

Question Number	Acceptable Answers	Reject	Mark
1(a)(i)	<p>Moles N = $\frac{14.42}{14} = 1.03$</p> <p>Moles H = 3.09</p> <p>Moles S = $\frac{33.06}{32.1} = 1.03$ (1)</p> <p>ALLOW Moles S = $\frac{33.06}{32} = 1.03$</p> <p>Moles O = $\frac{49.43}{16} = 3.09$ (1)</p> <p>(Ratio 1:3:1:3)</p> <p>IGNORE sf/rounding for moles</p> <p>NH₃SO₃ any order (1)</p> <p>Correct answer, no working (3)</p> <p>If O omitted, giving NH₃S (2)</p>		3

Question Number	Acceptable Answers	Reject	Mark
1(a)(ii)	<p>NH₃SO₃ (any order)</p> <p>since molar mass = empirical formula mass/ since empirical formula mass =97/ with some other justification</p> <p>TE from (i) N₂H₆S₂, as empirical formula mass =49, approx half molecular mass</p>		1

Question Number	Acceptable Answers	Reject	Mark
1(b)(i)	<p>Look for workable method. Don't penalise lack of labels on simple equipment eg test tubes.</p> <p>Workable way of making and collecting gas eg flask or tube + connection/ below inverted funnel with tube of water above Labelling of reactants not needed (1)</p> <p>Suitable (labelled) apparatus for measuring volume eg Gas syringe/ inverted burette or measuring cylinder containing water (1)</p>	Uncalibrated tubes	2

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1(b)(ii)	$(\frac{66}{24000}) = 2.75 \times 10^{-3} / 0.00275 / 0.0028$	0.003	1

Question Number	Acceptable Answers	Reject	Mark
1(b)(iii)	<p>1 mol sulfamic acid \rightarrow 0.5 mol H₂ OR ratio sulfamic acid : hydrogen gas = 2:1 OR $5.5 (\times 10^{-3})$(moles) = $(2 \times 2.75 (\times 10^{-3})$ (moles) OR TE using ratio calculated from (ii) (1)</p> <p>Each H₂ comes from 2 H⁺ (So 1 sulfamic acid \rightarrow 1 H⁺) (1)</p>	ratio sulfamic acid : hydrogen ions = 2:1	2

Question Number	Acceptable Answers	Reject	Mark
1c)(i)	$2\text{H}^+ + \text{CO}_3^{2-} \rightarrow \text{H}_2\text{O} + \text{CO}_2$ ALLOW $\text{H}^+ + \text{CO}_3^{2-} \rightarrow \text{HCO}_3^-$ $2\text{H}^+ + \text{CO}_3^{2-} \rightarrow \text{H}_2\text{CO}_3$		1

Question Number	Acceptable Answers	Reject	Mark
1(c)(ii)	<p>Less easy to spill solid (in storage) OR doesn't spread if spilt OR easy to sweep up if spilt OR less corrosive/ less strongly acidic than HCl</p> <p>ALLOW Weaker (acid) / HCl is a stronger acid</p>	<p>Just "it is a solid"</p> <p>Less reactive (unless with comment on acid strength) HCl produces poisonous gas / Cl₂ Less concentrated Has higher pH Just "HCl is harmful/irritant/corrosive" Just "sulfamic acid is not harmful/irritant/corrosive"</p>	1

Question Number	Acceptable Answers	Reject	Mark
2(a)	Starch (solution)		1

Question Number	Acceptable Answers	Reject	Mark
2(b)(i)	I_2 at start = $1 \times 10^{-3} / 0.001$ (mol)		1

Question Number	Acceptable Answers	Reject	Mark
2(b)(ii)	1.26×10^{-3} (mol) thiosulfate (1) $6.3(0) \times 10^{-4} / 0.00063$ (mol) I_2 (1) Correct answer with no working (2) Ignore SF except 1 SF		2

Question Number	Acceptable Answers	Reject	Mark
2(b)(iii)	I_2 used = $(1 \times 10^{-3} - 6.30 \times 10^{-4}) = 3.70 \times 10^{-4}$ (mol) (1) Mol SO_2 = mol $I_2 = 3.70 \times 10^{-4} / 0.00037$ (mol) (1) Correct answer with no working (1) ALLOW TE from (i) and (ii) Ignore SF except 1 SF		2

Question Number	Acceptable Answers	Reject	Mark
2(b)(iv)	Mass SO_2 in $100 \text{ m}^3 = (64.1 \times 3.70 \times 10^{-4})$ (1) Mass SO_2 in $1 \text{ m}^3 = 64.1 \times 3.70 \times 10^{-4} / 100$ $= 237(.2) \times 10^{-6} \text{ g} = 2.37 \times 10^{-4} \text{ g}$ (1) (= $237.2 / 237 / 240 \text{ } \mu\text{g}$) units required (\therefore within limit) Allow TE from (iii) Ignore SF except 1 SF		2

Question Number	Acceptable Answers	Reject	Mark
2(c)(i)	Improved because titration may be repeated /averages could be taken ALLOW Smaller titration reading so greater (%) error		1

Question Number	Acceptable Answers	Reject	Mark
2(c)(ii)	Larger titration reading (1) So smaller (%)error in titration reading (1) OR Smaller mass of sodium thiosulfate used to make solution (1) So greater %) error in the mass measurement (1) Second mark dependent on correct first or near miss		2
Question Number	Acceptable Answers	Reject	Mark
2(c)(iii)	Smaller titration reading as more I ₂ reacts/ less I ₂ left (1) So greater (%) error in titration reading (1) Second mark dependent on correct first or near miss) OR Smaller (%) error in measuring volume of air (1)		2