

2.3.2 Ion evidence and titration concentration

Name: _____ Class: _____ Date: _____ **Total: 19 marks**

KEY WORDS standard solution

Objective

Use separate ion tests and a balanced mole ratio to determine an unknown concentration. All questions and marking guidance are original.

1 Key knowledge and worked examples

Use separate aliquots. Acidify a sulfate test with dilute HCl before BaCl₂; use dilute HNO₃ before AgNO₃ for halides. HCl would introduce chloride and spoil the latter test. Warm ammonium salts with aqueous NaOH; ammonia turns damp red litmus blue.

■ Worked method

25.00 cm³ of 0.0500 mol dm⁻³ Na₂CO₃ uses 24.60 cm³ HCl. Na₂CO₃ + 2HCl → 2NaCl + CO₂ + H₂O.

$$n(\text{Na}_2\text{CO}_3) = cV = 0.0500 \times 0.02500 = 0.001250 \text{ mol}$$

$$n(\text{HCl}) = 2n(\text{Na}_2\text{CO}_3) = 0.002500 \text{ mol}$$

$$c(\text{HCl}) = n/V = 0.002500/0.02460 = 0.1016 \text{ mol dm}^{-3}$$

Concordant titres agree within the method's specified tolerance. Do not include the rough titre in their mean. A titre uses two readings, so add their absolute uncertainties.

2 Practice

2.1 Write the ionic equation for sulfate detection and explain acidification before adding BaCl₂. [3]

2.2 AgNO₃ gives a cream precipitate after acidification with HNO₃. State the likely halide and its behaviour with dilute and concentrated ammonia. [3]

2.3 A burette reads 0.25 cm³ initially and 23.90 cm³ finally. Calculate the titre and its maximum percentage uncertainty if each reading is ±0.05 cm³. [3]

3 Exam-style questions

3.1 25.00 cm³ of H₂SO₄ is neutralised by 20.40 cm³ of 0.1000 mol dm⁻³ NaOH. Calculate acid concentration in mol dm⁻³ and g dm⁻³. M(H₂SO₄) = 98.0 g mol⁻¹. [5]

3.2 Describe four actions needed to make an accurately known standard solution from a weighed solid acid. Explain why extra deionised water in a titration flask does not change the acid amount delivered by a pipette. [5]
