3.4 Concentrations in mol/dm3

Name: _____ Class: _____ Date: _____ **Total: 16 marks**

KEY WORDS titration • concentration

Objective

Use mol/dm^3 concentrations and titration calculations. Chemistry only, HT. Original questions for spec statement 4.3.4.

1 Key knowledge and worked examples

Concentration (mol/dm^3): moles of solute per dm^3 of solution.

$$\text{moles} = C \times V(\text{dm}^3) \qquad C = \frac{\text{moles}}{V} \qquad V = \frac{\text{moles}}{C}$$

Remember 1000 cm^3 = 1 dm^3. Link with mass: moles = mass ÷ Mr.

Titration logic: at neutralisation the moles of acid and alkali are in the **equation ratio**. Compute the known side's moles, scale by the ratio, divide by the other volume.

Worked example (4 marks). 25.0 cm^3 of NaOH is neutralised by 20.0 cm^3 of 0.150 mol/dm^3 HCl. Find the NaOH concentration.

Moles HCl = 0.150 × 0.0200 = 3.00 × 10^{-3}; HCl : NaOH is 1 : 1, so moles NaOH = 3.00 × 10^{-3}; volume NaOH = 0.0250 dm^3; C = 3.00 × 10^{-3} ÷ 0.0250 = 0.120 mol/dm^3.

2 Practice

2.1 How many moles are in 500 cm^3 of 0.200 mol/dm^3 solution? [2]

2.2 Convert 0.005 mol in 25.0 cm^3 into a concentration. [2]

2.3 In H_2SO_4 + 2 NaOH, one mole of acid neutralises how many moles of alkali? [1]

3 Exam-style questions

3.1 *(HT)* 23.50 cm^3 of 0.100 mol/dm^3 barium hydroxide neutralises 25.00 cm^3 of hydrochloric acid: $Ba(OH)_2 + 2\,HCl \rightarrow BaCl_2 + 2\,H_2O$. Calculate the acid concentration. [4]

3.2 *(HT)* A student makes 250 cm^3 of sodium carbonate solution containing 13.25 g of Na_2CO_3 (Mr = 106). Calculate the concentration in mol/dm^3. [3]

3.3 *(HT)* The final trial overshot the end point and its recorded result must be excluded. The trials read 21.10, 21.20, 21.15 and 24.60 cm^3. Give the mean titre, and the moles of 0.100 mol/dm^3 acid it represents. [4]