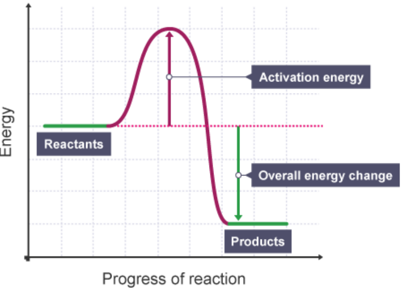
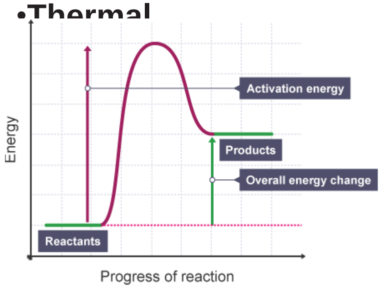
CE1

Exothermic reactions – give out heat energy.
Examples of exothermic reactions include:
•**combustion** reactions
•many **oxidation** reactions
•most **neutralisation**



Endothermic reactions – Take in heat energy.
Examples of endothermic reactions include:
•Thermal



Relative masses and Mole

Atoms are made up of **protons, Neutrons** and **electrons.**

Protons & **Neutrons** have a mass of 1 each.

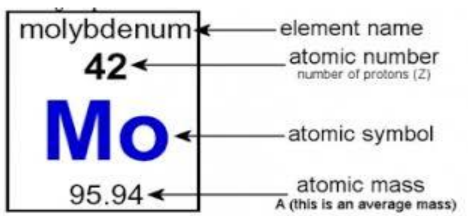
Electrons are negligible

Ar is atomic mass of an element

Mr is the combination of all elements **Ar** in a compound or Molecule

The masses of atoms are compared by measuring them relative to atoms of carbon-12.

One mole of any substance is its relative formula mass, in grams.



Work example

Helium (He) Ar = 4

Carbon dioxide = CO_2

Carbon (C) = 12 Oxygen (0) = 16

Mr of CO_2 = 12 + (16 x 2) = 44

1 mole of any substance always contains 6.02 X 10^{23} particles.

Number of moles = mass / A_r/ M_r

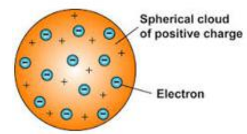
For example if you have 22g of carbon, how many moles would you have

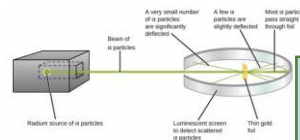
Moles = mass (22) / M_r (44)

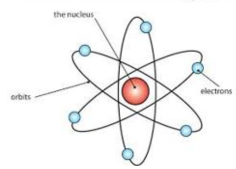
Development of Atomic Model

Dalton – atoms can't be divided

JJ Thompson discovered electrons – Plum pudding model





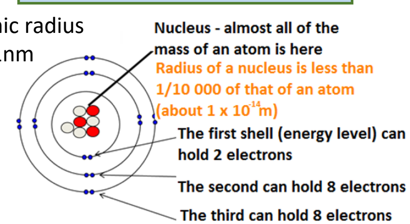


Geiger-Marsden The Nuclear Model of the Atom

Bohr – electrons in shells

Chadwick – the neutron

Atomic radius = 0.1nm



Reversible reactions

Can go in both directions.

$$A + B \rightleftharpoons C + D$$

If a reaction is exothermic in one direction it is endothermic in the other direction.

endothermic (in forward reaction)

hydrated copper(II) sulfate (blue) ⇌ anhydrous copper(II) sulfate (white) + water

$CuSO_4.5H_2O \rightleftharpoons CuSO_4 + 5H_2O$

exothermic (in reverse reaction)

Dynamic equilibrium – the rate of the forward and reverse reaction remain at a constant rate. This can only be achieved in a closed system.

Le Chatillier – a system at equilibrium will react to oppose any change made upon it.

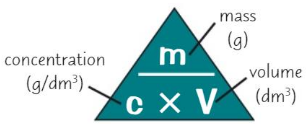
The equilibrium of a reversible reaction can be affected by:

- Changes in temperature
- Changes in pressure
- Changes in concentration.

Concentration

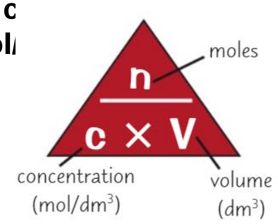
A **solution** forms when a **solute dissolves** in a **solvent**. The **concentration** of a solution is a measure of how 'crowded' the solute particles are. The more concentrated the solution, the more particles it contains in a given **volume**

To calculate concentration in G/



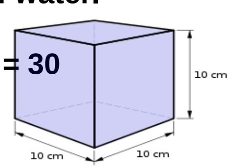
Example – 2g of salt are dissolved into 0.5dm^3 of solution.
Concentration – 2/ 0.5 = 4g/dm^3

To c tion in mol/



Example: 3 moles of a solid are dissolved in 0.1 dm^3 of water.

Concentration = 3/ 0.1 = 30 mol/dm^3

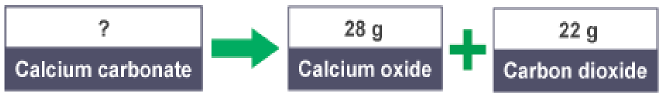


Note 1 dm^3 = 1000cm^3

The law of conservation of mass.

The law of conservation of mass states that no **atoms** are lost or made in a chemical reaction.

Example: in the example, the mass of calcium carbonate must be



28 + 22 = 50g

If a reaction releases a gas, it might appear that the mass goes down s

$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

In the example, CO_2 is given off and so the mass would appear to reduce **unless** carried out in a closed system.

The mass may appear to increase where an element reacts with an element in the atmosphere
Example:
$2Mg + O_2 \rightarrow 2MgO$
Magnesium reacts with oxygen from the atmosphere.

Potable water

Water is essential for life. Water that is safe for humans to drink is called **potable water**. Potable water is not pure water because it almost always contains **dissolved** impurities.

For water to be potable, it must have sufficiently low levels of dissolved **salts** and **microbes**. This is because:

- dissolved salts can sometimes be harmful for humans
- microbes can cause illnesses

Most potable water in the UK is produced from naturally occurring fresh water by:

1. passing the water through filter beds to remove **insoluble particles**
2. **sterilising** the water to kill microbes

Distillation

Sea water is heated until it boils. The salt remains in the liquid, and the steam is pure water. The steam is cooled and condensed to make potable water.

Reverse osmosis

Water is put under high pressure and passed through a **membrane** which has tiny pores (holes) in it. The pores allow water **molecules** through, but prevent most **ions** and molecules from passing through. Reverse **osmosis** requires expensive membranes and also produces a large volume of waste water, so its **efficiency** is often quite low.