height of a wave
VOLUME: How loud a note is.
If the frequency increases then the pitch will increase.
If the amplitude increases then the volume will increase.

8. Energy

Energy is needed to any useful job of work
This means if something is capable of helping you do some work it must have energy eg a wound up spring or a piece of coal.
Energy is measured in joules

Energy can exist is several forms:
Chemical energy
Electrical energy
Gravitational potential (height) energy
Kinetic (speed) energy
Elastic energy
Thermal (heat) energy
Sound energy
Light energy
Nuclear (atomic) energy

Law of conservation of energy
Energy can neither be created or destroyed, only changed from one form to another.

Energy transfer

There are many devices or transducers that can change energy from one form to another, eg

Motor: Electrical energy to kinetic energy

Lamp: Electrical energy to light and internal energy

Loudspeaker: Electrical energy to sound energy

Battery: Chemical energy to electrical energy

Dynamo: Kinetic energy to electrical energy

Running : Chemical energy (in human body) to kinetic and internal energy.

A falling stone: Gravitational potential energy to kinetic energy

Movement

Whenever anything is moving some kinetic energy is changed to internal energy (heat) due to friction. This internal energy heats up the air and is no longer useful.

Example 1

A bouncing ball

At every bounce some kinetic energy is changed to heat energy. The ball is now moving slower and so does not bounce so high at the next bounce. Eventually all the original potential energy is changed to heat energy and the ball stops moving.

Note: at each bounce energy is not 'lost', but only changed to a form that is less useful.

Example 2

Firing a firework rocket:

Rocket on the ground has chemical energy

Rocket rising : Chemical energy is being changed into kinetic energy and sound energy. When the gunpowder runs out and the rocket is high in the air, the kinetic energy is changed into gravitational potential energy.

Rocket at its highest point has maximum graviational potential energy

Rocket falls: gravitational potential energy is changed into kinetic energy

Rocket hits the ground: All kinetic energy is changed into heat energy.

All FUELS contain CHEMICAL ENERGY which can be converted to heat energy when they are burnt. eg When a piece of coal is burnt the stored up chemical energy is converted to internal energy and light energy .

Renewable and Non-renewable energy

Non-Renewable Energy

Coal, oil and natural gas are called fossil fuels, as they come from ancient plant remains. They are all forms of non-renewable energy as they cannot be replaced once they have been used up. They are cheap and convenient but they cause a lot of pollution and also, one day, there will be none left.

Renewable Energy

Renewable energy sources are now being used to replace the fossil fuels.
Examples are wind and solar power, wave and tidal energy and hydro-electric power. These forms of energy are clean and efficient, but are often inconvenient due to lack of wind, insufficient rainfall or not enough light. Bio-fuels such as alcohol are another form of renewable energy.

Producing Electricity from a coal-fired power-station

Coal can be burnt to produce heat. This heat can be used to turn water into steam to drive the turbines in electric power stations.

Energy changes that take place in a coal fired power station:

- The sun shines on trees.
- Trees convert this light energy into chemical energy by photosynthesis.
- Over the passage of time (millions of years) this stored up chemical energy in plants is converted to coal.
- When the coal is burnt the chemical energy is used to heat water
- The water boils and is turned into high pressure steam which is used to drive turbines. The kinetic energy of the turbine is used to turn a generator where electrical energy is produced.

A summary of these changes would look like this:

Sun: Nuclear energy to heat energy and radiation (light) energy.
Plants: Light energy (from sun) to chemical energy (photosynthesis).
Burning coal: Chemical energy to internal energy
Turbine : Heat energy to kinetic energy.
Generator: Kinetic energy to electrical energy
Light bulb: Electrical energy to light and internal energy

Nuclear power

Nuclear power is now sometimes used to boil the water instead of using coal. It is much cleaner, cuts down on the formation of greenhouse gases but raises problems about the disposal of radio-active waste and safety to the environment due to radio-active contamination.

The sun

- Nearly all energy transfers start from the sun.
- The sun provides energy for photosynthesis, allowing plants to grow.
- The plants provide energy for animals.
- All our food comes originally from plants or animals eg. toast is made from bread which is made from flour. Flour is made from wheat which needs the suns energy to grow.
- All fossil fuels, eg petrol, oil and coal, originally obtained there energy from the sun
- eg petrol comes from oil. The oil was made from dead organisms millions of years ago which obtained energy from the sun.

Energy efficiency:

Energy can be saved many ways: eg aerodynamic cars use less petrol because less kinetic energy is lost as heat due to air resistance

8. Electricity

- Know that in order for a current to flow there needs to be a complete circuit. That in order for a current to flow there needs to be a voltage which is produced by a cell or cells. It is this voltage that pushes the electricity around the circuit.
- That the current will increase if the voltage (number of cells) increases.
- Know that anything that the electricity has to flow through (eg a bulb) will have resistance and that if the electricity has to flow through the bulb the current will get less. Know that the current will decrease if the resistance of the circuit increases.
- Know the meaning of components being in series or parallel.
- Be able to use an ammeter to measure the current flowing through different parts of a circuit. Know what is meant by a "short circuit" and to say what effect this will have on the current.
- Know the symbol for and use of the following components: Bulb, cell, battery, ammeter, diode, variable resistor, fixed resistor, fuse, SPST switch, SPDT switch, push switch, reed switch, light emitting diode (LED), light dependant resistor (LDR) and reed relay.
- Be able to draw working circuits containing any of the above components.
- Know the use for the fuse in a plug and how the fuse works
- Be able to use and understand logic circuits including AND and OR
- Be able to draw truth tables for these.

Whenever an electric current flows when we must have a complete circuit.

The components in a circuit are represented by symbols

The battery (or cells) push the electricity around the circuit.

The wires are made of conductors , usually copper, covered with plastic insulation.

A light bulb has a thin metal filament, often made out of tungsten, which glows very hot when an electric current flows through it. The higher the current, the hotter the filament gets until it MELTS.

Lamps in Series (end to end)
When two lamps are wired in SERIES they will be DIMMER than a single lamp.

This is because two lamps in series have more resistance than a single lamp so the current flowing through them is less.
When one lamp is unscrewed the other goes out.

Lamps in Parallel
When two lamps are wired in PARALLEL they both stay BRIGHT.

More current will flow through the cell so it will run down more quickly.
The electricity can divide and when one lamp is unscrewed the other lamp stays bright

A Short Circuit
The electricity always travels more down the easier pathway.
In a short circuit ALL the electricity goes down the wire and the lamps go OUT.
A short circuit can be quite dangerous as a high current can flow and this often makes the battery run out quickly.

Ammeters and Current :

- How to Measure current: Use an instrument called an AMMETER
- Unit for Current: Current is measured in AMPS
- An ammeter must be placed in SERIES with the component being tested . Current always flows away from the positive terminal.
- In a series circuit, the current will be equal in any position in the circuit

- In a parallel circuit, the current will split equally down any branches

Note:

Brighter bulb = more current flowing

Dimmer bulb = less current flowing

(this assumes that the bulbs are all the same as each other)

In a series circuit, the current at every part of the circuit will be the same

The bulb does NOT use up any current

Fuses

A fuse is a short length of copper wire designed to melt when more than a certain amount of current flows through it.

The thin piece of wire is usually inside a china case to make it safer and easier to handle.

What a fuse is for:

When the fuse melts it breaks the circuit and stops the current flowing.

This helps stop an appliance breaking (e.g. toaster) from too high current or a fire starting.

9. Magnets and Electromagnets

Electromagnets

An electric current flowing through a wire creates a magnetic field

An electromagnet can be made by wrapping a coil of wire around a soft iron rod

The strength of the electromagnet will depend on three things:

- The number of turns of wire on the coil
- The strength of the current
- The material that the rod (core) is made from (iron is better than steel)

Experiment:

We can measure the strength of the electromagnet by seeing how many paper-clips it can pick up.

Warning: After about 4 amps the wire will get very hot.

Uses for the electromagnet:

i. an electro-magnet to separate iron from copper

ii. an electric motor – using a type of relay switch

iii. to separate scrap metal in a scrap yard

i.v. relay switches

Relay Switches

Relay switches use an electromagnet (which uses a smaller current), to switch on a circuit with a larger current. This is safer as people do not have to come into close contact with the large current.

10. The Earth in space

- Our Sun is a STAR.
- A star is very hot and gives out its own light. (An object that gives out its own light is called a LUMINOUS object.)
- A group of stars is called a GALAXY.
- Our sun is part of a galaxy called the MILKY WAY.
- The Universe is made up of many such galaxies.
- The Earth is a PLANET.
- The planets do NOT give out their own light but reflect the light from the sun.
- The planets are in ORBIT around the sun.
- This means they go around the sun.
- Our planet, Earth, is part of the SOLAR SYSTEM. The Solar System contains 9 planets.

Satellites and the Moon

- A SATELLITE is something in orbit around a planet.
- The MOON is a kind of natural satellite and is in orbit around the Earth.
- Planets and satellites are held in orbit by the pull of the Earth's gravity.
- Most planets have several moons. The Earth has only one moon.
- A moon does not give out its own light but reflects the light from the Sun
- The Earth also has several ARTIFICIAL SATELLITES.
- These are used to transmit television pictures or radio messages.

Phases of the Moon

- We see different phases of the moon over a cycle of 28 days
- This is because as the moon orbits the earth, the light from the Sun reflects off it and into our eyes at different angles, depending on the exact position of the Moon.
- Answer this question: why do we only get a full moon once per month but a half moon twice per month?

Seasons and the length of day and night

- The time it takes a planet to go once around the sun is called a YEAR.
- The Earth's year = 365 days.

- Most planets SPIN about their own AXIS. The time it takes the planet to spin once on it's axis is called a DAY.
- Seasons, and the length of day and night are both caused by the TILT of the Earth.
- In Summer the Northern hemisphere is tilted towards the sun. This gives us longer daylight hours. As the sun is overhead for more of the time it causes the ground to heat up more.
- In winter the northern hemisphere is tilted AWAY from the sun. This makes the day-light hours less. The sun is lower in the sky and so the ground does not absorb so much of the suns heat.
- If you were standing in England you would revolve around the Earth once every 24 hours, following the dashed line.

Eclipses

There are two types – eclipses of the Sun and eclipses of the Moon

Eclipse of the Sun (Solar Eclipse)

- An eclipse of the Sun is caused by the moon being between the sun and the earth and casting its shadow on the Earth, so blocking out some (a partial eclipse) or all (a total eclipse) of the sun's light.
- In a solar eclipse the Moon is between the Earth and the Sun.
- A shadow of the moon falls on the Earth , blocking out the light from the Sun.
- In a total eclipse none of the sun can be seen. In a partial eclipse some of the sun is still visible.

Eclipse of the Moon (lunar eclipse)

- An eclipse of the moon is caused by the Earth's shadow falling on the moon, making it invisible from Earth.
- In a lunar eclipse (eclipse of the moon), the Earth is between the moon and the Sun and a shadow of the Earth falls across the moon.
- When the Moon is in the Earth's shadow the moon cannot be seen.

Note: You do not need to know numeric details of the planets for exams like the Common Entrance but you need to be able to answer questions like this:

How many planets are there?
Which is the furthest planet from the sun?
Name the four largest planets?
Name the four planets nearest to the sun
What is meant by the terms: sun, planet, moon, satellite, orbit, day, year, eclipse?
What causes day and night?
Which planet was the last to be discovered. Why did it take so long to discover it?
Describe any step in the history of space exploration that you think important, along with the year it happened .

Some figures – for your interest

The temperature at the surface of the sun is about 6000C and at the centre about 14 million C.
The distance of the Earth to the sun is about 150 million km.
As astronomical distances are so large they are often given special units: eg
The AU (=Astronomical Unit=average distance of Earth from the sun)
The light year (= distance travelled by light in one year 1x1016m 10 million million kilometres).
The parsec (just over 3 light years)
The nearest star to us, Alpha Centauri, is about 4 light years away.

11. Density

What you need to know:

- That density = mass ÷ volume. You must be able to rearrange the equation
- Be able to measure mass and volume, and to be able to calculate the density of solids with a regular shape (eg cube), of an irregular shape (eg a small stone) and of liquids.

Measuring the volume of irregular-shaped objects

- You can use a **displacement can** or a **measuring cylinder.** To use a measuring cylinder, measure a starting volume of water then place your object into the water and measure the final volume of water. The volume of the object = end volume – starting volume.

Measure the volume of regular-shaped objects

- Length X width X height

10. Biology

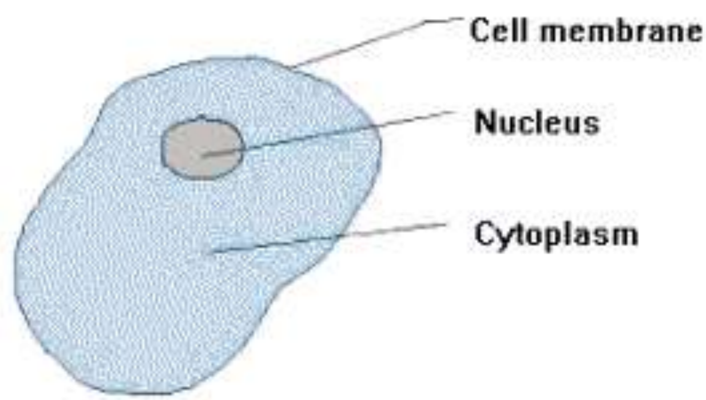
1. Cells and Microscopes

A cell is the basic structure of all life. Every living organism is made up of at least one cell..

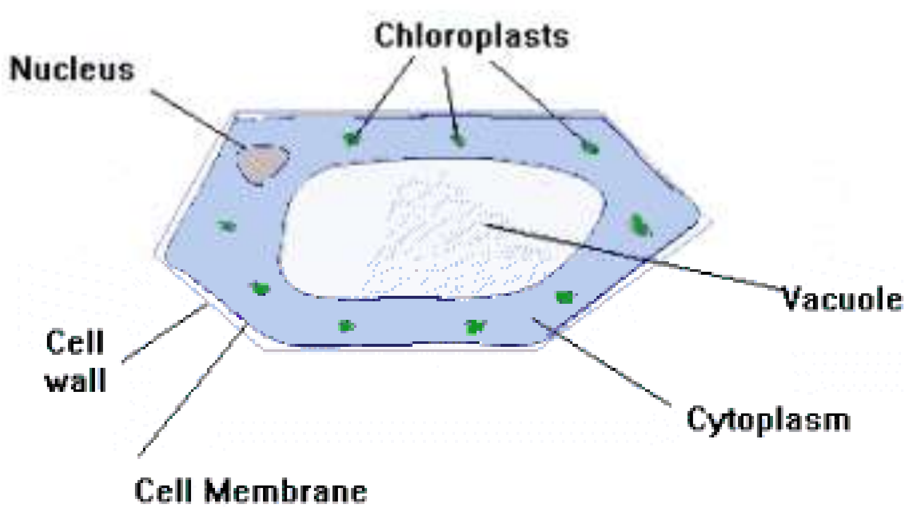
Some organisms (eg amoeba) have only one cell (these are called single-cellular organisms) but most have many cells (eg human) and these are called multicellular organisms.

[remember an organism is the name given to ANY living thing, animal or plant, whatever it's size]

- Animal cells only have a cell membrane, nucleus, cytoplasm and mitochondria
- Plant cells have cell membrance, nucleaus, cytoplasm, mitochondria, cell wall, chloroplasts and vacuole



ANIMAL CELL (Amoeba x1000)



PLANT CELL (Leaf cell x 750)

Definitions:

Cell membrane: The living outer layer to the cell. The membrane is selective about which substances enter and leave the cell.

Nucleus: Controls the function and behaviour of the cell. Contains the genetic information (genes). The genes are grouped into packages called chromosomes.

Cytoplasm: The liquid contents of the cel (excluding the nucleus). Contains structures for carrying out respiration (these are called mitochondria).

Chloroplasts: Where photosynthesis is carried out. Chlorosplasts contain a green chemical called chlorophyll which is needed for photosynthesis to take place.

Large vacuole: A cavity in the cytoplasm of a plant cell. It contains cell sap. It helps keep the cell rigid. Some cells (animal and plant) also contain a smaller vacuole that helps regulate the water content of the cell.

Cell wall: A structure made odf cellulose that surrounds a plant cell and helps it keep its shape.

Organisation of cells

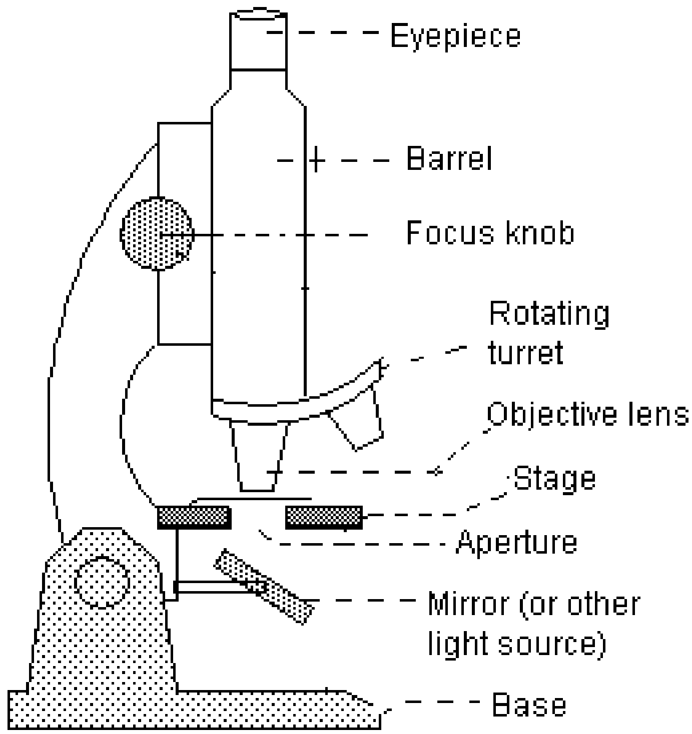
TISSUE: A group of cells that have a single use is called tissue (e.g. blood)

ORGAN: A group of tissues that have a single use is called an organ. Each organ has a particular job to do (e.g. heart – made up of muscle tissue, blood tissue, nerve tissue etc)

ORGANISM: An organism is any complete living thing – made up of lots of different tissues and organs.

In order of size: CELLS ------> TISSUE -----> ORGAN --------> ORGANISM

MICROSCOPES



1. Select a low power objective lens
2. Adjust the mirror to produce the best light.
3. Move the objective lens down towards the slide, looking from the side.
4. Focus by moving the lens AWAY from the slide.
5. Adjust the aperture to produce the best light.

Measuring the magnification

The total magnification is found by multiplying the magnification of the eye piece by the magnification of the objective lens
ie

total magnification = eyepiece magnification x objective lens magnification

Example:

eyepiece	Objective	Total magnification
10x	20x	200x

Preparing a slide of some cheek cells:

* Take a clean microscope slide
* Rub a clean cotton bud around the inside of your mouth and then smear it across the middle of the slide.
* Add one drop of water and a drop of methylene blue stain (this helps the different areas of the cells show up)
* Place a cover slip on the drop (at an angle so that there are no air bubbles)
* Squash it down gently using a piece of blotting paper
* Place the prepared slide on the microscope stage.
* Adjust the light source so that it shines through the slide.
* Focus by racking the lens AWAY from the slide

Size of cheek cells:
A micron (short for micrometer) is one-millionth of a meter.
A human hair is about 50 microns wide

2. Variation and Classification of Organisms

There are so many species of organisms we need to have some means of grouping them. In about 1750 Carolus Linnaeus, a Swedish naturalist, devised a system of grouping organisms into categories based on characteristics, such as shape or structure. It is his system we use today

The major classification levels, from largest group to smallest:

Kingdom - Phylum -Class - Order - Family - Genus- Species

Each kingdom is divided into several phyla, each phylum into several classes, each class into several orders and so on.

There are 5 major kingdoms:
Bacteria
Single celled animals
Fungi
Plants
Animals

Example: classification of the Lion : Felix leo
The genus name is written first (always Capitalized).
The species name is written second (never capitalized).

A lion is in the…..
Animal kingdom
Chordata (vertebrates) phylum
Mammal class
Carnivore order
Cat family
Felix genus
Felis leo species

Classification of the animal kingdom
For Common Entrance we need only know the name of the main groups (phyla) and some of the classes

The animal kingdom is split into **vertebrates** (have a backbone) and **invertebrates** (without a backbone)

Vertebrates are divided into 5 smaller groups (or classes)

- Fish

Body covered in scales. Lay jelly covered eggs in water. Live in water. Breath through gills
eg Shark, Herring, Eel, Minnow

- Amphibians

Skin damp with no scales. Lay jelly covered eggs in water. Adults live on land, young live in water.eg Frog, Toad, Newt

- Reptiles

Body has hard scales. Lay soft-shelled eggs on land.
eg Lizard, Snake, Tortoise, Crocodile

- Birds

Body covered in feathers. Lay hard-shelled eggs on land. Warm blooded.
eg Thrush, Eagle, Swan

- Mammals

Young born alive. Mother will suckle her young from mammary glands.
Body has hair or fur. Warm-blooded.
eg Man, Dog, Whale, Wombat, Hamster

Invertebrates are things like jelly fish, worms, insects

One group of invertebrates is the **arthropod** group. You need to know about 2 types and the difference between each – the insects and spiders:

- Insects

3 pairs of legs. Body divided into 3 parts. Often 2 pairs of wings.
eg Fly, Ant, Earwig, Flea

- Arachnids (spiders)

4 pairs of legs. Body has 2 parts. No wings.
eg Spider, Scorpion, Mite

Body Temperature
* A warm blooded animal keeps its body at a constant temperature
eg humans have a body temperature of 37 C
A cold blooded animal has a body whose temperature varies according to the conditions.
eg The temperature of a fish would be slightly above that of the surrounding water (more if it had just been swimming rapidly)
Only birds and mammals are warm-blooded. Fish, reptiles and amphibians are cold-blooded

Classification of the the Plant Kingdom

1.Flowering plants: produce SEEDS. Eg grass, apple, oak, rose

2.All other plants are NON-FLOWERING and do NOT produce seeds. Eg algae, moss and ferns.
- Algae are single-celled plants. Reproduce asexually by binary fission. Live in wet places. Have no leaves or roots.
- Moss Reproduces asexually by making spores. Live in damp, shady places.
- Ferns and Horsetails: plants that have a tough fibrous stem and grow from a rhizome just under the surface of the soil . Reproduce by making spores

Fungi

- Fungi are not true plants as they do not possess green chlorophyll so cannot carry out photosynthesis.
- They take their food from the material they are growing on/in.
- Reproduces asexually by making spores.
- Examples of different fungi: mushroom, yeast, mould.
- Fungi (along with bacteria) are very important in the food chain for the recycling of nutrients in the soil.
- Some fungi are harmful and can cause disease in crops (eg potato blight).
- Some fungi are useful to man eg yeast which is used to ferment sugar and produce alcohol in the brewing industry.

Words to know from this section:

VERTEBRATE Has a backbone

INVERTEBRATE Has no backbone

EXOSKELETON An external skeleton, like a hard skin.

WARM-BLOODED Animals whose body temperature is constant are called warm-blooded. eg Human: body temperature 37oC.

COLD-BLOODED Animals whose body temperature alters with the temperature of the surroundings eg fish

3. Life processes

- Living things are able to do several things a non-living thing may not be able to do like move, grow, reproduce and feed .
- There are seven processes that are carried out by all animals and plants. These can be remembered by thinking of the word MRS NERG:

Movement

Animals usually move their whole body from one place to another.
Leaves turn towards the light. Roots grow down into the soil.

Reproduction

Producing new plants or animals.
Animals have babies.
New plants grow from seeds.

Sensitivity

How things react and respond to what is happening around them eg plants turning and moving towards the light or your mouth watering when you smell something good to eat.

Nutrition

Taking in food. Food is needed to supply energy

Green plants can make their own food using sunlight, carbon dioxide and water. Animals eat plants or other animals.

Excretion

Getting rid of waste substances.

eg Plants and animals excrete (get rid of) carbon dioxide.

Respiration Making energy to keep you active.

Plants and animals use oxygen from the air to help turn food into energy. We need energy for our muscles.

Growth Cells multiplying and growing

Seedlings grow into bigger plants.

Babies grow into adults

4. Breathing and Respiration:

Respiration

Respiration is the name of a chemical reaction carried out by all living organisms in order to provide them with energy. In the human body, all cells respire.

Glucose (a kind of sugar) reacts with oxygen releasing energy.

Carbon dioxide and water are produced as waste products

Word equation:

Glucose + oxygen -----> carbon dioxide + water + energy

In humans the sugar enters the body through the mouth in food and oxygen enters the body through the lungs during breathing. Do not confuse breathing with respiration – they are very different.

Respiration is the exact reverse of photosynthesis. Learn them both carefully but DO NOT MUDDLE THEM UP

What happens when we run
Our muscles move more and so need more food and oxygen from the blood.
This causes the following changes in our body:

* Our heart pumps quicker to get the blood to the muscles quicker.
* We breath faster to transfer more oxygen to the blood
* We sweat more. As the sweat evaporates it helps cool the body and remove excess heat.

Heart disease
Heart disease can be caused by too much fat which clogs the arteries reducing the flow of blood to the heart. Exercise helps reduce the risk by speeding the flow up blood up which helps clear the arteries.

What is the energy for?
The energy gets used by our body in several ways:

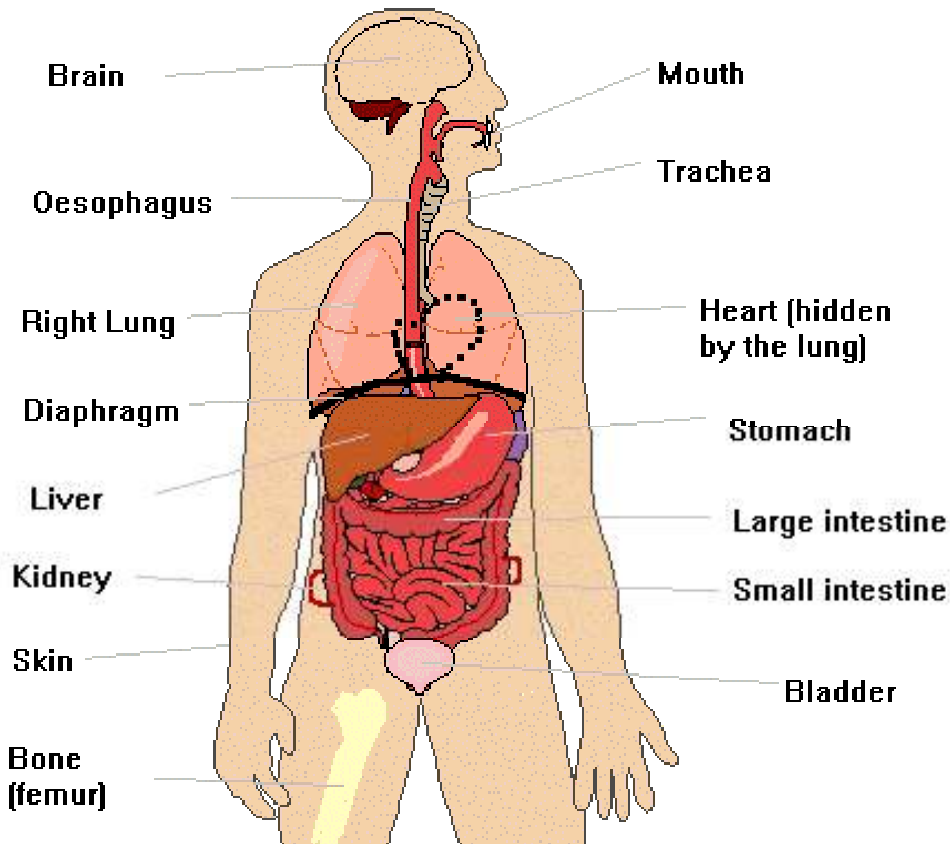
Movement
Warmth
Growth
Repair of cells

How much energy does my body use?

A 12 year old boy will use about 12000 joules (3000 calories) a day
(1 calorie = 4.2 Joules)

5. The Human Body

Main human body organs



BRAIN Controls and coordinates all the major functions of the body. Where all the nerves meet.0

HEART Muscular organ to pump blood around the body. Contains valves to control the direction of blood flow.

TRACHEA: a tube that joins the mouth to the lungs

LARYNX: Another name for the voice box

LUNGS Gaseous exchange i) Transfers oxygen to the blood. ii) Removes carbon dioxide from the blood.

DIAPHRAGM A sheet of muscle across the body, above the abdomen but below the lungs, that enables us to breath.

BLOOD i) Transports food and oxygen to the cells.

ii) Transports waste away from the cells.

iii) Helps protect the body from infection.

iv) Helps regulate the body temperature (37C)

RED BLOOD CELLS : carry oxygen.

WHITE BLOOD CELLS: Fight disease.

ARTERIES Carry blood away from the heart.

VEINS Carry blood towards the heart.

CAPILLARIES Tiny blood vessels that carry blood to the individual cells.

LIVER Stores and regulates body chemicals

MOUTH where food enters the body. Enzymes in the saliva start digesting the food

ALIMENTARY CANAL The tube that links the mouth to the anus down which food travels.

OESOPHAGUS (gullet): the tibe that carries food from the mouth to the stomach

STOMACH Part of the alimentary canal where food is held before it is passed into the small intestine.

SMALL INTESTINE Organ where most of the digestion and food absorption of food takes place.

LARGE INTESTINE Organ where water absorption takes place.

ANUS: Where un-needed food is egested

KIDNEY i) Removes waste (urea) from the blood.

ii) Removes water from the blood and so controls the blood concentration. The urea + water form urine. The urine passes down the URETER to the bladder.

BLADDER Stores urine. Urine leaves the bladder through a tube called the URETHRA. In males the urethra leaves the body through the penis.

TESTIS Where sperms and sex hormones are made.

OVARY Where eggs/ova and female sex organs are made.

EAR Used for HEARING. Rapid changes in air pressure cause the eardrum to vibrate. The ear also controls BALANCE by making use of small tubes filled with liquid and lined with tiny hairs.

EYE Used for seeing. Contains a LENS which focuses light onto light sensitive cells found in the RETINA.

SKIN Protects the body from germs. Blood capillaries in the skin open and close to help regulate the body temperature.

SKELETON Made up of rigid BONES. Provide a framework to support the other organs. Muscles and tendons are attached to the bones to hold the skeleton in shape.

6. Nutrition and Digestion

- The food that we eat contains lots of nutrients. Nutrients are useful chemicals needed by our body.
- In order to release the nutrients from the food the food needs to be broken down into smaller pieces.
- This breaking down of food is called digestion and is helped by special chemicals called enzymes.
- After the food is digested the nutrients are absorbed into the blood
- Most digestion takes place in the small intestine.
- Unwanted food is removed from the body through the anus.

Summary showing the order of events:

1. Ingestion (Taking in food) - in mouth
2. Digestion (Breaking down food using enzymes) - in stomach and small intestine
3. Absorption (Nutrients entering the blood) – in small intestine
4. Egestion (Removal of waste products) – through bowel

Diet
A balanced diet is selecting sensible foods so we have the right proportion of all the nutrients we need.

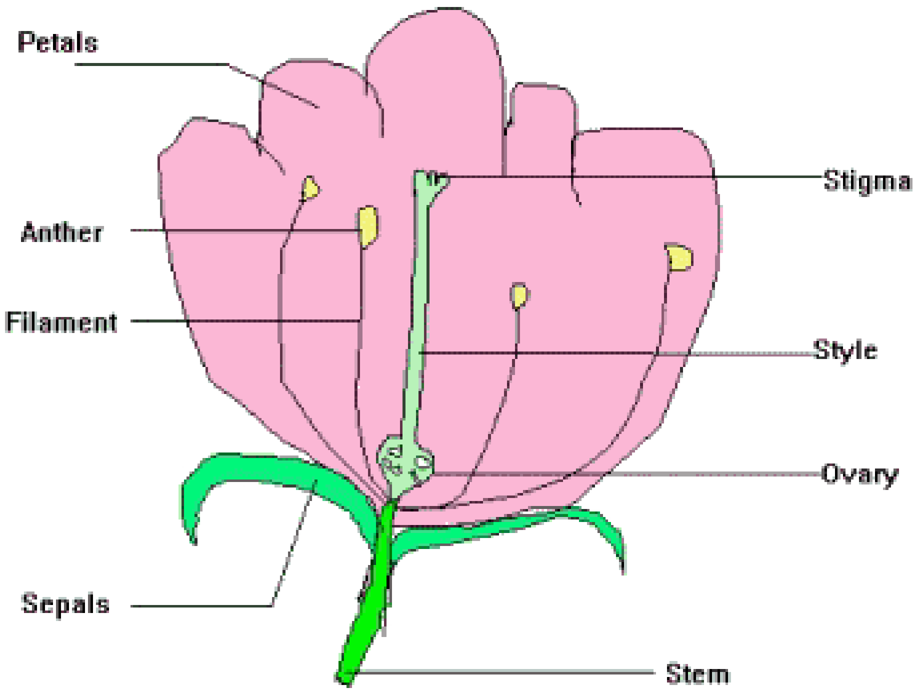
	Dietary Component	Why we need it?	Which foods provide us with it
1	Carbohydrates	Release energy quickly	Brown pasta, cereals, potatoes
2	Fats	Slow release of energy Keeps us warm	Oily fish, dairy products, nuts
3	Proteins	Build and repair muscle	Fish, meat, pulses
4	Vitamins & Minerals E.g. Vitamin C Calcium (a mineral)	Defence against disease, general functioning of body	Fruit and vegetables and fortified cereals
5	Fibre	Fills us up and keeps food moving through us	Fruit, vegetables, cereals
6	Water	Keeps our body hydrated	-

Vitamin. C helps stop a disease called scurvy
Minerals eg calcium (strong bones): a lack of calcium can cause rickets.
iron (making blood): a lack of iron can cause anaemia

Water is the main part of all living cells. Our body is 75% water.

7. Flowering plants

Plants differ from animals in the way they obtain food:
The only way an animal can obtain food is by eating something that is (or used to be) alive.
A plant can manufacture food using simple chemicals from the environment.
This process is called photosynthesis and is unique to the plant kingdom.



FLOWER: Contains the reproductive organs. Where the plant makes seeds. Flowers that are insect pollinated (eg rose) have colourful or scented petals to attract insects. Wind pollinated plants (eg grass) do not have petals but still have flowers.

STEM Transports food and water around the plant. Holds apart the leaves and flowers.

LEAVES Where photosynthesis is carried out. They have a large surface area to absorb as much sunlight as possible.

ROOTS: Absorb water and dissolved mineral salts from the ground. Support the plant in the soil so it doesn't blow over. The root hairs increase the surface area of the root.

Photosynthesis
Photosynthesis is how plants obtain food and is shown by the equation (the opposite to respiration):

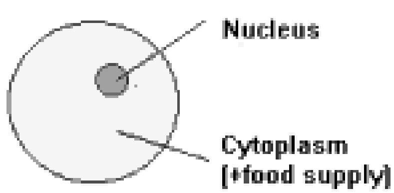
carbon dioxide + water + light energy --> sugar + oxygen

Light and chlorophyll (the green pigment in leaves) are needed for photosynthesis. Plants also obtain food from the soil in the form of minerals.   If the food is missing, poor growth results.

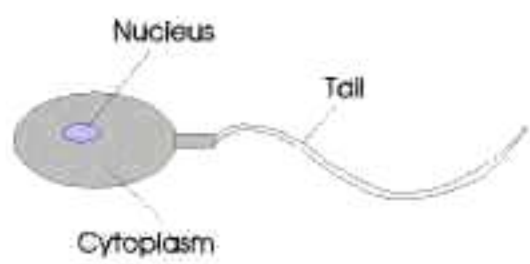
8. Human life-cycle

- Humans, along with all other mammals, reproduce by sexual reproduction.
- This means that an egg (from the mother) needs to be fertilized a single sperm (from the father).
- Fertilisation is internal which means that the egg is fertilized inside the mother's body and not outside (as with a fish, for example).
- The sperm (spermatozoa) are made in the testis. They leave the man's body through his penis. They are much smaller than the egg and can move by wiggling their tail.
- The eggs (ova, singular ovum) are made in the ovary and one egg is released every 28 days.

Human egg cell

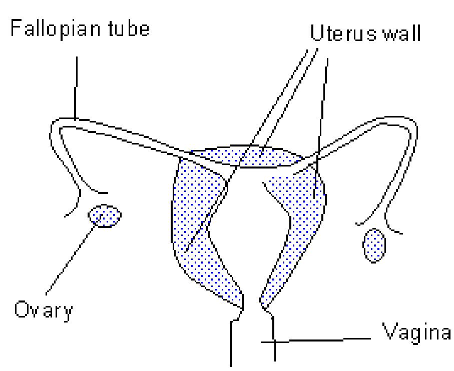


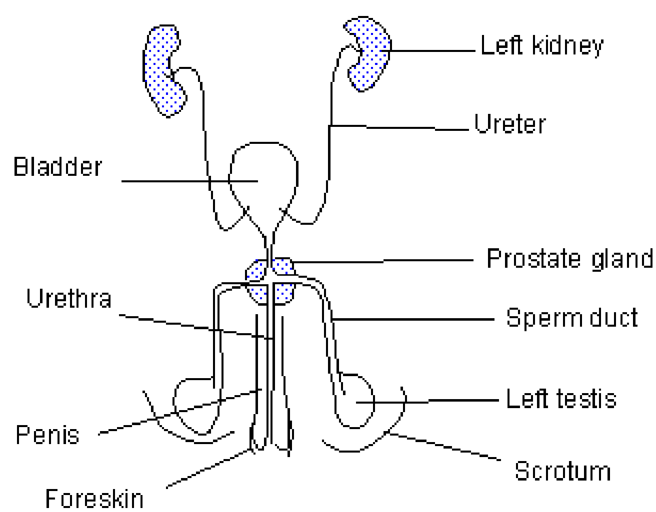
Human sperm



- The sperm is too small to see without a microscope
- The sperm enter the mother's body through the vagina.
- The egg is fertilized in the fallopian tube. The fertilized egg is known as a zygote.
- After fertilisation the egg cell starts to divide and an embryo begins to form. The embryo develops in the uterus (womb).

Diagrams showing the male and female reproductive organs





Development of the embryo

- The embryo obtains food and nourishment through its umbilical cord which is attached to the mother at the placenta.
- The umbilical cord, placenta, heart and brain are the first organs to form.
- When the embryo is recognisable as a baby (after about 2 months of development) it is known as a fetus.
- After about 4 months the embryo is nearly completely developed, but is still small (about 15cm).

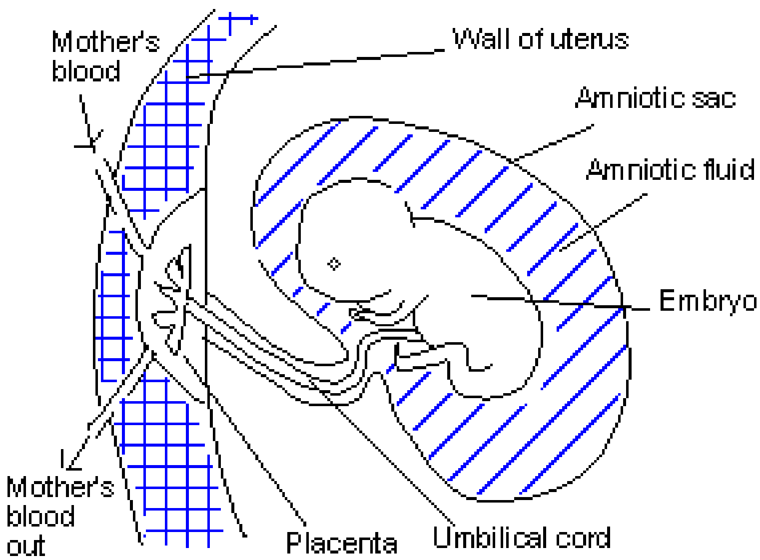


Diagram showing part of the uterus with the embryo at 3months gestation (10cm)

- In about another 5 months the baby is ready to be born and the body will have turned so that the head faces downwards towards the vagina (birth canal)
- The total time from fertilisation (conception) to birth is known as the gestation period which in humans is 9 months.
- A new born baby weighs about 4kg. Its head is quit large because the brain needs to be quite well developed.

The Placenta

- The placenta is an organ which attaches the embryo to the mother via the umbilical cord.
- Food and oxygen pass from the mother's blood to that of the embryo.
- Waste, mostly carbon dioxide and urea, pass back from the embryo to the mother.
- Other dangerous chemicals, such as alcohol or medicines, can also pass from the mother to the embryo and effect its growth.

- Note that the mother's blood cells do NOT pass across the placenta. If they did it could seriously harm the baby and the mother.

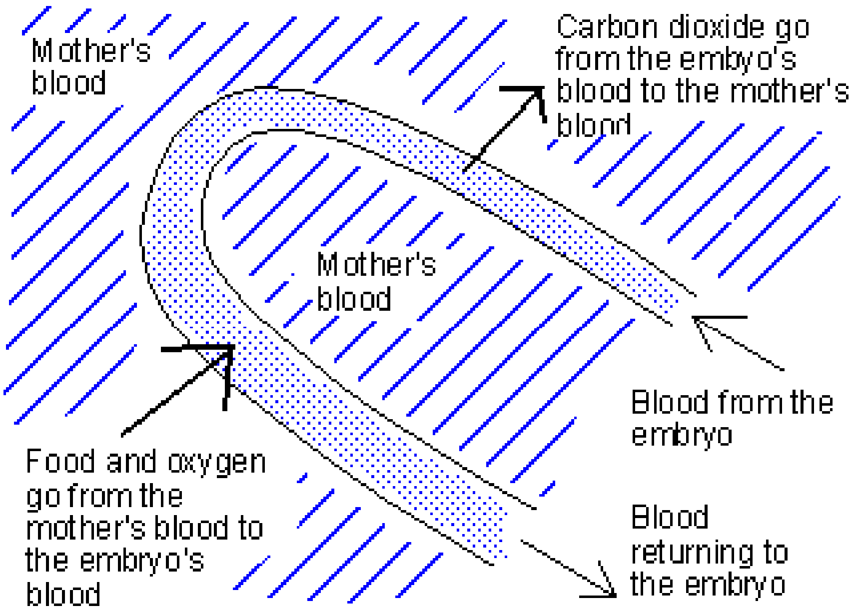


Diagram showing part of the placenta

Contraception

Contraception is any way of preventing a sperm from meeting an egg so that the mother does not get pregnant. Contraceptives include the condom, worn by the man and the contraceptive pill, which is taken by the mother. The use of contraceptives is important to prevent families from getting too large.

WORDS TO KNOW

TESTIS Where sperms (male gamete) are manufactured.

SPERM DUCT (vas deferens) Carry sperm from the testis to the urethra.

PROSTATE GLAND Produces a liquid to help nourish the sperm.

PENIS Contains the urethra. Where urine and sperm leave the body.

OVARY Where eggs/ova (female gamete) are manufactured.

FALLOPIAN TUBE (egg duct) Carries the eggs from the ovary to the uterus.
Where an egg is fertilized. The eggs take about seven days to travel down the Fallopian tube.

UTERUS Organ where the embryo/foetus develops.

EMBRYO The young child inside the uterus. While the child is only partly formed it is often called a FETUS.

AMNION A water filled sac (containing AMNIOTIC FLUID) that helps support and protect the developing embryo.

PLACENTA An organ that supplies the developing embryo with food and oxygen from the mother's blood. Waste (carbon dioxide and urea) travels back through the placenta from the embryo to the mother. Other substances (alcohol, nicotine, drugs) can also travel through the placenta and these can effect the development of the embryo. Blood cells do NOT pass through the placenta.

UMBILICAL CORD An artery and vein from the embryo that connects the embryo's blood circulatory system to the placenta.

GAMETE (sex cell) One of the cells that join during sexual reproduction. Contains only half the number of chromosomes in the nucleus compared to a normal cell.
In animals the male gamete is in the sperm and the female gamete is in the ovum.

FERTILISATION The fusion (joining) of the male and female gamete.

ZYGOTE The cell formed by the fertilisation of a male and female gamete. ie a gamete is a fertilized egg.

GESTATION PERIOD The time taken for the embryo to form in the uterus (ie the time from fertilisation to birth) In a human this is 9 months.

9. Habitats and Adaptations

- ECOLOGY is the study of animals and plants in their natural environment.
- In any habitat there will be a community of animals and plants.
- The habitat, the animals and plants in the habitat and the physical environment make up an ecosystem
- The habitat provides a place for an animal or plant to live and breed. It provides the correct food, shelter from the weather and protection from enemies.

Food Chains

- Plants can make food from simple chemicals around them, (carbon dioxide from the air, water containing dissolved minerals from the soil). The energy to do this comes from the sun.
- Animals rely on plants or other animals for their food.
- Without plants all life on this planet would die.
- A food chain list of organisms to show a simple feeding pattern within a habitat

eg CABBAGE LEAF → SLUG → THRUSH → FOX

This means that the cabbage is eaten by the slug ....
which is eaten by the thrush.
.. which is eaten by the fox.

The arrows show the transfer of food energy from one organism to the next.
The cabbage leaf gets its energy from the sun

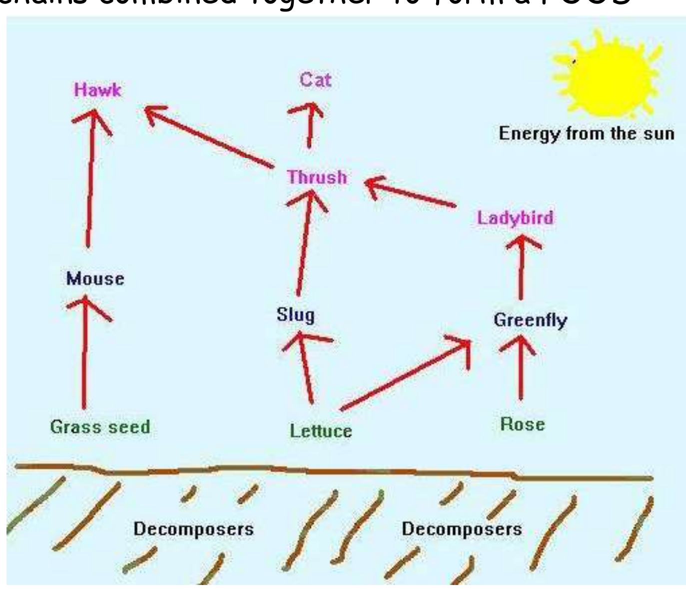
The first organism in a food chain is called a PRODUCER and is always a PLANT
All other organisms in the food chain are CONSUMERS
The animal at the top of the food chain is often a PREDATOR and is called a top carnivore

PRODUCER -> PRIMARY CONSUMER -> SECONDARY CONSUMER

The animals which eat the plant are called HERBIVORES
The animals which eat other animals are called CARNIVORES

Food Webs

In any habitat there will be several food chains combined together to form a FOOD WEB. A food web from an English garden:



The importance of bacteria and fungi in a habitat
Decomposers (small animals that live in the soil, worms, beetles etc) help recycle the dead food and so provide simple chemicals (mostly nitrates) for the plants to use again. A vital part of this recycling are the SAPROPHYTES (fungi and bacteria)

Saprophytes are DECAY ORGANISMS and are responsible for getting dead animals and plants to rot (decompose). They break down the remains into simple chemicals eg nitrates which contain nitrogen, an important element needed by plants.
Without saprophytes the soil would quickly run out of nutrients and the plants would have no food.

The balance of nature
Life in any ecosystem is in a delicate balance.
Changing one organism in a food web can alter that balance.

Examples:
A) If an insecticide (insect killer) was sprayed on to a garden what might happen in the food web on the previous page?

1. The greenfly (an insect) would all die
2. This would make the ladybird population go down and the roses would not get eaten
3. The thrush would have less food so would have to eat more slugs
4. This would mean that there would be more lettuces.

If the slugs had got killed as well by the insecticide there would have been be a different effect.

B) Imagine the effect of introducing a pike (or other predator) into a village pond.

* All the small fish would get eaten.
* The pike would then have no food so it would also die
* The number of plants in the pond would increase because there would be nothing eating them.

C) In some countryside areas of Europe they used to cut down the hedges to make the fields larger so make it easier to harvest the crops.

This had a disastrous effect:
By moving the hedges they destroyed the habitat of small birds (thrushes etc).
The birds moved away so there was nothing to eat the insects.
The insects, now with a much larger population, caused a lot of damage to the crops.

Limiting Factors
A limiting factor is something that prevents a population from getting any larger.
Eg. Food, space or a build up of waste

If there was a field full of rabbits they would breed rapidly and so eat more grass. As the grass starts to run out a lot of rabbits will die (or move away). The amount of grass will now start to increase again and so will the number of rabbits. The number of rabbits and amount of grass will continue to cycle up and down.

Adding a fox to the field will alter the balance.

Words to know
ENVIRONMENT The external surroundings that an animal or plant lives in and which influence its life or development. The environment can be effected by physical factors such as soil temperature, humidity, air temperature, moisture content of soil, pH, light intensity and nutrients in the soil.

HABITAT The place where an animal or plant makes its home
eg woodland, fresh-water stream, desert.

POPULATION A group of animals or plants of the same species living in a particular area.

COMMUNITY A collection of all the animals and plants that live in a particular area.

ECOSYSTEM A community of animals and plants and the habitat where they live.

HERBIVORE An animal that eats only plants
(herbivorous) (leaves, seeds, berries, bark etc) eg snail, mouse

CARNIVORE An animal that eats only meat.
(carnivorous) eg thrush, pike, ladybird

OMNIVORE An animal that eats plants and meat.
(omnivorous) eg rat, human

PREDATOR An animal that hunts for food. eg hawk, pike.

PARASITE An animal or plant that lives on (or inside) the body of another living organism eg leech, flea, tapeworm

HOST The organism on which a parasite is living
eg if a flea lives on a fox then the fox is the host and the flea the parasite.

SCAVENGER An animal that lives from the remains of other animals.
eg shrimp, various beetles.

DECOMPOSER An animal that lives on the rotting remains of other organisms. Decomposers help in the recycling of dead material returning essential nutrients to the ground.
eg fungi, bacteria, various beetles, worms

SAPROPHYTE A decay organism. Saprophytes cause the remains of organisms to rot. They are vital for the recycling of nutrients into the ground. eg fungi and bacteria.
PRODUCER The first organism in a food chain. Always a green plant. Green plants are the only organisms that can carry out photosynthesis and produce their own food from simple chemicals in the soil and air. Note: fungi do not possess chlorophyll and so are NOT considered as producers

CONSUMER All the animals in a food chain. Animals rely on other animals or plants for their food as they cannot produce their own.

PRIMARY CONSUMER The first consumer in a food chain. Always a herbivore.

TOP CARNIVORE The carnivore at the end of a food chain. eg fox, pike.

FOOD WEB A diagram that represents several interlinked food chains

FUNGI - Fungi (along with bacteria) are very important in the food chain for the recycling of nutrients in the soil.
Some fungi are harmful and can cause disease in crops (eg potato blight).
Some fungi are useful to man eg yeast which is used to ferment sugar and produce alcohol in the brewing industry.

QUADRAT A rectangle of known area (eg 1m2) used for estimating the population size of an organism.

POOTER A device for sucking up small organisms.

The different animals and plants in a habitat can be identified using a key. You must be able to use a key.

KEYS

A key is used to identify an organism.
A key consists of pairs (or small groups) of statements
In each pair or group of statements only one of those statements will be true

When using a key follow these rules:

1. Always start at clue number 1. This will have 2 or more statements in it.
2. Look for the correct statement . This may give you the name of the organism. If it doesn't you must go to the clue it directs you to.
3. Repeat rule 2 until you have the name of the organism you are trying to identify.

Example key which identifies different animal groups

1.How many legs does it have?
  no legs..Goto 2
  two legs..Goto 3
  four legs..Goto 4
  six legs ....Goto 8
  eight legs..Spider (arachnid)
  more than eight, less than twenty legs ....Crustacean
  more than twenty..Goto 5

2. Body divided into segments..Goto 6
  No segments. Smooth, often slimly skin (mollusc)........................Goto 7

3. Is it warm blooded and has feathers ....Bird
  Smooth skin with some hair Mammal......................................(human)

4. Is warm-blooded, has fur or hair..Mammal
  Has a dry, scaly skin. Breaths using lungs ....Reptile
  Has moist, smooth skin. Often lives near water ....Amphibian
  Has a wet, scaly skin. lives in water. Breaths using gills ....Fish

5. Has one pair of legs on each segment....................................Centipede
  Has two pairs of legs on each segment ....Millipede

6. Pinkish brown. Slender body. Body has small bristles on each segment......Earthworm

Small squat body, (1 to 3 cm), pale yellow in colour. No proper legs.....Insect larva

7. No shell. ....Slug
   Body protected by a hard shell ....Snail

8. Body divided into 3 parts, often has 2 pairs of wings.....................Insect
   1 to 3 cm long, soft, cylindrical body ....Insect larva

10. Reproduction in Plants

The structure of a flower
You should be able to label the below parts of a flower on a diagram:
Petals: Brightly coloured structures used to attract insects by their bright colour and scent.

Sepals: Green leaves around the outside of the flower. Sepals are usually smaller than the petals,. Used to protect the flower while it is still in bud.

Stamens: Male part of the flower. Consist of two parts: the filament (a thin stalk) and the anther (a swelling at the top of the stalk). Pollen, which contains the male gamete, is formed on the anther.
(Anther + filament = stamen)

Carpel: Female part of the flower. Contains the ovary, stigma and style. The ovules, which contain the female gamete, are found in the ovary.
(Stigma + style + ovary = carpel)

Pollination
Sexual reproduction in a flowering plant has two main stages: pollination and fertilisation. After this, a seed is formed and it has to be dispersed and then needs to germinate. Pollination can occur two main ways:

a. By **insects**: which visit the flower to obtain nectar. Some of the pollen grains from the stamen stick to the body of the insect. When the insect visits another flower some pollen grains fall off its body and stick to the stigma. These flowers often have features to attract insects eg brightly coloured petals or a pleasant smell. eg rose

b. By **wind**: pollen is easily blown from the male part of one flower to the female part of another plant Eg in a hazel.

Self-Pollination and Cross Pollination:

- Usually pollen moves from one plant to another plant of the same species. This is called cross pollination.
- Sometimes pollen land on the stigma of the same plant. This is called self-pollination.
- Only insect pollinated flowering plants have petals. Grass IS a flowering plant but it is WIND pollinated.

Fertilisation

- Fertilisation is when two gametes join. In plants the male gamete is in the pollen female gamete is in the ovum
- After pollination fertilisation takes place. This is when the male nucleus and female nucleus join.
- After fertilisation the fertilised egg cell (zygote) divides many times and forms an embryo. The embryo forms a hard wall around it and is then known as a seed.
- The seed also contains a food store, usually starch.
- The part of the flower surrounding the seed is known as the fruit. This usually formed from the ovary.
- After fertilisation the petals and stamens wither and die. The ovary (which forms the fruit) swells up, sometimes considerably (ie as in an apple)

Seed dispersal

The job of the fruit is to carry the seeds as far as possible from the parent plant so the new plants have room to grow and do not compete for resources such as light, water and nutrients in the soil. This process is called seed dispersal.

Fruits disperse their seeds four main ways:
1. The fruit is eaten by animals such as birds but are not digested. The seeds pass out the animal along with its droppings eg cherry, blackberry. These fruits look and taste nice.

2. The fruit splits open. sometimes this happens with a lot of force and the seeds are shot out. eg beans. the pod is the fruit and the beans are the seeds.

3. The fruits have little hooks. these hooks stick to the fur of animals. eg burdock.

4. The fruits have wings or hairs and this lets them get carried by the wind,. eg sycamore trees have winged fruits.

Germination

Germination is the process by which the dormant seed actually starts to grow. (Dormant means sleeping or resting. By becoming dormant it helps the seed survive adverse conditions - eg the cold winter.)

Conditions needed for germination

- The seed needs the following three conditions to germinate: water, oxygen and warmth.
- When the seed gets damp it absorbs water, often doubling in mass. Providing that the seed has oxygen and water it will start to germinate.
- The germination period is time between planting and starting to germinate.

Experiment to show how warmth effects the germination period

- Three small pots had damp cotton wool placed in the base, with tree bean seeds placed on each piece of cotton wool.
- The pots were placed at the following locations: A warm, brightly lit window-sill, a closed refrigerator and a warm dark airing cupboard.
- The seeds were inspected and watered daily.
- The time taken to germinate was recorded in each case.

Conditions:

Window-sill:	warmth, light and water
Airing cupboard:	warm, no light and water
Refrigerator:	cold, no light and water;

NOTES: This type of experiment is called a controlled experiment.
The seeds on the window-sill are the control, where the conditions are normal. To make it a 'fair test' only ONE condition is altered between each experiment; the others are kept the same. Several seeds are used in case of any fail to grow, and the average time to germinate recorded.

Results
The seeds in the refrigerator took longer to germinate showing that warmth is necessary for germination.
The other two sets of seed germinated in a similar time showing that light is NOT needed for germination

Practical Skills

You should:

- Know how to carry out a CONTROLLED experiment
- Understand how to carry out a fair test and realise the importance of a fair test. (so the results can be compared with accuracy).
- Change only one variable (the independent variable) and measure the dependent variable. Keep all other variables the same

Graph skills you need:

Correct use of tables and graphs
Labelling graphs with correct units
Using the correct type of graph (line or bar graph)

Some example investigations to remember:

Showing how effective an insulation is at keeping water warm.
Showing that light intensity controls the rate of photosynthesis.
Showing how the resistance of a wire increases with length
Showing how the solubility of a solvent increases with temperature
Showing the presence of starch in a leaf
Measuring the speed of a ball rolling down a slope