

Markscheme

May 2025

Chemistry

Higher level

Paper 1b

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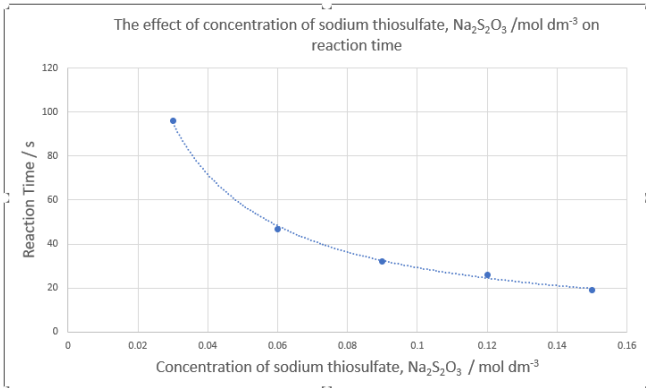
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Subject Details: Chemistry Higher Level Paper 1B Markscheme

Candidates are required to answer **ALL** questions. Maximum total = **[35 marks]**.

1. Each row in the “Question” column relates to the smallest subpart of the question.
 2. The maximum mark for each question subpart is indicated in the “Total” column.
 3. Each marking point in the “Answers” column is shown by means of a tick (✓) at the end of the marking point.
 4. A question subpart may have more marking points than the total allows. This will be indicated by “**max**” written after the mark in the “Total” column. The related rubric, if necessary, will be outlined in the “Notes” column.
 5. An alternative word is indicated in the “Answers” column by a slash (/). Either word can be accepted.
 6. An alternative answer is indicated in the “Answers” column by “**OR**”. Either answer can be accepted.
 7. An alternative markscheme is indicated in the “Answers” column under heading **ALTERNATIVE 1** etc. Either alternative can be accepted.
 8. Words inside chevrons « » in the “Answers” column are not necessary to gain the mark.
 9. Words that are underlined are essential for the mark.
 10. The order of marking points does not have to be as in the “Answers” column, unless stated otherwise in the “Notes” column.
 11. If the candidate’s answer has the same “meaning” or can be clearly interpreted as being of equivalent significance, detail and validity as that in the “Answers” column then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by **OWTTE** (or words to that effect) in the “Notes” column.
 12. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
 13. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script.
 14. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the “Notes” column.
 15. If a question specifically asks for the name of a substance, do not award a mark for a correct formula unless directed otherwise in the “Notes” column. Similarly, if the formula is specifically asked for, do not award a mark for a correct name unless directed otherwise in the “Notes” column.
 16. If a question asks for an equation for a reaction, a balanced symbol equation is usually expected, do not award a mark for a word equation or an unbalanced equation unless directed otherwise in the “Notes” column.
- Ignore missing or incorrect state symbols in an equation unless directed otherwise in the “Notes” column.

Question			Answers	Notes	Total
1.	(a)		158.12 «g mol⁻¹» ✓ «0.5000 dm³ * 0.1500 mol dm⁻³ * 158.12 g mol⁻¹ =» 11.86 «g Na₂S₂O₃» ✓	Award [2] for correct final answer.	2
1.	(b)		«fully» dissolve Na₂S₂O₃ in distilled/deionized water ✓ fill up to line/mark ✓ «stopper the flask and» turn flask over «several times»/shake/homogenize «the solution» ✓	Marking points can be in any order. Accept “pure water” for “deionized water”. Do not award any marks for preparation of solution by dilution. Penalize missing deionized/distilled once only in both 1b and 1c.	3
1.	(c)		«100.0 cm³ * 0.03000 mol dm⁻³/0.1500mol dm⁻³ =» 20.00 «cm³» ✓ Any two of: use volumetric/graduated pipette «to remove 20.00 cm³» OR burette «to transfer 20.00 cm³» ✓ use 100 cm³ volumetric flask ✓ fill to mark/line with deionized/distilled water ✓ «stopper the flask and» turn flask over «several times» shake/homogenize «the solution» ✓	Accept “0.02000 dm³” for M1. Do not accept graduated cylinder for M2. Penalize missing deionized/distilled once only in both 1b and 1c.	3 max

Question			Answers	Notes	Total
1.	(d)	(i)	at lower concentration/mass/moles «of thiosulfate» is smaller AND relative value of uncertainty is larger ✓	Accept explanation using equations.	1
1.	(d)	(ii)	«1/19.1 =» 0.0524 ✓ s ⁻¹ ✓	Accept «1/24.2 = » 0.0413 for M1 if student uses value from table in (f).	2
1.	(e)		 The effect of concentration of sodium thiosulfate, Na₂S₂O₃ / mol dm⁻³ on reaction time best-fit smooth curve ✓	Do not accept a series of connected lines that pass through ALL points OR any straight line representation.	1

Question			Answers	Notes	Total
1.	(f)		<i>Any two of:</i> may not have started/stopped at the same time ✓ not «looking at» same angle/distance/parallax ✓ different judgment of when X cannot be seen ✓ different/brighter lighting conditions «for second experiment» ✓ different/lower temperature «for second experiment» ✓	<i>Apply List Principle</i> <i>Accept “different student reaction time” for M1.</i> <i>Do not accept reference to equipment or solutions as same solutions and equipment in stem.</i> <i>Do not accept residue left on flask.</i> <i>Do not accept “human error” alone.</i> <i>Do not accept “only one trial”.</i>	2 max

Question		Answers	Notes	Total
1.	(g)	Alternative 1 <i>Safety:</i> SO₂ (g) AND corrosive/irritant/toxic/acidic «to respiratory tract» ✓ OR SO₂ (g) AND severe skin burn OR SO₂ (g) AND eye damage <i>Precaution:</i> use fume hood/well-ventilated lab/outdoors «to avoid inhaling fumes» OR safety goggles/glasses/gloves OR use respirator ✓ Alternative 2 <i>Safety concern:</i> S(s) AND flammable OR S(s) AND harmful if swallowed/throat irritant OR S(s) AND skin/respiratory tract/eye irritant ✓ <i>Precaution:</i> keep away from heat/flame OR keep tightly sealed/explosive free container OR safety goggles/glasses OR wear protective clothing/gloves/skin covering ✓	<i>Apply List Principle to M1 not M2.</i> <i>Do not accept environmental hazards for SO₂.</i> <i>Do not penalize list principle for SO₂ if second safety concern is related to environmental hazards.</i> <i>Do not accept “use mask” for Alternative 1 SO₂ (g) Precaution.</i> <i>Accept “S(s) AND allergen” for M1 for Alternative 2.</i> <i>Do not accept HCl(aq) for M1 as question asks for product not reactant but award M2 as ECF if Precaution correct for HCl(aq) “safety goggles/glasses</i> OR <i>wear protective clothing/gloves/skin covering”</i>	2

Question			Answers	Notes	Total
2.	(a)		<i>Any four of:</i> use magnet to remove iron/Fe ✓ add «excess» water to dissolve salt/NaCl ✓ filter/wash sand «into saltwater filtrate»✓ allow/heat sand to dry ✓ boil off/evaporate water from salt OR allow salt to dry overnight ✓	<i>Accept other reasonable orders to separations and names or formulas.</i> <i>Accept references to NaCl(aq) for M2.</i> <i>Do not accept responses that include sifting, separating with a sieve, OR by particle size.</i> <i>Accept “distill off water from salt” for M5.</i>	4 max
2.	(b)		<i>Iron:</i> $\left\langle \frac{2.17}{5.62} \times 100 = \right\rangle 38.6\%$ AND <i>Sand:</i> $\left\langle \frac{1.98}{5.62} \times 100 = \right\rangle 35.2\% \checkmark$		1

Question			Answers	Notes	Total
2.	(c)		Alternative 1 <i>Error:</i> sand/salt/sample wet/contains water when weighed ✓ <i>Reduce or Eliminate:</i> heat/dry to a constant mass ✓ Alternative 2 <i>Error:</i> iron oxidized OR iron changed to Fe₂O₃/FeO/rust ✓ <i>Reduce or Eliminate:</i> reduce time iron is exposed to air/water OR mix with water after removing the iron ✓	<i>Accept formulas or names.</i> <i>Do not accept systematic, random, or human error.</i> <i>Do not accept heat without idea of constant mass for Alternative 1 M2.</i>	2
2.	(d)		iron has high density «as compared to salt and sand» OR «salt, sand, and iron» do not have the same density ✓	<i>Accept “smaller volume/quantity can have larger percent mass comparatively”.</i> <i>Do not accept answers related to molar mass alone.</i> <i>Do not accept answers repeating data from table.</i> <i>Accept answers related to “Fe₂O₃/rust increasing percent by mass” if student used Alternative 2 for 2c.</i>	1

Question			Answers	Notes	Total
2.	(e)		<i>Separation method:</i> «fractional» distillation ✓ <i>Physical property:</i> boiling point ✓		2
3.	(a)		Absorbance of copper (II) sulfate reasonable line of best fit ✓ extrapolated past data given «extended beyond 0.08 AND 0.4 mol dm⁻³» ✓	<i>Line can touch all data points.</i> <i>Accept range of extrapolation through origin to 0.02 mol dm⁻³ AND past data given for M2. Line can extend beyond graph range.</i>	2
3.	(b)		«directly/positively» proportional OR positive linear ✓	<i>Accept answers based on $y=mx+b$.</i> <i>Accept “«directly/positively» proportional OR positive linear” if extrapolation started from 0.02 mol dm⁻³.</i> <i>Do not accept “positive correlation” alone.</i>	1

Question			Answers	Notes	Total
3.	(c)		wavelength with maximum absorbance required OR absorbance varies with wavelength ✓	Accept “different substances absorb at different wavelength to determine concentration” OR “to quantify a substance more accurately” Do not accept “to improve accuracy/precision of the instrument” alone. Do not accept “CuSO ₄ can only absorb complimentary color/certain wavelength of light” alone.	1
3.	(d)		gradient = 2.0 ✓ absorbance/A = 2.0 concentration/C OR y= 2.0 x ✓	Accept gradient/slope range of 1.9-2.3 for M1. Accept “y=mx+b” with range of –0.03-0 for b. Do not accept equation with +b values for M2.	2
3.	(e)		1.22 ✓	Accept answer in the range of 1.20-1.30. Do not ECF from calculation as error is contradiction to graph.	1

Question			Answers	Notes	Total
3.	(f)		no «significant» difference/they give the same value ✓		1
3.	(g)		635 «nm» ✓	Accept any value OR range of values from 585-647 «nm».	1
