



**General Certificate of Education**

**Chemistry 1421**

**CHM3X      Externally Marked Practical  
Assignment**

**Post-Standardisation Mark  
Scheme**

*2009 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.

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**Task 1**

| Question | Part | Sub Part              | Marking Guidance  | Mark  | Comments   |
|----------|------|-----------------------|---|-------|--|
| 1        | (a)  |                       | Results recorded clearly in a sensible table;   | 1 (R) | If you can read it, it is clear.<br>Full means completes all of the boxes.<br>Allow answer outside the box.<br>Allow without box lines but <u>must be</u> in tabular form. |
| 1        | (b)  | <b>General points</b> | <p>Check the teacher observations against the published grid, noting any significant discrepancies.</p> <p>Keep these discrepancies in mind when marking the scripts; allow <b>either</b> the published answer <b>or</b> the teacher alternative.</p> <p>If answers contradict e.g. "No visible change with white precipitate" then scoring point is <b>not</b> awarded.</p> <p>Look for the basic colour; ignore additional shades if the answer is unambiguous.</p> <p>'Clear' is <b>not</b> the same as 'white' or 'colourless'.</p> <p>If centre puts 'orange/yellow' allow 'orange' or 'yellow'.</p> <p>If 'precipitate' missing in the answer, penalise each omission.</p> <p>Ignore 'milky', 'cloudy' or 'opaque'.</p> |       |  |

|   |     |       |   |                      |       |   |
|---|-----|-------|---|----------------------|-------|---|
| 1 | (b) | (i)   | NaOH solution                             | White precipitate;   | 1 (A) | Accept <b>sediment</b> or <b>solid deposit</b> as alternatives to 'precipitate'.<br>Do <b>not</b> accept <b>cloudy, suspension, milky, opaque, misty</b> or <b>emulsion</b> |
|   |     |       |   | Insoluble in excess; | 1     | Accept <b>no change, no reaction</b> or <b>stays the same</b> as alternatives to 'insoluble in excess'  |
| 1 | (b) | (ii)  | H <sub>2</sub> SO <sub>4</sub> solution   | No visible change;   | 1 (A) | Accept <b>no change, no reaction, stays the same, colourless solution</b> as alternatives to 'no visible change'  |
| 1 | (b) | (iii) | NH <sub>3</sub> solution                  | White precipitate;   | 1 (A) | See Additional Guidance to 1(b)(i).   |
|   |     |       |   | Insoluble in excess; | 1     |   |
| 1 | (b) | (iv)  | Na <sub>2</sub> CO <sub>3</sub> solutions | White precipitate    | 1 (A) | See Additional Guidance to 1 (b)(i)   |

## Task 2

| Question | Part | Sub Part | Marking Guidance   | Mark                    | Comments   |
|----------|------|----------|--|-------------------------|--|
| 1        | (a)  |          | Results recorded clearly and in full in a sensible table;  | 1 (R)                   | If you can read it, it is clear.<br>Full means initial volume, final volume and titre volumes for at least two titrations.<br>Table does not have to have gridlines.<br>Allow clear answer outside of a table box.<br>Lose this mark if there is an arithmetic error in calculating a titre.<br>Units are not needed in this results table, but if given they must be correct.<br>Labels such as <i>initial reading</i> , <i>final reading</i> etc are not needed in this very familiar table. |
| 1        | (b)  |          | All titre volumes to 0.05 cm <sup>3</sup> ;  | 1 (P)                   | Allow zero entries as 0 or 0.0   |
| 1        | (c)  |          | Concordant if two results are within 0.10 cm <sup>3</sup> of each other;   | 1 (C)                   | Award the mark for concordancy if the table contains at least two concordant results, even if candidate has not recognised these as concordant results.  |
| 1        | (d)  |          | The accuracy of the candidate's average titre, measured against a teacher value for the titration:<br>Average titre is within 1% of teacher value;<br>Average titre is within 1.5% of teacher value;<br>Average titre is within 2% of teacher value;<br>Average titre is within 2.5% of teacher value; | (A)<br>4<br>3<br>2<br>1 | 4 max.<br>If a student has two concordant results then both concordancy and accuracy marks can be awarded.<br>If a student does not have two concordant results but does have two results within 0.2 cm <sup>3</sup> , then the concordancy mark cannot be awarded but the accuracy marks can.<br>Results outside of 0.2 cm <sup>3</sup> cannot receive concordancy or accuracy marks.<br>Choose the combination of concordant results that gives the highest accuracy mark.                   |

## EMPA Test

| Question | Part | Sub Part | Marking Guidance   | Mark   | Comments   |
|----------|------|----------|--|--------|--|
| 1        |      |          | White ppt, (insoluble in excess), <u>with</u> NaOH/ NH <sub>3</sub> / CO <sub>3</sub> <sup>2-</sup> ;            | 1      | Consequential on candidate's result.   |
| 2        |      |          | No visible change <u>with</u> H <sub>2</sub> SO <sub>4</sub> ;<br>Expect white ppt/ BaSO <sub>4</sub> insoluble; | 1<br>1 | Accept 'no change', 'no reaction', 'stays the same', 'colourless solution' as alternatives to 'no visible change'  |
| 3        |      |          | Correct average titre using the candidate's indicated <b>concordant</b> results ;                                | 1      | Ignore precision of answer.<br>If candidate has not indicated concordant results to be used, this answer must equal your average titre to score mark.<br>Penalise excessive rounding.<br>Allow answer without working. |
| 4        |      |          | Answer from q3 multiplied by 0.1 x 10 <sup>-3</sup> ;  | 1      | Must multiply answer to question 3 by 0.1 x 10 <sup>-3</sup> to score mark.<br>Ignore precision of answer.<br>Allow answer without working.  |
| 5        |      |          | 1.25 x 10 <sup>-2</sup> ;  | 1      | Allow answer without working.  |
| 6        |      |          | Answer to question 5 - answer to question 4;   | 1      | Must subtract answer to question 4 from answer to question 5 to score mark.<br>Ignore precision of answer.<br>Allow answer without working.  |
| 7        |      |          | Answer to question 6 divided by 2;   | 1      | Must divide answer to q6 by 2 to score mark.<br>Ignore precision of answer.<br>Allow answer without working.   |
| 8        |      |          | 0.520 divided by answer to question 7;<br>Answer given to 1 dp;  | 1<br>1 | Must divide 0.52 by answer to q7 to score mark.<br>Allow answer without working.<br>Any Mr given to 1 dp scores the second mark.   |

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|----|--|--|--|---|--|
| 9  |  |  | [(answer to question 8) - 84.3] divided by 18; | 1 | If correct calculation gives 1.3, allow 1, 1.3 or 2.<br>Allow answer without working.<br>Ignore precision of answer.   |
| 10 |  |  | Mass of mineral on x-axis;                     | 1 | If axes unlabelled use data to decide if mass of mineral is on the x-axis.   |
|    |  |  | Sensible continuous scales;                    | 1 | Lose this mark if the <b>plotted points</b> do not cover at least 9 squares by 7.<br>Lose this mark if the graph plot goes off the squared paper.<br>The graph does not have to start at the origin. |
| 11 |  |  | Plots points correctly $\pm$ one square;       | 1 | Award this mark if the line is close to your line.   |
|    |  |  | Draws a best fit straight line                 | 1 | Award this mark if best fit line is consistent with candidate's plotted points.<br>Lose this mark if line is kinked or doubled.  |
| 11 |  |  | 1.48 or 1.49 or 1.50 or 1.5 (g);               | 1 | Accept these answers <b>only</b><br>Ignore precision of answer.<br>Allow range 1.48 – 1.5  |
| 12 |  |  | 0.0124 (mol);                                  | 1 | Accept 0.012, 0.0125<br>Allow answer without working.  |
| 13 |  |  | (1.49/ 0.0124) = 119.4 – 125.0;                | 1 | Must divide answer to question 11 by answer to question 12 to score first mark.<br>Allow consequential answer from question 11.<br>Allow answer without working.<br>Ignore precision of answer.      |

|    |     |  |            |   |
|----|-----|--|------------|---|
| 14 |     | Answer to question 14 close to 120.3;  | 1          | Allow consequential answer from question 13.<br>Allow correct calculation of x  |
| 15 |     | <u>x</u> must be a whole number;   | 1          |   |
| 16 |     | Good/ straight line so results good/ reliable;<br><br>Anomaly at 1.34 g;   | 1<br><br>1 | Allow consequential answers from candidate's graph<br>Do not allow 'so results are accurate'.<br>Allow anomaly clearly indicated on the graph.                            |
| 17 |     | Ensure reaction/decomposition goes to completion;  | 1          | Do not allow 'to make fair test' or 'improve reliability'<br>Accept to 'remove all carbon dioxide and <u>water</u> '.   |
| 18 | (a) | Percentage errors too high/ errors in weighing too high;   | 1          | Do not allow 'to make fair test' or 'improve reliability'<br>Do not allow 'errors' on its own.  |
| 18 | (b) | Incomplete decomposition or words to that effect;  | 1          | Do not allow 'to make fair test' or 'improve reliability'<br>Do not allow 'takes too long' or 'wastes chemicals'<br>Do not allow 'not all of the water removed'.          |
| 19 |     | 39.05/18 = 2.170 and 60.95/84.3 = 0.723;<br><br>MgCO <sub>3</sub> .3H <sub>2</sub> O;                                | 1<br><br>1 | Allow <i>M<sub>r</sub></i> of MgCO <sub>3</sub> .H <sub>2</sub> O = 138.3<br><br>54/138.3 + 39.05%<br>MgCO <sub>3</sub> .3H <sub>2</sub> O without working scores 1 mark. |
| 20 |     | Atom economy for Reaction 1 is (40.3/84.3) x 100 = 47.8%<br>Atom economy for Reaction 2 is (40.3/58.3) x 100 = 69.1% | 1<br>1     | Maximum 1 mark if no working.<br>Ignore precision of answers.   |
| 21 |     | No gas produced in <u>stomach</u> / won't cause wind;  | 1          | Do not allow 'gas produced' on its own.   |

|    |     |  |   |  |
|----|-----|--|---|--|
| 22 | (a) | Temperature/ pressure;                       | 1 | Do not allow 'amount' or concentration of reactants.         |
| 22 | (b) | Determine gradient;                          | 1 | Do not allow volume / time.<br>Accept 'steepness' or 'slope' |
| 23 |     | Add (hydrochloric) acid to the mixture;      | 1 | Allow correct acid eg nitric acid.                           |
|    |     | <u>Filter</u> to isolate strontium sulphate; | 1 | Do not allow 'drain' or decant'                              |
| 24 | (a) | Eliminate/ reduce <u>fire</u> risk;          | 1 | Allow ethanol flammable/ burns/ combusts.                    |
| 24 | (b) | <u>Orange to green</u> ;                     | 1 | Need full colour change to score mark.                       |