

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

**MARK SCHEME for the May/June 2011 question paper
for the guidance of teachers**

9701 CHEMISTRY

9701/51

Paper 5 (Planning, Analysis and Evaluation),
maximum raw mark 30

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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|---------------|---------------------------------------|-----------------|--------------|
| Page 2 | Mark Scheme: Teachers' version | Syllabus | Paper |
| | GCE A LEVEL – May/June 2011 | 9701 | 51 |

| Question | Sections | Indicative material | Mark |
|--------------|-----------------|---|------|
| 1 (a) | PLAN Problem | Predicts that the higher A_r elements/ M_r compounds decompose less easily. | [1] |
| | | Distortion/polarisation decreases. Accept reverse argument if related to correct group/ M_r / A_r trend. | [1] |
| | | Any graph showing a decreasing rate (not time) with M_r (bar chart or any line). Axes must be labelled (accept group II carbonate). Ignore units. | [1] |
| | | Allow consequential graph answer from incorrect prediction. | |
| (b) | PLAN Problem | (i) Element/carbonate as the independent variable. Mass negates. | [1] |
| | | (ii) Time identified as dependent variable/ rate (of reaction) or equivalent. | [1] |
| (c) | PLAN Methods | Diagram to show only experimental setup | |
| | | (i) Any suitable closed container and heat (no baths). | [1] |
| | | (ii) Syringe labelled with the volume (10 cm^3 to 1000 cm^3). Or inverted measuring cylinder/burette (10 cm^3 to 1000 cm^3). Must be calibrated. | [1] |
| (d) | PLAN Methods | (i) Statement of the gas volume. Minimum 10 cm^3 . Exceeding capacity negates. If the diagram has a syringe/cylinder $< 10\text{ cm}^3$ which loses the mark in (c) , then allow a reasonable measured volume in (d) including up to the syringe/cylinder volume. | [1] |
| | | (ii) An indication that the mass of each carbonate used must contain the same number of moles. A generalised mole calculation is acceptable. | [1] |
| | | (iii) Having the same settings on the Bunsen (strength). | [1] |
| | | Bunsen at the same distance from the reaction vessel. | [1] |
| (e) | PLAN Methods | Reference to 'hot' apparatus not any heating equipment. | [1] |
| | | Heat proof gloves/handling devices/cool before handling. | [1] |
| | | Accept sucking back and removing delivery tube. | |

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| Page 3 | Mark Scheme: Teachers' version | Syllabus | Paper |
| | GCE A LEVEL – May/June 2011 | 9701 | 51 |

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| (f) | PLAN Methods | 1. element/carbonate and 4 rows 2. time to chosen point and rate /1/t/1/time 3. Units (/s, /seconds), ($/s^{-1}$), ($/1/s$) All correct 2 marks; One error 1 mark; Two or more errors, zero. If 1 column missing but all rest correct award 1 mark. | [2] |
| (g) | ACE Evaluation | Has to have a change to the apparatus. Regulated heating device/electrical hotplate/time to complete decomposition (syringe stops moving/or equivalent)/gravimetric mass loss in a set time. Change to a smaller reaction vessel e.g. conical to boiling tube/collecting in a syringe rather than over water to combat solubility not suck back. A larger syringe/cylinder to collect a larger volume (less proportion of displaced air). | [1] |
| | Total | | [16] |

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| Page 4 | Mark Scheme: Teachers' version | Syllabus | Paper |
| | GCE A LEVEL – May/June 2011 | 9701 | 51 |

| Question | Sections | Indicative material | Mark |
|--------------|--------------------|---|-------------|
| 2 (a) | ACE Data | Both M_r s calculated correctly 85, 69, ignore units. May be seen in table. | [1] |
| (b) | ACE Data | Moles of NaNO_3 , B-A/ M_r , and full columns. Ignore units and moles of NaNO_2 , C-A/ M_r and full columns. Ignore units. | [1] |
| | | All data correct and to 2 sig figs ECF incorrect M_r . Allow 2 arithmetic or sig fig errors. No ECF of incorrect formula. | [1] |
| | | If no score, allow 1 for 1 full heading and 1 column correct in any combination. | |
| (c) | ACE Data | Labelled axes (name and moles needed somewhere, nitrate to be the x-axis). Accept column label if its heading fully correct. Appropriate scaling (origin not necessary). | [1] |
| | | Correctly plotted points. All 10 points need plotting. (Check points 1, 4, 7 & 10 and any that appear incorrect). | [1] |
| | | Line of best fit which must go through 0,0. | [1] |
| (d) | ACE Evaluation | Give one mark if the two anomalous points furthest from the line (one on each side) are identified. Allow only one anomaly if there is only one or all the anomalies are on the same side. Allow extra anomalies due to misplotting. For credit, the anomalies must include the most anomalous. In plotting the points, it is possible that some points will be a little way from the correctly drawn line. These in many cases are likely not to be 'ringed'. Examiner judgement will be required in determining whether or not a point should be 'ringed'. If 5 or more points are 'ringed' do not award this mark but allow any subsequent correct discussion. | [1] |
| | | Point 4 incomplete decomposition/not heated for long enough/not hot enough. | [1] |
| | | Point 7 solid loss during heating/damp sample/nitrite may decompose. | [1] |
| | | One mark for two correct reasons not related to the points. | |
| (e) | ACE Data | Construction lines on graph. If line into origin and 0,0 used only 1 line necessary. | [1] |
| | ACE Conclusions | Takes intercept readings from the graph. | [1] |
| | | Calculates the slope (independent mark). Do not accept calculations that give negative differences in x or y values. | [1] |
| (f) | ACE Conclusions | For stating that the slope supports the equation. ECF applies from incorrect gradient. | [1] |
| | | For using the slope (1) and deducing a ratio (1:1). The mole relationship must be present. ECF incorrect ratio provided related to the above gradient. | [1] |
| | Total | | [14] |