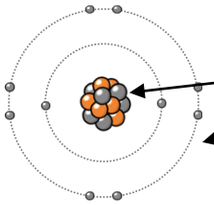
Edexcel Topic 1: Key concepts in chemistry

Atomic structure

Atom	***The smallest part of an element that can exist***	Have a radius of around 0.1 nanometres and have no charge (0). The nucleus is very small compared to the overall size of the atom.
Element	***Contains only one type of atom***	Around 100 different elements each one is represented by a symbol e.g. O, Na, Br.
Compound	***Two or more elements chemically combined***	Compounds can only be separated into elements by chemical reactions.



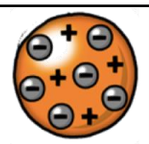
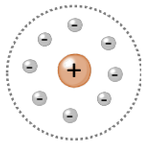
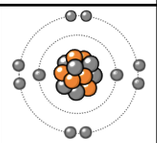
Central nucleus	**Contains protons and neutrons**
Electron shells	**Contains electrons**

Name of Particle	Relative Charge	Relative Mass
Proton	+1	1
Neutron	0	1
Electron	-1	Very small

Atoms contain equal numbers of protons and electrons in order to have an overall neutral charge.

Electronic shell	Max number of electrons
1	**2**
2	**8**
3	**8**
4	**2**

The model of the atom

Pre 1900		***Tiny solid spheres that could not be divided***	Before the discovery of the electron, John Dalton said the solid sphere made up the different elements.
1897 'plum pudding'		***A ball of positive charge with negative electrons embedded in it***	JJ Thompson 's experiments showed that showed that an atom must contain small negative charges (discovery of electrons).
1909 nuclear model		***Positively charge nucleus at the centre surrounded negative electrons***	Ernest Rutherford's alpha particle scattering experiment showed that the mass was concentrated at the centre of the atom.
1913 Bohr model		***Electrons orbit the nucleus at specific distances***	Niels Bohr proposed that electrons orbited in fixed shells; this was supported by experimental observations.

James Chadwick	***Provided the evidence to show the existence of neutrons within the nucleus***

Subatomic particles; masses, charges and numbers

7
Li
3

Mass number	***The sum of the protons and neutrons in the nucleus***	
Atomic number	***The number of protons in the atom***	Number of electrons = number of protons
Elements	***All atoms of a certain element had the same number of protons***	This number of protons is unique to that element.

Isotopes	***Atoms of the same element with the same number of protons and different numbers of neutrons***	**^{35}Cl (75%) and ^{37}Cl (25%)** Relative abundance = (% isotope 1 x mass isotope 1) + (% isotope 2 x mass isotope 2) ÷ 100 **e.g. (25 x 37) + (75x 35) ÷ 100 = 35.5**

The periodic table

Metals	***To the left of the Periodic table***	Form positive ions. Conductors, high melting and boiling points, ductile, malleable.
Non metals	***To the right of the Periodic table***	Form negative ions. Insulators, low melting and boiling points.

1	2											3	4	5	6	7	0
H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	?	?	?						

Elements arranged in order of atomic number

Elements arranged in order of atomic number	***Elements with similar properties are in columns called groups***	Elements in the same group have the same number of outer shell electrons and elements in the same period (row) have the same number of electron shells.

Before discovery of protons, neutrons and electrons	***Elements arranged in order of atomic weight***	Early periodic tables were incomplete, some elements were placed in inappropriate groups if the strict order atomic weights was followed.

Mendeleev	***Left gaps for elements that hadn't been discovered yet***	Elements with properties predicted by Mendeleev were discovered and filled in the gaps. Knowledge of isotopes explained why order based on atomic weights was not always correct.