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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.

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

eg: Cl has 2 isotopes $Cl·35$ is 75% and $Cl37$ is 25% abundant.

$$\therefore Ar = \left(\frac{75}{100} \times 35\right) + \left(\frac{25}{100} \times 37\right) = \frac{35·5}{1}$$

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: $CaCO3 = Ca + C + 3(O) = 40 + 12 + 3(16) = 100$

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 (Ar)* and the *% abundance* of isotopes.
>   ① Vapourisation
>   ② Ionisation
>   ③ Acceleration
>   ④ Deflection

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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.

$$1 \text{ mole} = 6.02 \times 10^{23} \text{ particles}$$

↳ Avogadro's constant

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

$$n = \frac{M}{Mr}$$

g → moles ÷ Mr

moles → g × Mr

Q-6) What is the empirical formula?

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

eg: CH_3COOH = $\underline{C_2 \ H_4 \ O_2}$ = CH_2O

seperate all atoms
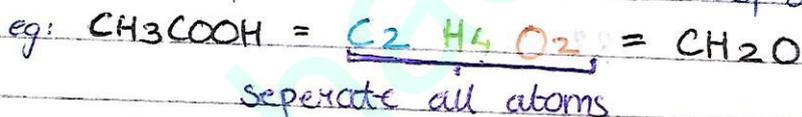
Q-7) ⟨⟨⟨ Calculations
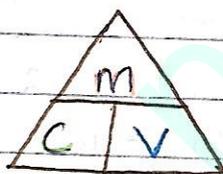
$$\text{mass (g)} = \text{concentration} \times \text{volume}$$
(mol)   (g/dm³)   (dm³)
         (mol/dm³)

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   The volumes of gas can also be cancelled

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

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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 $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$.
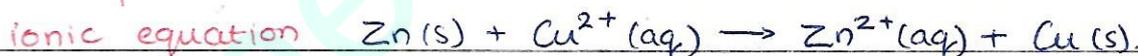
Q6) ✱ To calculate empirical formula : $\dfrac{\%}{Mr} \longrightarrow$ (of the element)

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