## MARK SCHEME for the October/November 2011 question paper

## for the guidance of teachers

## 9701 CHEMISTRY

9701/52

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.

Cambridge is publishing the mark schemes for the October/November 2011 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.



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Question Sections		Sections	Indicative material			
1	(a)	PLAN Problem	Predicts that the solubility increases (with temperature). If gave "decreasing" then ecf into sketch and do not mark explanation.			
			KNO <sub>3</sub> needs energy to dissolve OR supplying heat or energy or increasing temperature will promote the endothermic change/ reaction.			
			Any graph showing an increasing solubility with temperature (curve or straight line) that reflects the prediction. Do not accept a concave curve that becomes vertical. Accept a convex curve (accept with a max or an end decline). There can be a plateau in solubility. Have solubility on the $y$ axis and temperature on the $x$ axis. Ignore units unless the unit is the label. If gave "decreasing" above then ecf into sketch. If the prediction is irrelevant e.g. rate then can mark sketch as stand alone			
	(b)	PLAN Problem	(i) Temperature as the independent variable.	[1]		
			(ii) Solubility as the dependent variable. Has to be a double quantity, not just mass or amount of solute.	[1]		
			Ecf "concentration" if given as <i>y</i> -axis in sketch.			

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(c)	PLAN Methods	There are four different approaches, all of which share the first five marking points.	
		Use 7 number labelled ticks and crosses for these points.	
		(i) At least 5 experiments.	[1]
		(ii) Uses a range of at least 40°C.	[1]
		(iii) Pilot run to choose relative amounts of materials.	[1]
		(iv) Mass by balance. Water by measuring cylinder/pipette/ burette or mass of water by balance.	[1]
		(v) stirs	[1]
		Alternate 1	
		(vi) Heat mixture to dissolve all the solute.	[1]
		(vii) Cool and measure the temperature at which first crystals appear.	[1]
		OR Alternate 2	
		(vi) Heats mixture to a particular temperature.	
		(vii) Filters the solution (not cooled or decanted) and weighs the residue.	
		OR Alternate 3	
		(vi) Heats mixture to a particular temperature.	
		(vii) filters the solution (not cooled or decanted) and evaporates the filtrate and weighs solid.	
		OR Alternate 4	
		(vi) Heats mixture to dissolve the solute.	
		(vii) Records temperature at which the solute dissolves.	
(d)	PLAN Methods	Reference to 'hot' apparatus, not Bunsen or water	
		with	[1]
		Handle with tongs/heat resistant gloves/cool before handling	

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(e)	PLA Met	N hods	<ul> <li>1(c)(i) &amp; (ii) could award here.</li> <li>Mass of solid dissolved; volume/mass of wattemperature (solution) and units.</li> <li>Only accept a final temperature if it relates to solution.</li> <li>All five correct 2 marks;</li> <li>Three or four correct (one/two errors) 1 martial temperature or less correct (more than two errors) 2</li> </ul>	to the temperatur	e of	[2]
	Tota	al				[15]

Qı	uestion	Sections	Indicative material	Mark
2	(a)	ACE Data	$Log_{10}$ (rate) or $Log_{10}$ (1/time) or $Log_{10}$ (1/t). One of these labels also serves as expression, full column no units. Accept log with no base.	
			Reciprocal absolute temperature or reciprocal Kelvin temperature or 1/T (not temp etc.). One of these labels also serves as expression, full column with unit, $K^{-1}$ . Don't accept $1/T \times 10^{-3}/K^{-1}$ but $/10^{-3}K^{-1}$ OK	
			Data in both columns above to 3 sig figs and correct, allow 2 errors.	[1]
			Allow salvage mark for rate column if ALL correct. A heading of 1/time or 1/t or 1/C also serves as expression.	
	(b)	ACE Data	Unambiguously labelled axes. $1/T$ on the <i>x</i> -axis and $log_{10}$ (rate) on the <i>y</i> axis AND appropriate scaling. Ignore units unless it is the label.	
			Correctly plotted points. Ecf incorrectly calculated data. All 10 points need to be plotted. Check points 3 & 7 and 1 & 10 and any others off the line.	[1]
			Line of best fit.	[1]
			Allow plot and line marks if other axes used.	

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(c)	ACE Evaluation	Allow the candidate to select up to five anor include that furthest from the line. This mark is available if other axes used.	malies which mu	st [1]	
	The data has two anomalies, Points				
		Point 3, Timed to past opacity (not late stop alone), or solutions not equilibrated with wa or clock started early.		ature	
		Point 7, Timed to prior to opacity (not early alone), or clock started late.	stopping the clo	ck [1]	
		Give a rescue mark if both correct anomalie linked to their points.	es present but no	ot	
		These last two marks not available if other a	axes used.		
(d)	ACE Evaluation	Either no repeats OR five or more points no unreliable	Either no repeats OR five or more points not on line hence unreliable		
		OR most points on line OR points produce s reliable.	straight line hend	ce	
		This mark not available if other axes used.			
(e)	ACE Data	Has construction lines on the plot.		[1]	
		States intercept readings from them. (Could the line and construction is to that point. Point (e.g. × $10^{-3}$ ) must be included if necessary) slope (around $-1050$ ). Slope is $(y_1 - y_2)/(x_1)$ the gradient must be correct from the sign printercept calculations.	owers of 10 then calculates $-x_2$ ). The sign	the of	
		Allow these marks if other axes used.			
(f)	ACE Conclusion	Correct calculation. Any calculation that has multiplied by 19 i.e. $-E_A$ = slope × 19. Or sl Ignore units. Also accept that calculation su by 1000 i.e. about 19950 or 19.95. T is not	ope = $-E_A/19$ . ubsequently divide		
	Allow this mark for other plots.				
(g)	(g) ACE Increased K.E/energy/speed.			[1]	
		More collisions/unit time or more frequent c chance of collisions or more energetic collis collisions exceeding activation energy or mo collisions or more effective collisions.	ions or more	· [1]	
	NOT just more collisions.				
	Total			[15]	