



General Certificate of Education

Chemistry 1421

**CHM3X Externally Marked Practical
Assignment**

Mark Scheme

2010 examination - June series

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 meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting 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 the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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TASK 1 - Assessment

| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|----------|------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | Records initial temperature of the acid | (R) 1 | Allow clear answer outside of the box |
| | | | Records other results clearly and in full in a table | (R) 1 | If you can read it, it is clear Allow clear answer outside of a table box 'Full' means completes the temperature row correctly, with no entry for the 4 th minute Do not penalise a missing result at 0 minutes Table does not have to have gridlines |
| | | | Records all temperatures to 1 dp | (P) 1 | This includes the original temperature of the acid on the Task Sheet |
| | | | The accuracy of the candidate's temperature rise, ΔT , measured against a teacher value for the experiment. ΔT is within 3 % of teacher value - 5 marks ΔT is within 5 % of teacher value - 4 marks ΔT is within 8 % of teacher value - 3 marks ΔT is within 10 % of teacher value - 2 marks ΔT is within 12 % of teacher value - 1 mark | (A) 5 | Ensure that the candidate has correctly plotted the graph Ensure that the temperature rise is determined correctly in questions 2-5 If the value entered by the candidate in question 3 of Section A is wrong, underline the wrong value and write the correct value by the side Use the corrected value to assess accuracy. If candidate has not recorded the initial temperature of the acid assume both reagents were at the same initial temperature. |
| | | | Total | 8 | |

TASK 2 - Assessment

| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|--------------|------|----------|----------------------------------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | Results recorded clearly and in full in a table | (R) 1 | If you can read it, it is clear Full means completes all of the boxes |
| | | | | | Check the teacher observations against the answers below Allow either the published answer or the teacher alternative, as long as this is reasonable If answers contradict e.g. "No visible change with white precipitate" then scoring point is not awarded |
| 1 | a | | NaOH solution no visible change | (A) 1 | Accept 'no change', 'no reaction', 'stays the same' or 'colourless solution' |
| 1 | b | | Heat the mixture from 1(a) indicator paper blue | (A) 1 | Accept 'green/blue' or 'purple' Do not accept 'green' or quoted pH on its own Ignore references to smell |
| 2 | | | CaCl ₂ solution white precipitate | (A) 1 | Accept 'suspension', 'sediment', 'solid (deposit)' as well as 'precipitate' Accept 'white crystals' Do not accept 'cloudy', 'misty' or 'emulsion' alone |
| 3 | | | BaCl ₂ and HCl solutions white precipitate | (A) 1 | See 2 Do not accept 'crystals' |
| 4 | | | AgNO ₃ and HNO ₃ solutions no visible change | (A) 1 | See 1a |
| Total | | | | 6 | |

SECTION A Ignore absence of units unless units are required in the Marking Guidelines. Incorrect units lose the mark

| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|----------|------|----------|-------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | | | Temperature on <i>y</i> -axis, time on the <i>x</i> axis | 1 | If axes unlabelled use data to decide that temperature is on <i>y</i> -axis |
| | | | Uses sensible scales | 1 | Lose this mark if graph does not cover half of the paper (minimum 8 small squares on <i>y</i> -axis) |
| | | | Plots all of the points correctly \pm one square | 1 | Lose this mark if the graph plot goes off the squared paper Lose this mark if plots a non-linear/broken scale |
| | | | Draws two best-fit straight lines | 1 | Candidate must draw two correct lines Lose this mark if the candidate's line is doubled |
| | | | Both extrapolations correct to the 4 th minute | 1 | Award this mark if the candidate's extrapolations are both close to your extrapolation |
| 2 | | | Correct value for temperature before mixing from graph | 1 | Ignore precision of answer |
| 3 | | | Correctly calculates average temperature before mixing | 1 | Lose this mark if initial temperature of acid not recorded Do not penalise precision Allow average of acid temperature + answer to Q2 |
| 4 | | | Correct value for temperature after mixing from graph | 1 | Do not penalise precision |
| 5 | | | Correct value for temperature rise from graph | 1 | Lose this mark if answer not given to 1 dp Round up before assessing for accuracy Allow answer to Q4 minus answer to Q3 |
| 6 | | | $q=mc\Delta T$ equation | 1 | Must quote equation or show working to score this mark |
| | | | Correct result using answer from Q5 $50 \times 4.18 \times \Delta T$ | 1 | Allow answer in J or kJ Do not penalise missing units If units are used they must be correct to score this mark |

| | | | | | |
|----|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7 | | | 2.5×10^{-2} mol | 1 | Do not penalise precision Do not accept 0.03 |
| 8 | | | Answer from Q6 divided by answer from Q7 | 1 | Must divide answer to Q6 by answer to Q7 to score mark Ignore sign of enthalpy change Must divide by 1000 if answer from Q6 is in joules Ignore units Do not penalise precision |
| 9 | | | Calculates thermometer error correctly | 1 | Must calculate (0.2×100 divided by answer from Q5) correctly to score mark Ignore precision of error Allow if error is given without working |
| 10 | | | Can/ can't extrapolate with confidence | 1 | Statement must correlate with candidate's graph |
| | | | Lines go through/ don't go through most of the points OR results are/ are not consistent | 1 | Must make a written comment to score this mark Comment must correlate with candidate's graph |
| 11 | | | Improve reliability of results/ appreciates repeating allows for possible anomalies (in single experiment) | 1 | Do not allow 'fair test' without further qualification Ignore references to improved accuracy |
| 12 | | | May be other <u>alkalis</u> present in the cleaner or similar/non-standard conditions used/ correct improvement to experimental technique for data book value | 1 | Ignore 'impurities' Allow 'incomplete reaction (of acid)' Allow 'something reacts with the acid' |
| 13 | | | (Ammonium) sulfate | 1 | Accept name or correct formula Allow consequential answer from candidate's results Allow 'ammonium sulfate' plus an incorrect formula |
| 14 | | | White ppt with $\text{BaCl}_2/ \text{CaCl}_2$ | 1 | Need correct observation and correct test Allow consequential answer from candidate's results If negative ion in Q13 is wrong on candidate's results, can't score mark in this question If no negative ion given in Q13, allow correct answer in this question |

| | | | | | |
|----|--|--|------------------------------------------------------------------------------------------------|-----------|-----------------------------------------------------------------------------------------------------------|
| 15 | | | No effervescence/ gas (produced in tests 3 or 4) (carbon dioxide would be formed) with acid | 1 1 | Allow consequential answer from candidate's results |
| 16 | | | Wear gloves/ flood skin with water | 1 | Ignore 'eye protection' Do not allow 'lab coat', 'ingest chemical' or 'fume cupboard' (list principle) |
| | | | Total | 23 | |

SECTION B Ignore absence of units unless units are required in the Marking Guidelines. Incorrect units lose the mark

| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|----------|------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------|
| 17 | | | Ammonia is an <u>alkali</u> / would <u>react with HCl</u> | 1 | Do not allow 'fair test' or 'to improve accuracy' without further qualification |
| 18 | | | Batches may vary/ batch might be contaminated | 1 | Do not allow 'fair test', 'to improve accuracy', 'reliable' or 'reproducible' without further qualification |
| 19 | | | $\text{NH}_4\text{NO}_3 \rightarrow \text{N}_2\text{O} + 2\text{H}_2\text{O}$ | 1 | Accept multiples |
| 20 | a | | ammonium chloride $134/26.2 = 5.11 \text{ £ per \%}$ ammonium nitrate $175/35 = 5.00 \text{ £ per \%}$ ammonium sulphate $111/21.2 = 5.24 \text{ £ per \%}$ | 1 | Must have some evidence of working to score this mark Accept calculations of nitrogen content per pound |
| | | | ammonium nitrate | 1 | Accept name or correct formula Allow consequential answer from candidate's results |
| 20 | b | | <u>Washed/ dissolved/ leached from soil by rainwater/ eutrophication</u> | 1 | Allow root damage due to temperature drop when salt dissolves |
| 21 | | | 17.6 | 1 | Ignore precision of answer Ignore units Do not allow 18 |
| | | | Total | 7 | |

SECTION C Ignore absence of units unless units are required in the Marking Guidelines. Incorrect units lose the mark

| Question | Part | Sub Part | Marking Guidance | Mark | Comments |
|--------------|------|----------|-----------------------------------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 22 | a | | 2-6 drops/ 0.1-0.3 cm ³ | 1 | Accept 'a few drops' |
| 22 | b | | Incorrect volume recorded/ space will fill during titration/ produces larger titre value | 1 | Do not accept 'to give an accurate result' without further qualification Do not accept references to contamination |
| 23 | | | Measure <u>volume</u> of gas/ <u>mass loss</u> | 1 | If 'measure concentration' must explain how to score mark |
| | | | At (regular) time intervals | 1 | Ignore references to temperature Accept 'against time' Do not accept 'with time' or 'over time' on its own |
| 24 | | | Add Tollens/ Fehling's/ Benedict's reagent / ir spectra | 1 | Accept any other chemically correct reagent and observation |
| | | | Silver mirror/ blue to red OR red precipitate (with ethanal)/ peak at 1700 cm ⁻¹ (in ethanal) | 1 | Must have correct test to access second mark Accept 'silver'. Do not accept 'silver solution' Give one mark for 'silver mirror test' and 'silver mirror' Accept correct answer based on n.m.r. spectra |
| Total | | | | 6 | |