Moles and Equations

Q-1) What is the relative atomic mass?

> The relative atomic mass is the weighted average mass of an atom relative to the mass of an atom of carbon-12 which has a mass of exactly 12 units.

$$A_r = \frac{\%\ \text{abundance}}{100} \times \text{isotope no. (isotope mass)}$$

eg: Cl has 2 isotopes Cl-35 is 75% and Cl-37 is 25% abundant.

$\therefore A_r = \left(\frac{75}{100} \times 35\right) + \left(\frac{25}{100} \times 37\right) = 35.5$

Q-2) What is relative isotopic mass?

> Relative isotopic mass is the mass of an isotope of an element relative to the mass of an atom of carbon-12.

eg: Ne = 20, Ne = 22.

Q-3) What is the relative formula/molecular mass?

> It's the weighted average mass of the formula/molecule of a compound relative to mass of an atom of C-12

eg: $CaCO_3 = Ca + C + 3(O) = 40 + 12 + 3(16) = 100$

eg: $C_6H_{12}O_6 = 6(12) + 12(1) + 6(16) = 180$

Formula mass is used for compounds containing ions

Q-4) What is mass spectrometry?

> mass spectrometer is used to find the accurate relative atomic mass (A_r) and the % abundance of isotopes.

1. Vapourisation
2. Ionisation
3. Acceleration
4. Deflection
5. Detection

Q-5) What is a mole?

> A mole is the mass that has same no. of particles (atoms, molecules or ions) as there are atoms in 12g of C-12.

1 mole = 6.02×10^{23} particles
↳ Avogadro's constant

no. of moles (mol) = $\frac{\text{mass of substance (g)}}{\text{relative molecular mass } (M_r / A_r)}$

$n = \frac{m}{M_r}$

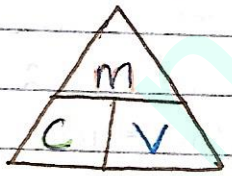
g → moles ÷ M_r
moles → g × M_r

Q-6) What is the empirical formula?

⊛ > Empirical formula is the simplest ratio of atoms of each kind present in one molecule of a compound.

eg: $CH_3COOH = \underbrace{C_2H_4O_2}_{\text{seperate all atoms}} = CH_2O$

Q-7) Calculations



mass (g) (mol) = concentration (g/dm³) (mol/dm³) × volume (dm³)

Reacting masses / mole ratio / stoichiometry - solids

① Find out no. of moles.
② Find mole ratio.
③ Use mole ratio in equation.

Stoichiometry of gas volumes

At room temperature (rtp) one mole of any gas has a volume of 24 dm³

$n_{(mol)} = \frac{V\ dm^3}{24\ dm^3}$

The volumes of gas can also be cancelled

eg: $C_xH_y + 5O_2 \rightarrow 3CO_2 + 4H_2O$

50cm³ 250cm³ 150cm³

1 : 5 : 5

Molecular formulae from empirical formulae

① Find empirical formula mass
② molecular mass ÷ empirical mass = factor of multiplication
③ multiply the no. of atoms in empirical formula by the factor.

Q-8) Ionic formula.

Ion		charge
ammonium	=	NH_4^+
carbonate	=	CO_3^{2-}
hydrogencarbonate	=	HCO_3^-
hydroxide	=	OH^-
nitrate	=	NO_3^-
phosphate	=	PO_4^{3-}
sulfate	=	SO_4^{2-}

The ions that play no part in the reaction are called spectator ions.

eg: Full chemical equation $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$

with charges $Zn(s) + Cu^{2+} + SO_4^{2-}(aq) \rightarrow Zn^{2+} SO_4^{2-}(aq) + Cu(s)$

Cancel spectator ions

ionic equation $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$.

Q6) ⊛ To calculate empirical formula: $\frac{\%}{\text{mr.} \rightarrow \text{(of the element)}}$