Reacting Masses, and Chemical Equations - Chapter 5

UNIT 5.1 - The names of compounds

1. Compound containing a metal and non-metal
   First : metal's name
   Second: Non-metal's name ending with -ide.
   Eg - Sodium Chloride

2. Compound containing 2 non-metals
   First: Hydrogen if it's present, otherwise non-metal with lower group number
   Second: non-metal with higher group number ending with -ide.
   Eg - Carbon dioxide (carbon - group 14; oxygen - group 16)

Formulae of ionic and molecular compounds

1. The formulae of giant structures gives the ratio of the ions or atoms.
   (Giant structures have several atoms bonded together, and aren't made up of molecules.)
   Eg - Sodium Chloride NaCl - this tells us that for every sodium ion there is one chloride ion
2. The formula of a molecular compound gives the exact number of atoms bonded in each molecule.
   Eg - Water H_2O- This tells us that in one molecule of water there are 2 hydrogen atoms and 1 oxygen atom.

Valency

The valency of an element is the number of electrons its atoms lose, gain or share, to form a compound.

Metals lose electrons, while non-metals gain or share electrons.

Q. What is the formula of aluminium oxide ?
Aluminium's valency: + 3
Oxygen's valency: -2
Exchange valencies to balance charges : Al_2O_3
(Now Al has a charge of +3 x 2 = + 6; and O has a charge of -2 x 3 = -6
Adding both the charges we get +6 +(-6) = 0)

UNIT 5.2

Equations :

$C + O_2 \rightarrow CO_2$ This is a symbol equation

Recatants : C and O_2 , product : CO_2

The equation must be balanced, which means that the number of each type of atom must be the same on both sides of the arrow.

State symbols

(*s*) solid

(*l*) liquid

(*g*) gas

(*aq*) aqueous solution (solution in water)

$C(s) + O_2(g) \rightarrow CO_2(g)$

UNIT 5.3

Relative atomic mass - A_r

Many elements have isotopes, which have different masses. The A_r is the average of these masses.

The relative atomic mass, A_r, of an element is the average mass of its naturally occurring isotope, relative to the mass of a carbon-12 atom.

Finding the A_r of chlorine:
75% of chlorine isotopes have a mass of 35, and 25% have a mass of 37.

(75% of 35) + (25% of 25) = 35.5
$A_r = 35.5$

Relative formula mass - M_r

- An ion has the same mass as its atom, as an ion is formed by adding or removing electrons which have negligible mass.

A substance made of ions has a relative formula mass M_r

Eg - NaCl

A_r of Na = 23, A_r of Cl = 35.5

M_r = (23 x 1) + (35.5 x 1) = 58.5

Relative molecular mass - M_r

A substance made of molecules has a relative molecular mass.

Eg - H_2O

H A_r = 1, O A_r = 16

M_r = (1 x 2)+(16 x 1) = 18

UNIT 5.4

Two laws of chemistry

1. Elements always react in the same ratio, to form a given compound.
   If 6g carbon combines with 16g of oxygen (6:16 = 3:8), 12 g of carbon will combine with 32g oxygen (12:32 = 3 : 8)
2. The total mass does not change during a chemical reaction. Mass of reactants = mass of products.
   So 6g carbon reacting with 16g oxygen will form 6+16=22g carbon dioxide.

Percentage composition of a compound

How much of each element a compound contains as a percentage of its total mass.

Q. Calculate the percentage of oxygen in sulfur dioxide

Oxygen A_r : 16

Sulfur A_r : 32

SO_2 M_r : 32+(16x2) = 64

There are 2 oxygen atoms in SO_2, so oxygen mass= 16x2=32

(Mass of oxygen/ total mass)x 100 = 32/64 x 100 = 50%

% Purity

% purity = (mass of pure substance / total mass of compound)x 100%