UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

9701 CHEMISTRY

9701/53 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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UNIVERSITY of CAMBRIDGE
International Examinations

Question	Sections	Indicative material	Mark
1 (a) (i)	PLAN Problem	States that the boiling point increases with concentration because the lowered vapour pressure means that the temperature has to be raised in order to raise the vapour pressure to that of the ambient value. (Accept boiling point is proportional to concentration or reverse).	[1]
(ii)		Straight-line or curve showing a gradual increase. (This line may start anywhere). Ignore any plateau but any line which shows a boiling point decrease is wrong.	[1]
		Line or extrapolated line to begin on the *y*-axis with the value 100°C labelled. [there is no ecf here from **(i)** to **(ii)**]	[1]
(b)	PLAN Problem	Mass / weight / concentration of potassium chloride.	[1]
		Temperature / temperature change. Accept boiling point or change in boiling point. (Ignore any reference to water but boiling point of potassium chloride is wrong).	[1]
(c)	PLAN Method	Give one mark for a diagram which shows some form of heating (not a water bath, but allow oil-bath or heating mantle) of an apparatus containing water. (No mark if the apparatus is sealed). (If the apparatus is 'obvious' labels are not necessary).	[1]
		Give one mark for showing the thermometer bulb at the interface between liquid and vapour (bulb half in and half out of the liquid).	[1]
		Give one mark for showing an appropriate temperature range for the thermometer (must cover 100°C).	[1]

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Question	Sections	Indicative material	Mark
(d)	PLAN Method	Give one mark for a method, which gives details / a list of the masses / volumes / weights of water to be used along with the need to have masses of the potassium chloride to produce a solution, provided that the total mass of water does not exceed 100g. Give one mark if at least five different concentrations are indicated. (Allow a method based on adding increasing portions of the solute to one initial mass of water. First mark for a mass of water 100g or less; second mark for adding at least five portions of solute, table in **(g)** will require the same four headings). These details may be shown in the expression detailed below. Give one mark for the following correct expression. Mass of chloride / 74.6 × 1000 / mass or vol. of water. (Any or all these marks may be covered in the table in **(g)**. If there is a correct calculation of molality but the candidate refers to molarity give the mark, but if then molarity appears in the table in **(g)** count this second use as an error.)	[1] [1] [1]
(e)	PLAN methods	Give one mark for identifying 'boiling water' / boiling solution / hot apparatus / steam or equivalent (ignore risks). Accept any sensible suggestion that might produce burns. (Reference to hot potassium chloride or its corrosive nature are wrong).	[1]
(f)	PLAN Methods	Any statement which clearly indicates that the experiment is limited by the solution becoming saturated gains one mark. (Reference to solubility alone is not enough.) Accept reference to limited volume of water.	[1]
(g)	PLAN Methods	A minimum of four columns is required: Boiling point; mass / volume / weight (not amount) of water; mass of potassium chloride; (all with correct units); molality (ignore units here). If all four are fully correct give two marks; if only three are correct give one mark; otherwise zero.	[2]
	Total		**[15]**

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Question	Sections	Indicative material	Mark
2 (a)	ACE Data	The required two M_rs are correct. (249.6 and 97.5)	[1]
(b)	ACE Data	The required two column headings are correct. (A / 249.6, moles of $CuSO_4.5H_2O$: B / 97.5, moles of $Cu(OH)_2$) [If moles are given as shown separate units are not needed.] (the expressions need a number not just M^r) The first two calculations are correct and both columns are fully completed to the correct number of significant figures. [0.010; 0.025 and 0.008; 0.020] If only one column is fully correct give a salvage one mark.	[1] [1]
(c)	ACE Data	Give the mark if excess sodium hydroxide is identified	[1]
(d)	ACE Data	Give one mark for labelling the x-axis copper sulfate and the y-axis copper hydroxide provided all the plotted points cover at least half the grid in both directions. [moles of …….. or / moles or (moles) are acceptable as units. (all points must be on the given grid). Give one mark for correctly plotting the nine points, which must include both anomalous points. Give one mark for drawing a 'straight-line of best fit' passing through the origin. (allow 'ecf' here from incorrectly plotted points – the line may of course now not pass through the origin).	[1] [1] [1]
(e)	ACE Data	Give one mark if all the anomalous points are circled. There should be one each side of the line if the plotting is correct. (If points are misplotted there may be either one or more than two anomalies. If there are points close to the line judgement will be needed as to whether these are anomalies or not). For each of the two different anomalies an appropriate explanation gains one mark. Point 4 (not enough $Cu(OH)_2$): loss of the sulfate solution / not an excess of NaOH / loss of precipitate / recorded mass of the sulfate more than the actual value. Point 8 (too much $Cu(OH)_2$): $Cu(OH)_2$ still wet / contamination with other chemicals / excess sulfate weighed out / recorded mass of the sulfate less than the actual value. There may be other acceptable reasons. (If there are two correct comments which are not 'tied' to a particular anomaly give a salvage one mark).	[1] [2]

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Question	Sections	Indicative material	Mark
(f)	ACE data	For appropriately drawn lines on the graph give one mark. For correctly deducing the graph values give one mark. For a value of the slope within +/–0.05 of the 'correct value'. This should be in the order of 0.80. If the axes have been reversed the value will be 1.25. If the slope is significantly different due to earlier errors the answer should be within +/–0.05 of their 'actual' value.	[1] [1] [1]
(g)	ACE Data	For the correct statement that the equation is not confirmed. Allow ecf. For an appropriate comment. (e.g. the slope is 0.8 or 1.25 (or ratio is 4 to 5 or 5 to 4) but the equation needs a 1:1 ratio).	[1] [1]
	Total		**[15]**

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