

Version 1.2



**General Certificate of Education (A-level)
June 2012**

Chemistry

CHM6X

(Specification 2420)

**Unit 6X: Investigative and practical skills in A2
Chemistry**

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

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CHM6X Task 1 Assessment

| Marking Guidelines | Mark | Additional Guidance |
|--|-------------|--|
| Results recorded clearly and in full in a sensible <u>table</u> | (R) 1 | <p>If you can read it, it is clear.</p> <p>Penalise missing units.</p> <p>'Full' means the table must have values for all five experiments and must contain a column/row containing the volume of iodide used and the time in that experiment.</p> <p>The table does not have to have gridlines.</p> <p>Ignore any extra columns of information.</p> |
| Times recorded to the appropriate precision | (P) 1 | Lose mark if the time is not recorded in seconds – integer or to 0.1 precision. |
| <p>The accuracy of the results</p> <p>When plotted correctly the candidates' results give a good straight line – 1 mark</p> <p>The gradient of the line when calculated correctly</p> <ul style="list-style-type: none"> • is between ± 0.03 from Teacher Value – 3 marks • is between ± 0.07 from Teacher Value – 2 marks • is between ± 0.10 from Teacher Value – 1 mark | (A) 4 | <p>At least four points must lie on the straight line or very close to it (\pm one small square).</p> <p>For these three marks, allow three or more points on or very close to the straight line in order to calculate the gradient.</p> <p>Use the Teacher Value or a Group average to assess accuracy, whichever gives the candidate a better mark.</p> |
| Total | 6 | |

CHM6X Task 2 Assessment

| Marking Guidelines | Mark | Additional Guidance |
|---|-------------|---|
| Results recorded clearly and in full in a sensible <u>table</u> | (R) 1 | If you can read it, it is clear. 'Full' means the table must have results for all five tests. The table does not have to have gridlines. |
| Observations 12 correct – 7 marks 11 correct – 6 marks 9-10 correct – 5 marks 7-8 correct – 4 marks 4-6 correct – 3 marks 2-3 correct – 2 marks 1 correct – 1 mark | (A) 7 | Accept suspension, sediment, solid and deposit as well as precipitate. Do not accept cloudy, misty or emulsion . If solution is missing in more than one observation only penalise once. Look for the basic colour; ignore additional shades if the answer is unambiguous. Accept colourless solution in place of no visible change in Tests 2 and 5. |
| Total | 8 | |

Expected Observations for Task 2

| | | | |
|---|--|--------------|---|
| Test 1 ($\text{MnO}_2 + \text{H}_2\text{O}_2$) | Gas evolved / effervescence / fizzing Tube gets warm Black solid settles to bottom after a few minutes | 2 Max | Ignore mist / fumes. If black solution or black precipitate is mentioned, max 1 scoring point. |
| Test 2 ($\text{I}^- + \text{S}_2\text{O}_8^{2-}$ then Fe^{3+}) | No visible change / <u>colourless solution</u> / pale <u>yellow solution</u> initially <u>Yellow/brown solution</u> / darkening after E added | 2 | Allow orange. Allow red-brown but not red. |
| Test 3 ($\text{S}_2\text{O}_3^{2-} + \text{H}^+$) | No initial reaction/slow Formation of a <u>white/yellow ppt.</u> | 2 | |
| Test 4 ($\text{S}_2\text{O}_3^{2-} + \text{H}^+$ then Fe^{3+}) | <u>Purple solution</u> after adding Fe^{3+} Fades to colourless Formation of a <u>white/yellow ppt.</u> | 3 | |
| Test 5 (Tartrate + H_2O_2 then Co^{2+}) | No visible change after adding solution A <u>Pink/colourless solution</u> turns to a <u>green solution</u> Gas evolved / effervescence / fizzing <u>Green solution</u> returns to <u>pink/colourless solution</u> | 3 Max | Ignore any reference to gas after adding solution A. Ignore intermediate shades. Ignore intermediate shades. |

CHM6X Written Test - Section A

- Ignore absence of units unless units are required in the Marking Guidelines.
- Incorrect units lose the mark.
- Incorrect rounding of calculations must be penalised, but only once per paper.

| Question | Marking Guidelines | Mark | Additional Guidance |
|----------|--|------|---|
| 1 | Correctly fills in values for log V | 1 | All values must be correct to gain mark. |
| | Correctly fills in values for log 1/t | 1 | Do not penalise precision. |
| 2(a) | Graph correct orientation and axes labelled | 1 | Do not penalise if units appear. Lose this mark if y-axis has ascending negative numbers. |
| | Scale correct | 1 | Graph must occupy at least half the grid. Lose this mark if graph plot goes off squared paper. Lost this mark if a non-linear or broken scale. |
| | Points plotted correctly | 1 | ± 1 small grid square. |
| | Line of best fit | 1 | Must be a straight line. Penalise if kinked or doubled. Must go through or close to at least three points (\pm half a small square). |
| 2(b) | Chooses appropriate x and y values from their graph | 1 | Mark consequentially if axes are plotted the wrong way around. Allow information clearly shown on graph. Difference in x values and y values must be at least 10 small squares. |
| | Correctly calculates y/x | 1 | Lose this mark if answer not to 2 d.p. |

Mark Scheme – General Certificate of Education (A-level) Chemistry – Unit 6X: Investigative and practical skills in A2 Chemistry – June 2012

| | | | |
|--------------|--|-----------|---|
| 2(c) | Candidate's value read from their graph at $\log V = 1.23$ and correctly processed back to a value of t | 1 | Do not penalise precision. |
| 3 | Weigh out MnO_2 at start | 1 | Allow heat/evaporate to dryness. Ignore chemical testing. |
| | <u>Filter and dry</u> at end | 1 | |
| | Weigh again to show mass same | 1 | |
| 4 | Any soluble iron(II) salt | 1 | Allow any soluble copper(II) salt. Must be a complete reagent. |
| 5 | $\text{S}_2\text{O}_3^{2-} + 2\text{H}^+ \rightarrow \text{S} + \text{SO}_2 + \text{H}_2\text{O}$ or sulfur | 1 | Allow S in an incorrectly balanced equation. |
| 6 | (Cobalt) changes colour (when it changes oxidation state) | 1 | A specific colour change must correspond to observations in Task 2 Test 5. Ignore any attempts to explain the oxidation states involved. |
| Total | | 15 | |

CHM6X Written Test - Section B

- Ignore absence of units unless units are required in the Marking Guidelines.
- Incorrect units lose the mark.
- Incorrect rounding of calculations must be penalised, but only once per paper.

| Question | Marking Guidelines | Mark | Additional Guidance |
|----------|---|------|--|
| 7 | Keep the concentration/volume of iodide ions constant | 1 | Ignore any reference to the other reagents unless the concentrations/volumes are changed. Do not allow any references to 'amount' of reagents. |
| | Vary the concentration/volume of hydrogen peroxide | 1 | |
| 8(a) | 3.7% | 1 | Allow 4% |
| 8(b) | Result error is greater than the apparatus error so the student's technique must have been at fault | 1 | Answer implying human/procedural/operator error but not experimental error. Allow temperature variations. Allow references to contamination of reagents. Mark consequentially on Q8(a). |
| 9(a) | Zero, zeroth or 0 | 1 | |
| 9(b) | Horizontal line | 1 | Consequential on Q9(a). For first and second order, graph is a straight line with a positive gradient. If axes unlabelled, assume that $\log 1/t$ is on the y-axis. |
| 10(a) | $\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$ | 1 | Allow molecular formulae. Allow one mark only if formulae are swapped in position. |
| | $\text{CH}_2\text{OHCHOHCH}_2\text{OH}$ | 1 | |

Mark Scheme – General Certificate of Education (A-level) Chemistry – Unit 6X: Investigative and practical skills in A2 Chemistry – June 2012

| | | | |
|--------------|--|------------------------------|--|
| 10(b) | Keeping the foodstuff dry | 1 | Allow an answer which refers to removal of water from the environment. Do not allow dehydration/removal of water from the fat. |
| 10(c) | They (antioxidants) react with free radicals And they are used up in the reaction/do not remain behind after reaction | 1 1 | Lose one mark for any reference to 'catalysts can't slow down a reaction'. |
| 10(d) | Mol of fat = $(2.78/806 =) 3.45 \times 10^{-3}$ Mol of NaOH = 3.68×10^{-3} Mol of fat hydrolysed = $(3.68 \times 10^{-3} / 3 =) 1.23 \times 10^{-3}$ Percentage hydrolysed = 35.5 - 35.7 | 1 1 1 1 | Mol of NaOH = 3.68×10^{-3} = mol of fatty acid Mol of fat hydrolysed = 1.23×10^{-3} Mass of fat hydrolysed = 0.987 g Percentage hydrolysed = 35.5 - 35.7 Do not penalise precision at any point. Since there are a variety of approaches to this calculation, award four marks for a correct answer but it must be clear that there is some relevant working. The answer alone gets M4 only. Any incorrect use of the 3:1 ratio is CE - lose M3 and M4. |
| Total | | 15 | |

CHM3X Written Test - Section C

- Ignore absence of units unless units are required in the Marking Guidelines.
- Incorrect units lose the mark.
- Incorrect rounding of calculations must be penalised, but only once per paper.

| Question | Marking Guidelines | Mark | Additional Guidance |
|--------------|--|----------|--|
| 11(a) | Stop the formation of MnO_2 /Ensures all MnO_4^- reacts to form Mn^{2+} /becomes colourless | 1 | |
| 11(b) | Weak acid / Does not supply sufficient H^+ | 1 | |
| 11(c) | It is self-indicating/Purple to colourless end-point or vice versa | 1 | If colours mentioned they must be correct. |
| 12(a) | Melting range would be wide (>3 deg C)/not sharp | 1 | Allow melts over a range of temperatures. |
| | below/before the true m.p. | 1 | Do not allow 'above or below'. |
| 12(b) | Temperature on <u>thermometer</u> not the same as the sample | 1 | Allow sample heats up at a different/higher/lower rate than <u>thermometer</u> . |
| Total | | 6 | |