

CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the October/November 2012 series

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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

Page 2	Mark Scheme	Syllabus	Paper
	GCE A LEVEL – October/November 2012	9701	51

Question	Sections	Indicative material	Mark
1 (a)	PLAN Problem	PbO 1:1, Pb ₃ O ₄ 1:1.33, PbO ₂ 1:2 All three correct two marks. Two correct one mark.	[2]
(b)	PLAN Problem	Correctly labelled axes and three straight lines drawn converging at the origin. Correct order of the lines. If 'O' is on the y-axis, order on axes is PbO ₂ (steepest gradient), Pb ₃ O ₄ , PbO. Allow 'Pb' on y-axis, order reversed.	[2]
(c)	PLAN Problem	(i) lead (allow lead oxide or oxide) AND (ii) oxygen (allow O ₂ OR lead)	[1]
(d)	PLAN Method	Diagram shows a heated piece of apparatus containing some lead oxide with hydrogen passing over it with inlet and outlet shown. Diagram shows apparatus to generate hydrogen using Mg/Al/Zn/Fe AND any dilute acid (labelled) OR group 1 metal/alcohol OR Ca with water or dilute acid. Shows excess hydrogen being burned OR led away from apparatus/collected.	[1] [1] [1]
(e)	PLAN Method	Chooses mass (M) of lead oxide between 1 g and 25 g. Re-heats to constant mass. Calculates a volume of hydrogen sufficient to reduce the oxide. (mark is for the method, units are required.) Suggests calculating the moles of Pb and O/mole ratio of Pb to O.	[1] [1] [1] [1]
(f)	Plan Method	Hydrogen is explosive in air, so expel air from the apparatus before lighting flame to burn hydrogen OR lead/lead oxide is harmful/toxic, so wear a mask/use a fume cupboard to prevent inhalation of hydrogen/lead/lead oxide OR acids are corrosive/irritant, use chemically resistant gloves OR reduction tube is hot, allow to cool before handling/use heat resistant gloves/tongs.	[1]
(g)	PLAN Method	Columns are: mass/weight of the oxide; mass/weight of lead; mass/weight of oxygen; (mass units needed for these three) moles of lead; moles of oxygen; (no units). If five/four are fully correct, 2 marks, if only three/two are correct, 1 mark.	[2]
	Total		[15]

Page 3	Mark Scheme	Syllabus	Paper
	GCE A LEVEL – October/November 2012	9701	51

2 (a)	ACE Data	Correct log column heading as $\log C/\log(a-x)/\log(1-B)$.	[1]																																														
		<p>Calculations for the log column in the table below are correct and given to 3 sig figs. (Allow 1 error without penalty.)</p> <table border="1"> <thead> <tr> <th>A</th><th>B</th><th>C</th><th>D</th></tr> </thead> <tbody> <tr> <td></td><td></td><td>$1 - B / \text{mol dm}^{-3}$</td><td>$\log C$</td></tr> <tr> <td>0</td><td>0.000</td><td>1</td><td>0</td></tr> <tr> <td>30</td><td>0.101</td><td>0.899</td><td>– 0.0462</td></tr> <tr> <td>60</td><td>0.193</td><td>0.807</td><td>– 0.0931</td></tr> <tr> <td>100</td><td>0.259</td><td>0.741</td><td>– 0.130</td></tr> <tr> <td>130</td><td>0.370</td><td>0.630</td><td>– 0.201</td></tr> <tr> <td>180</td><td>0.469</td><td>0.531</td><td>– 0.275</td></tr> <tr> <td>210</td><td>0.551</td><td>0.449</td><td>– 0.348</td></tr> <tr> <td>240</td><td>0.573</td><td>0.427</td><td>– 0.370</td></tr> <tr> <td>270</td><td>0.617</td><td>0.383</td><td>– 0.417</td></tr> <tr> <td>300</td><td>0.655</td><td>0.345</td><td>– 0.462</td></tr> </tbody> </table>	A	B	C	D			$1 - B / \text{mol dm}^{-3}$	$\log C$	0	0.000	1	0	30	0.101	0.899	– 0.0462	60	0.193	0.807	– 0.0931	100	0.259	0.741	– 0.130	130	0.370	0.630	– 0.201	180	0.469	0.531	– 0.275	210	0.551	0.449	– 0.348	240	0.573	0.427	– 0.370	270	0.617	0.383	– 0.417	300	0.655	0.345
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(b)	ACE Data	Both axes scaled from zero with x-axis labelled as ‘time /min’ and y-axis as $\log C$. Plotted points must cover at least half the grid in both directions.	[1]																																														
		All nine points plotted correctly. (Allow tolerance of \pm of $\frac{1}{2}$ small square.)	[1]																																														
		Appropriate straight line drawn through the origin. (If all points do not lie on the line then the net deviation of the non-anomalous points on each side of the best fit line must be approximately the same.)	[1]																																														
(c)	ACE Evaluation	<p>2 anomalous points circled at time 100 min and 210 min.</p> <p>$t = 100$ min – sample taken out too early OR recorded time is later than sample withdrawn.</p> <p>$t = 210$ min – sample taken out too late OR recorded time is earlier than sample withdrawn.</p>	[1] [2]																																														
(d)	ACE Evaluation	Most of the points are on the line OR only a few points are not on the line OR there are only a few anomalies.	[1]																																														
(e)	ACE data	Appropriately drawn lines on the graph.	[1]																																														
		Correctly read values from the graph. (If no construction lines shown, allow values from the table if graph drawn does actually go through point(s) used.)	[1]																																														
		Correctly calculated value of the slope given to 3 sig figs with correct unit (min^{-1}) using the candidate’s figures.	[1]																																														
(f)	ACE Conclusion	Statement that the relationship is justified since a straight line is produced.	[1]																																														

Page 4	Mark Scheme	Syllabus	Paper
	GCE A LEVEL – October/November 2012	9701	51

(g)	ACE Conclusion	Draws a straight line from the origin with a different gradient.	[1]
		Shows shorter elapsed times. (Steeper gradient)	[1]
	Total		[15]