The structure of atoms

Atomic number and mass number

- atomic number (number of protons / electrons)
- mass number (number of protons plus neutrons)

eg Na has an atomic number of 11 & a mass number of 23. This means that Na has 11 protons, 11 electrons and 12 neutrons (23-11).

Ions – formed when atoms lose or gain electrons to achieve a full valence shell (outermost energy level)

Eg Mg atom (atomic no. 12) has the electron arrangement 2.8.2 It loses 2 electrons to become 2.8 & now has a 2+ charge, Mg^{2+}

Eg Cl atom (atomic no. 17) has the electron arrangement 2.8.7 It gains 1 electron to become 2.8,8 & now has a 1- charge, Cl^-

Ions have FULL valence shells.

Distribution of electrons around a nucleus

- Ist shell can hold up to 2 electrons
- 2^{nd} shell can hold up to 8 electrons
- 3^{rd} shell can hold up to 8 electrons

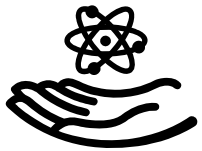
Eg Si atom, atomic number of Si is 14; 2,8,4

Eg S^{2-} ion, atomic number of S is 16; 2,8,8 (add 2 electrons as it is S^{2-} ion)

CHEMISTRY 6329 v4

Relate similarities & differences within the periodic table to atomic structure

Level 1, 3 credits



Describe the structure of atoms, relate the chemical properties of elements to their electron arrangement, and derive the formulae of ionic compounds.

Similarities in chemical properties of a group

- is related to their electron arrangement;

Eg group 1 (alkali metals) Li, Na, K, all react in a similar way because they all form 1+ ions; the atoms all have 1 electron in their outer shell and lose this to form 1+ ions; they now have a full valence shell which is a stable arrangement.

Eg group 17 (halogens) F, Cl, Br, I, all react in a similar way because they all form 1- ions; the atoms all have 7 electrons in their outer shell and gain one to achieve a full valence shell, a stable arrangement.

Eg group 18 (inert / noble gases) are all chemically unreactive (do not form compounds) and do not form ions. They already have full valence shells (2 for He, 8 for Ne & Ar) which is a stable arrangement (and so they don't lose/ gain any electrons).

The first 20 elements

Symbols

H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar
K	Ca						

Atomic numbers

1							2
3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18
19	20						

Electron arrangements (and groups)

1	2	13	14	15	16	17	18
1							2
2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8
2.8.1	2.8.2	2.8.3	2.8.4	2.8.5	2.8.6	2.8.7	2.8.8
2.8.8.1	2.8.8.2						

Formulae of ionic compounds (the ions are given)

Number of **+** and **–** charges overall must be equal in the formula of the compound.

If polyatomic ions (ammonium, hydroxide, nitrate etc) are used more than once place them in brackets.

Eg sodium chloride Na_2O (as Na^+ & O^{2-} ions)

Eg iron(III) chloride $FeCl_3$ (as Fe^{3+} & Cl^- ions)

Eg iron(II) hydroxide $Fe(OH)_2$ (as Fe^{2+} & OH^- ions)

Eg aluminium sulfate $Al_2(SO_4)_3$ (as Al^{3+} & SO_4^{2-} ions)

+1	+2	+3	-1	-2
NH_4^+ ammonium	Ca^{2+}	Al^{3+}	**OH^-** hydroxide	O^{2-}
	Mg^{2+}	Fe^{3+}		S^{2-}
Na^+	Cu^{2+}		Cl^-	
K^+	Pb^{2+}		**NO_3^-** nitrate	**CO_3^{2-}** carbonate
Ag^+	Fe^{2+}			
	Zn^{2+}		**HCO_3^-** hydrogen carbonate	**SO_4^{2-}** sulfate