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.

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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 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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(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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Question	Sections	Indicative material	Mark
2 (a)	ACE Data	Both M_rs 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. All data correct and to 2 sig figs ECF incorrect M_r. Allow 2 arithmetic or sig fig errors. No ECF of incorrect formula. If no score, allow 1 for 1 full heading and 1 column correct in any combination.	[1] [1]
(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). Correctly plotted points. All 10 points need plotting. (Check points 1, 4, 7 & 10 and any that appear incorrect). Line of best fit which must go through 0,0.	[1] [1] [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. Point 4 incomplete decomposition/not heated for long enough/ not hot enough. Point 7 solid loss during heating/damp sample/nitrite may decompose. One mark for two correct reasons not related to the points.	[1] [1] [1]
(e)	ACE Data ACE Conclusions	Construction lines on graph. If line into origin and 0,0 used only 1 line necessary. Takes intercept readings from the graph. Calculates the slope (independent mark). Do not accept calculations that give negative differences in *x* or *y* values.	[1] [1] [1]
(f)	ACE Conclusions	For stating that the slope supports the equation. ECF applies from incorrect gradient. 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] [1]
	Total		**[14]**

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