Solutions and Gases Map

AQA A-level Chemistry · 3.1.2 Amount of substance: solutions and gases

1 Concentration

3.1.2.2 v

- **c = n ÷ V**, V in dm³ (cm³ ÷ 1000)
- **n = c × V**
- g dm⁻³ = mol dm⁻³ × M
- Ions: $CaCl_2$ gives 2 × c of Cl^-
- Dilution: moles stay the same



2 Standard solutions

3.1.2.2 v

- Weigh by difference
- Dissolve, transfer **with rinsings**
- Make up to the mark in a **volumetric flask**
- Stopper and invert to mix
- Past the mark? Start again

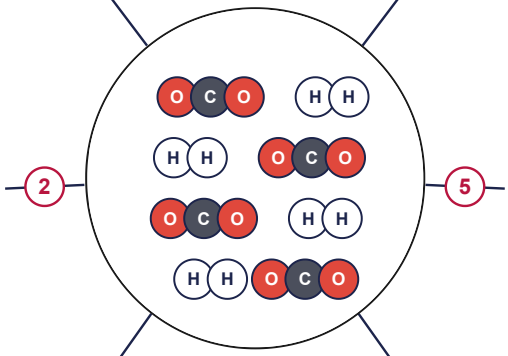


3 Titration calculations

3.1.2.5 ix

- Mean of the **concordant** titres (±0.10 cm³)
- Moles of what you know: c × V
- **Ratio** from the equation (H_2SO_4 1 : 2)
- Then c = n ÷ V of the unknown
- Portion of a flask: × the **dilution factor**





4 The ideal gas equation

3.1.2.3

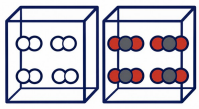
- **pV = nRT**, R = 8.31 J K⁻¹ mol⁻¹
- p in Pa, V in m³, T in K
- Rearrange, then substitute
- Convert the answer back
- M_r = m ÷ n from gas data



5 Equal volumes

3.1.2.5 vi

- Same T and p: **V ∝ n**
- Gas coefficients = **volume ratio**
- $N_2 + 3H_2 \rightarrow 2NH_3$: 1 : 3 : 2
- Leave out liquids and solids
- Add any gas left over



6 Gases from reactions

3.1.2.5 vi, ix

- Moles from a mass or from **c × V**
- Find the **limiting** reactant
- Ratio, then **V = nRT ÷ p**
- × 10⁶ for cm³, × 10³ for dm³
- Or n = pV ÷ RT to find a mass



Units and conversions

convert every quantity before substituting; give answers to the data's significant figures

Quantity	Given in	Calculate in	Convert
Solution volume	cm³	dm³	cm³ ÷ 1000
Gas volume	cm³ or dm³	m³	cm³ × 10⁻⁶; dm³ × 10⁻³
Pressure	kPa	Pa	kPa × 1000
Temperature	°C	K	°C + 273
Concentration	g dm⁻³	mol dm⁻³	÷ M (× M to go back)
Titre	cm³ (2 d.p.)	dm³	÷ 1000; mean of concordant titres

Worked examples

A titration

- 12.40 cm³ of 0.0500 mol dm⁻³ H_2SO_4
- 6.20 × 10⁻⁴ mol × 2 = 1.24 × 10⁻³
- **c(NaOH) = 0.0496 mol dm⁻³**

Gas from a mass

- 2.50 g $CaCO_3$: 0.0250 mol CO_2
- (0.0250 × 8.31 × 298) ÷ 100 000
- **618 cm³**

Gas from a solution

- 50.0 cm³ of 1.00 mol dm⁻³ HCl
- Zn + 2HCl: 0.0250 mol H_2
- **619 cm³** at 100 kPa, 298 K

Concentrations and gas volumes return in energetics, equilibria (Kp) and acids and bases.

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