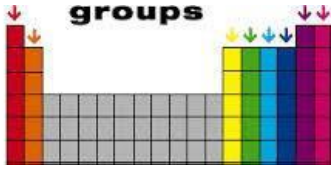
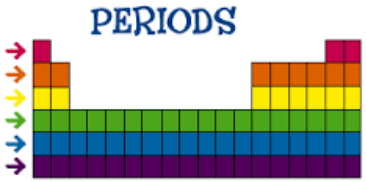
Chemistry Knowledge Organiser
C1 - Atomic structure

Elements

- An ***element*** contains only one type of atom. All elements are given a symbol and are found on the periodic table. You need to learn the symbols for the first 20.
- The Periodic Table is arranged into groups (columns) and periods (rows), as shown below.





Elements in the same group have:

- The same number of electrons in their outer shell
- Similar properties

Elements in the same period have:

- The same number of electron shells

Compounds

- Compounds are 2 or more elements that are chemically bonded
- These are made in chemical reactions.
- Compounds are given a formula for example carbon dioxide is CO_2 means 1 carbon atom and 2 oxygen atoms.
- Another example is calcium hydroxide $Ca(OH)_2$ which means 1 calcium, 2 oxygen atoms and 2 hydrogen atoms

Chemical Reactions

- In some chemical reactions it may appear that there are less products than there were reactants; however this is often because a gas has been made and this has escaped into the atmosphere.

Key Terms	Definitions
Element	A substance that contains only one type of atom
Mixture	A mixture is two or more different atoms which are not chemically bonded – can be separated
Compound	Two or more elements that are chemically bonded
Group	The columns on the Periodic Table
Period	The rows on the Periodic Table
Reactant	What you start with in a chemical reaction
Product	What is made in a chemical reaction

The Conservation of Mass

- In a chemical reaction, chemical bonds are broken the atoms are rearranged and the chemical bonds are made again.
- In a chemical reaction, ***mass is never lost***, you must start and finish with the same mass.

Balancing Equations

- We need to write balanced chemical equations represent chemical reactions and the conservation of mass.
- For example: The equation below shows hydrogen and oxygen making water but there are more oxygen atoms on the right than the left.

$$H_2 + O_2 \rightarrow H_2O$$

- In the equation below there are 4 hydrogen atoms on the left and right of the equation and 2 oxygen atoms on each side

$$2H_2 + O_2 \rightarrow 2H_2O$$

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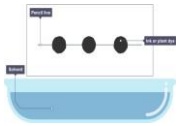
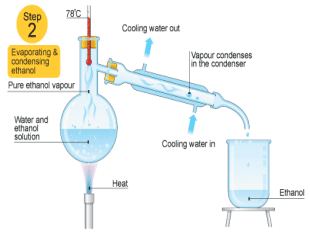
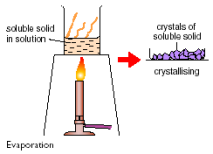
Pure and Impure Substances

- A pure substance contains only one type of **element** or **compound.**
- **An impure substance** contains more than one type of element or compound in a mixture, for example salt water contains NaCl and H_2O. All mixtures are impure substances.
- Mixtures are much easier to separate than elements or compounds as they are not chemically bonded
- There are a variety of ways that mixtures can be separated and they are outlined below. Remember that these are all physical changes and chemical bonds are not broken during any of these processes.

Key Terms	Definitions
Pure	A substance made of only ONE type of element or compound
Impure	A mixture of elements and/or compounds
Chromatography	A technique where mixtures can be separated based on their solubility.
Distillation	A separation technique which means a mixture of two liquids is heated
Crystallisation	Method of mixture separation where a solvent is evaporated, leaving the solute behind.

Separating Impure Substance

Name	Diagram	Explanation
Chromatography		• Different substances travel different distances up the paper depending on their solubility in the solvent used (it is often water but not always). The more soluble, the further it moves up the paper • Line must be drawn with pencil because pencil will not run. • Artificial colours in foods can be identified using chromatography. Additives do not necessarily have a colour and therefore are identified using chemical analysis.
Distillation		• **Distillation is** when two liquids with *different boiling points* are separated • For example ethanol (alcohol) boils at 78 °C and water boils at 100 °C • If you heat a mixture of water and ethanol to 80°C the ethanol will **evaporate** but the water will not. • You then **condense** the ethanol and collect the pure ethanol
Crystallisation		• Crystallisation is when a solvent is evaporated from a solute.

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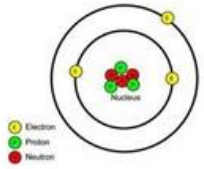
The structure of the Atom

- All matter is made from atoms. Atoms are very small. The radius of atom is about $1x10^{-10}$ m (this is also known as 0.1 nanometres).
- The central part of the atom is known as the nucleus. It is only $1x10^{-14}$m across, which is 10,000 times smaller than the total atom.
- An atom is made up of three subatomic particles: **protons**, **electrons** and **neutrons**.
- Protons and neutrons are found in the nucleus
- Electrons are found orbiting the nucleus in shells (also known as *energy levels*).

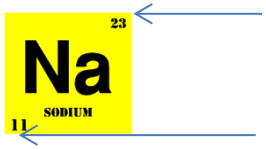


- The mass and charges of the sub atomic particles is shown below:

	Mass	Charge
Proton	1	+1
Neutron	1	0
Electron	0	-1

- Atoms have **no overall charge** because they have the same number of positive protons as negative electrons.

Atomic Number and Mass Number



Mass number: This is the total of protons+neutrons

Atomic number: This is the number of protons

Therefore sodium has 11 protons, 11 electrons and 23-11= 12 neutrons

Key Terms	Definitions
Atom	The particles that make up all substances with mass, they contain protons, neutrons and electrons.
Nucleus	The centre of an atom, it contains protons and neutrons.
Nanometre	A unit of measurement: $1x10^{-9}$m
Proton	A sub atomic particle found in the nucleus, it has a charge of +1 and a relative mass of 1.
Electron	A sub atomic particle found in the shells of an atom, it has a charge of -1 and a negligible mass
Subatomic	These are the smaller particles that make up an atom
Neutron	A sub atomic particle found in the nucleus of an atom, it has a charge of 0 and a mass of 1
Atomic Number	The number of protons in an atom.
Mass Number	The total of protons and neutrons in an atom.

Electron Configuration

There are very strict rules about how electron fill up the electron shells, the inner shell is always filled first. Each shell has a maximum number of electrons it can take.
Shell 1: maximum 2 electrons
Shell 2: maximum 8 electrons
Shell 3: maximum 8 electrons

Example:

11 electrons

The electronic configuration of Sodium (Na) can also be written like this 2,8,1. This shows there is 2 electrons in the 1st shell, 8 electrons in the second shell and 1 electron in the 3rd shell.

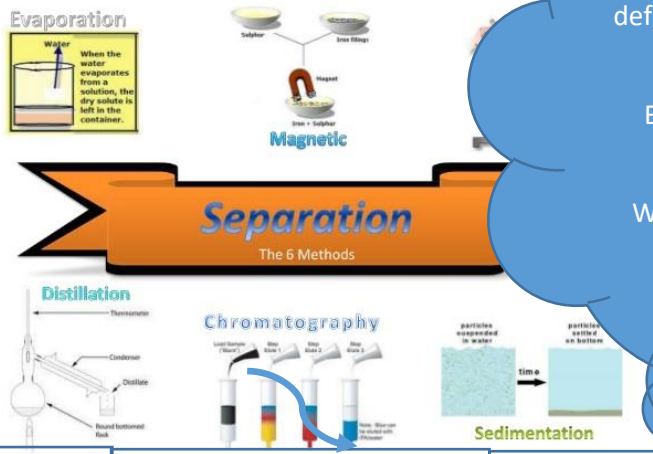
Year 9 Chemistry topic 1 learning journey.

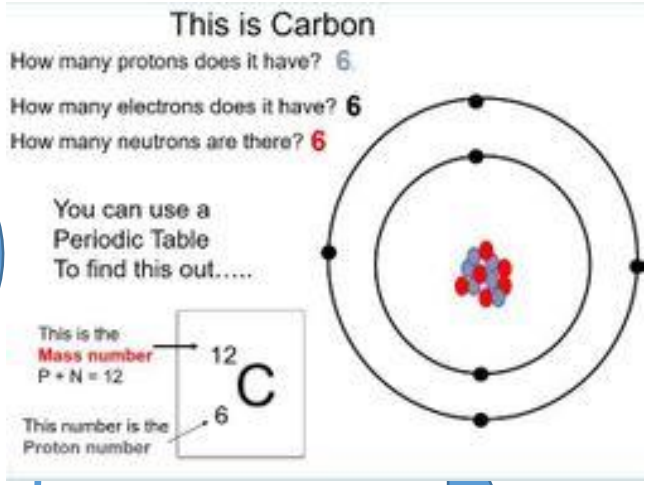
What I already know from year 7 and 8:

Particle patterns in solids liquids and gases definitions for atoms, elements, compounds and mixtures.

Basic filtration, evaporation and simple chromatography method.

Where metals and non-metals are on the periodic table.





All substances are made from atoms, elements are made from one type of atom only, when elements react and bond together they form compounds. In such reactions the mass of reactant = mass of product.

Mixtures are easily separated by; **filtration** of an insoluble solid from a liquid, **Distillation** of two or more liquids with different boiling points, **Chromatography** of a mixture of chemicals with different solubilities.

Rf= distance spot moves/distance solvent

Experimental evidence led to the development of the atom. Discovery of the electron and the plum pudding model, gold foil scattering experiment gave the nuclear model, Niels Bohr put electrons in energy shells and Chadwick discovered the neutron

Atoms have a central nucleus with **protons** (+1 charge and 1mass unit) and **neutrons** (0 charge and 1mass unit). **Electrons** are in energy shells around the nucleus. 2 electrons in the first shell, 8 in all other shells. Atomic radius is 0.1nm and the nuclei are 1/10000 of the atom.

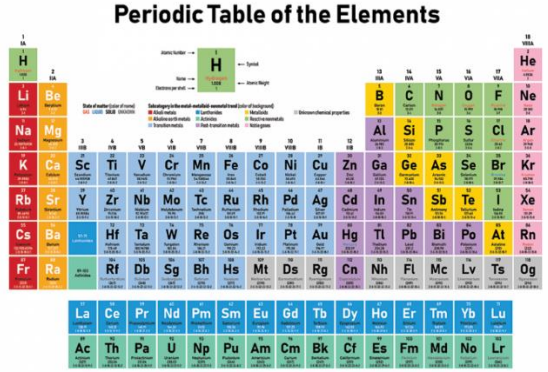
Mendeleev developed the first periodic table elements in order of mass but also properties. Now elements in order of atomic number. Groups have similar properties as same number of electrons in outer shell. Describe properties and reactivity of Grp 1,7,0 and transition metals.

Future learning

How atomic structure effects type of bonding and properties.

How atoms react and chemical changes take place.

Vocabulary: Atom, element, compound, conservation of mass, filtration, distillation, soluble, insoluble, chromatography, solvent, Rf value, plum pudding model, nuclear model, electron, proton, neutron, group, period, Mendeleev, properties.

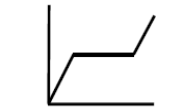


C8 part 1 Chemical Analysis

1.1 & 1.2 Pure substances and mixtures

Pure substance	A single element or compound not mixed with any other substance.
Mixture	More that one substance, mixed but not chemically bonded together
Formulation	A mixture that has been designed as a useful product. Many formulations are complex mixtures in which each chemical has a particular purpose.

Pure substances melt and boil at **specific** temperatures. Heating graphs can be used to distinguish pure substances from impure.



Melting point of a pure substance

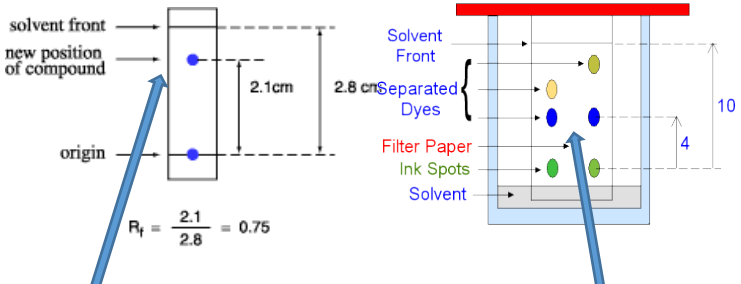
Melting point of an impure substance

Examples of Formulations: Fuels, cleaning agents, paints, medicines and fertilisers

1.3 Chromatography

A technique that can be used to **separate** mixtures and the identify substances.

R_f = Distance moved by the substance / Distance moved by the solvent

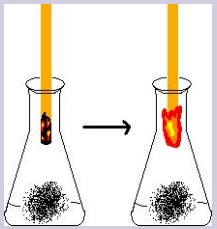


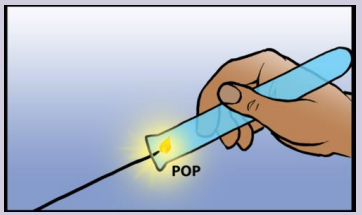
Pure substance - only one spot above origin

Mixture – more than one spot above origin

2.1 to 2.4 Gas tests

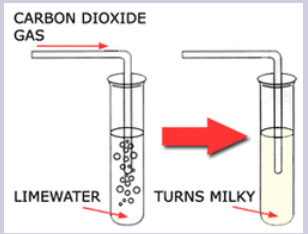
Oxygen – relights a glowing splint

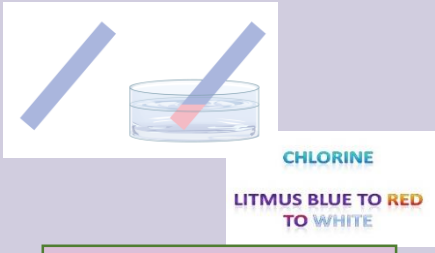




Hydrogen –a lighted splint causes a squeaky pop

Carbon dioxide – bubble it through limewater which then goes cloudy

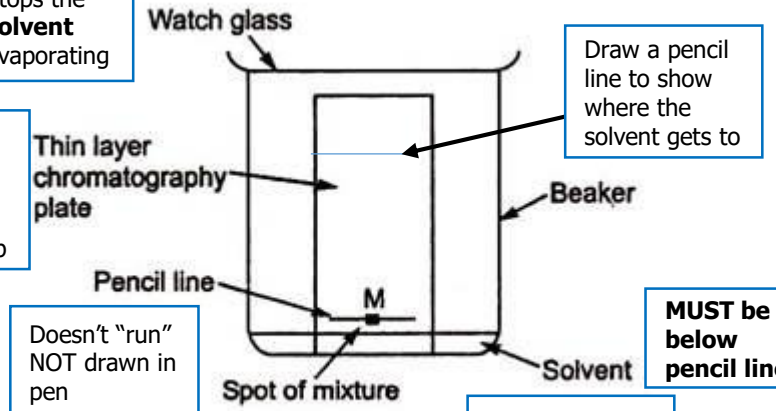




Chlorine – Damp blue litmus paper goes red then white

Required Practical

Stops the **solvent** evaporating



The stationary Phase – solvent and dyes move up

Doesn't "run" NOT drawn in pen

MUST be below pencil line

The mobile Phase – moves **up** the paper

Fig. 22.9

1	Define a pure substance
2	Describe a method to find out if water is pure
3	What is a formulation?
4	Describe the process used in chromatography
5	State the equation for the Rf value in chromatography
6	Why should the start line in chromatography be drawn in pencil?
7	Describe the test for hydrogen
8	Describe the test for oxygen
9	Describe the test for carbon dioxide
10	Describe the test for chlorine

Pure substance	A single element or compound not mixed with any other substance.
Formulation	A mixture that has been designed as a useful product. Many formulations are complex mixtures in which each chemical has a particular purpose.
Pure	A substance that has nothing added to it.
Chromatography	A technique used to separate mixtures.
Stationary phase	The material the sample travels on but which doesn't move itself e.g. paper
Mobile phase	The solvent which moves the sample. The more soluble the sample is in the solvent, the further it moves.
Solvent front	The maximum point on the chromatography paper that the mobile phase reaches – usually marked on afterwards using a pencil.
Retention Factor	The ratio of how far a substance moves compared to the distance to the solvent front. For the same substance this number will always be the same.