Chemical Reactions

Element	a substance containing only one type of atom eg Mg, O2
Compound	a substance containing two or more different types of atoms that are **CHEMICALLY BONDED**

Equations must be balanced due to the **PRINCIPLE OF CONSERVATION OF MASS**

Mixtures & Separation Techniques

Filtration	removes large, insoluble particles from a liquid. eg, sand from water
Evaporation	leaves behind crystals of a dissolved substance (solute) if heated gently (**CRYSTALLISATION**)
Distillation	involves condensin the evaported solvent and collecting it
Fractional Distillation	can separate liquids due to their different boiling points
Chromatography	causes substance to rise up due to **CAPILLARY ACTION**. Lighter particles move further up (links to paper 2)

States of Matter

Solid	- particles in regular arrangement (lattice) - vibrate about **FIXED POSITIONS** - cannot be compressed
Liquids	- particles have no regular arrangement - able to move past each other - cannot be compressed

States of Matter (cont)

Gas	- particles are far apart - move randomly at fast speeds (high energy) - can be compressed
Solid --> Liquid	melting
Liquid --> Gas	evaporation or boiling
Gas --> Liquid	condensing
Liquid --> Solid	freezing or solidification
Solid <--> Gas	sublimation
Physical Change	no new substance made

Energy (heat) is needed to overcome the **ELECTROSTATIC FORCES OF ATTRACTION** between particles to melt/evaporate substances

Atomic Structure

Ancient Greeks	thought that matter was made of small indivisible particles
JJ Thomson	- plum pudding model - a ball of an overall positive charge - small, negatively charged electrons embedded throughout
Ernest Rutherford	- discovered that the nucleus was small and positively charged - gold leaf alpha scattering experiment - most particles went straight through but some were deflected back - cloud of electrons surrounding nucleus
Neils Bohr	- electrons exist in "shells"

Atomic Structure (cont)

James Chadwick	- nucleus must contain protons and neutrons

Subatomic Particle	Relative Charge	Relative Mass
proton	+1	1
neutron	0	1
electron	-1	0 (very small)

Atomic & Mass Numbers

Mass Number (Ar)	- top number - number of protons + neutrons in a nucleus
Atomic Number	- bottom number - number of protons in a nucleus - an atom must also have this number of electrons in order to be neutral. If not, it is an ion instead.

Some mass numbers are not whole numbers because the Ar is an **AVERAGE** of all isotopes

average mass = total mass of 100 atoms/100

Development of the Periodic Table

The elements were initially ordered according to their **ATOMIC "WEIGHT"** even though grouped together due to having **SIMILAR PROPERTIES**

DMITRI MENDELEEV realised that it made more sense to swap/reverse the order of some elements

His table had gaps in, which he predicted would be for elements not yet discovered

In time, this table was proven largely correct due to **PEER REVIEW** and so it is not the basis of the modern periodic table

Metals & Non-Metals

Metals	- left of the periodic table - always **DONATE** electrons to gain an empty outer shell - they form **POSITIVE IONS** - transition metals also form positive ions but form different numbers
Non-Metals	- right of the periodic table - always **ACCEPT** electrons to gain a full outer shell - can share electrons (see bonding)

Groups 1, 7 and 0

Group 1 - Alkali Metals	- react with water to produce an alkali - they all form a 1+ ion (eg Na^+) - Get **MORE REACTIVE** as you go down the group because the outer shell electron is further from the nucleus so is donated more readily due to the lower force of attraction so easier to lose an electron
Group 7 - Halogens	- form 1- ion (eg Cl^-) - boiling point increases going down the group - they get **LESS REACTIVE** going down the group as the force of attraction decreases so harder to gain an electron
Group 0 - Noble Gases	- very unreactive as they already have an empty outer shell

The final bullet point for Group 1 and 7 is a very common 3-5 mark question so learn it in detail! 3 marks is common for either group and 5 marks is usually for both together.

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Transition Metals	- can donate different numbers of electrons - Iron (II) => Fe^{2+} while Iron (III) => Fe^{3+}

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