Chemistry Knowledge Organiser
Separating techniques (Trilogy Science)

Atoms and symbols

All substances are made of **atoms.**

Atoms – smallest part of an element that can exists

Atoms of each element are represented by a chemical **symbol**, e.g. O represents an oxygen, and Na represents an atom of sodium.

When a symbol for an element is 2 letters, the first letter with be a capital and the second will be lower case. Sodium is Na, not NA or na or nA.

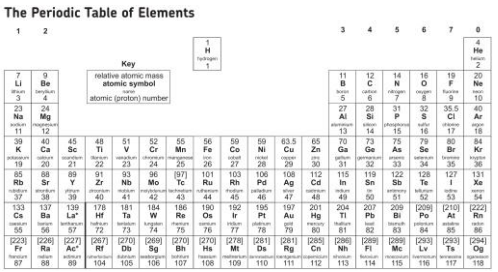
Know that the formula for all the following elements ends in a 2. Iodine (I_2), bromine (Br_2), chlorine (Cl_2), fluorine (F_2), oxygen (O_2), nitrogen (N_2) and hydrogen (H_2).

16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86

Compounds

There are about 100 different **elements** that are shown in the **periodic table**.

Compounds are formed from elements by **chemical reactions**.



Chemical reactions always involve the formation of one or more new substances, and often a detectable **energy change**.

Formulae

Compounds contain two or more elements chemically combined in **a fixed ratio** - represented by formulae using the symbols of the atoms from which they are formed.

H_2O

2 x hydrogen

1 x oxygen

Naming compounds

Compounds of 2 elements – write down the name of the metal followed by the name of the non-metal changing the end to –ide

calcium and chlorine – calcium chloride

iron and oxygen – iron oxide

Compounds of 2 elements and oxygen – write down the name of the metal followed by the name of the non-metal changing the end to –ate

copper, carbon and oxygen – copper carbonate

zinc, sulfur and oxygen – zinc sulfate

Compounds with oxygen and hydrogen – write down the name of the metal followed by hydroxide

sodium, hydrogen and oxygen – sodium hydroxide

Equations

Equations represent the changes occurring in a reaction using words or symbols.

→ represents the reactants turn into the products during the reaction

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Mixtures

Two or more elements or compounds not chemically combined.

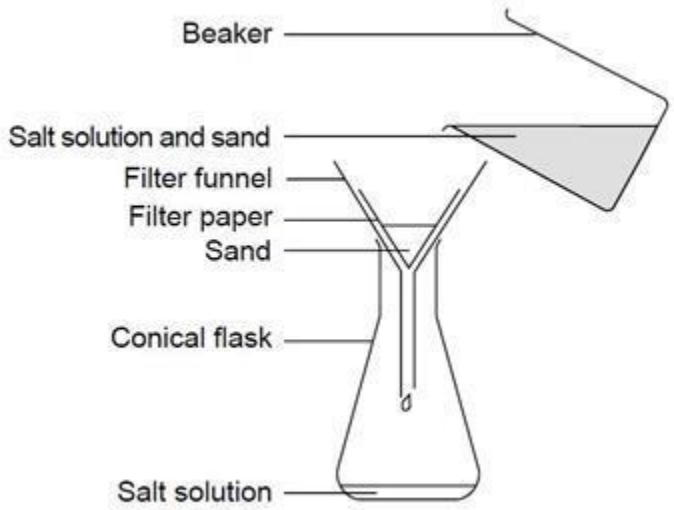
Chemical properties of each substance in the mixture are unchanged.

Can be separated by physical processes

These physical processes do not involve chemical reactions and no new substances are made

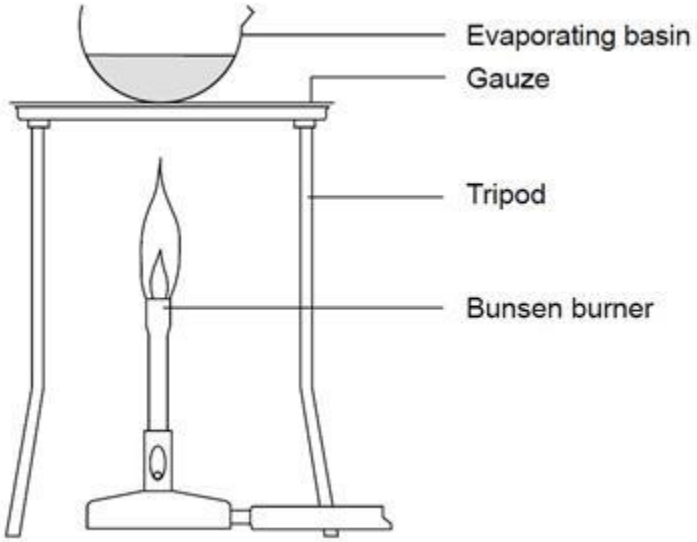
Filtering

Separates an insoluble solid from a liquid or solution.



Crystallisation

Separates a soluble solid from a solution.



Solution is heated until crystals start to form – saturated solution

Gentle heating can be achieved using a water bath (beaker of boiling water)

Solution allowed to cool – solubility of solid is less in the cooler solution so solid cannot remain dissolved and crystals form.

Any impurities remain in the solution and are discarded so crystals formed are pure.

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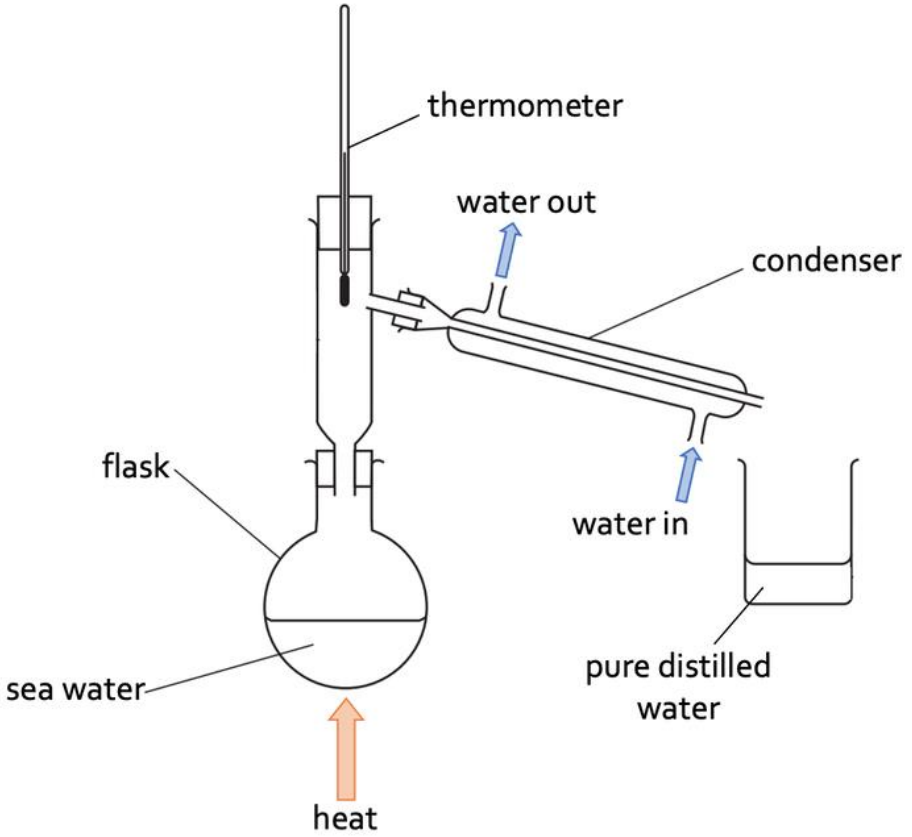
Simple distillation

Separates a liquid from a liquid or solution.



Evaporation occurs on the surface of the liquid and condensation happens in the condenser.

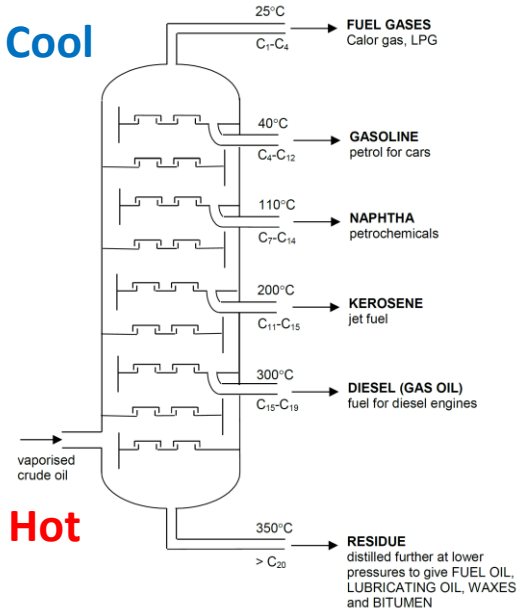
Fractional distillation

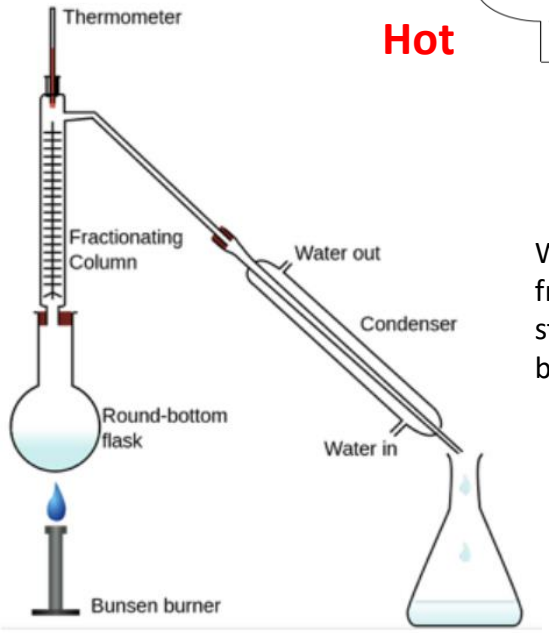
Crude oil is **separated into fractions**, mostly used as fuels or as a feedstock for the chemical industry and used to make materials such as solvents, lubricants, polymers, detergents.

Vapourised crude oil is passed into the bottom of the column.

Vapours **rise up** the column **cooling** and **condensing**.

Hydrocarbons with **different boiling points** condense at **different levels**.





When done in the lab each fraction is collected in turn, starting with the lowest boiling point.

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Chromatography

Used to separate a mixture of compounds which are all soluble in the same solvent.

Method

Start line is drawn in **pencil** about 1cm from the bottom of the paper. Pen is not used as the ink could run.

Spots of each substance placed on the start line.

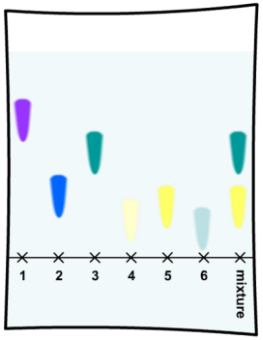
Bottom of the paper placed in the solvent – spots must not be covered - will dissolve in the solvent in the beaker.

Results

Spots that move the **same distance** are the **same compound**.

If a spot does not move it is insoluble in that solvent and another solvent should be used.

Pure substances will produce a **single spot** in all solvents.



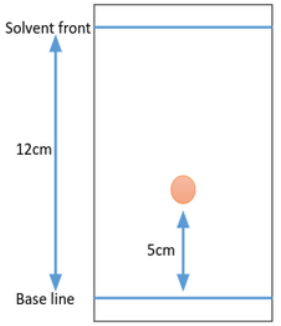
R_f values

$$R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$

e.g. $R_f = \frac{5}{12}$

$R_f = 0.417$

R_f values depend on the solvent used.



How chromatography works

Stationary phase - paper

Mobile phase – solvent

- solvent **moves** through the paper
- the different compounds **have different solubilities** in the solvent (mobile phase) and **attraction** for the paper
- **most soluble** compounds **move furthest** and compounds with strongest attraction to the paper move least