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.

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Question	Sections	Indicative material	Mark
1 (a)	PLAN Problem	PbO 1:1, Pb_3O_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_3O_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/A*l*/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]**

2 (a) ACE Data

Correct log column heading as log C/log(a-x)/log(1-B). [1]

Calculations for the **log column** in the table below are correct and given to 3 sig figs. (Allow 1 error without penalty.) [1]

A	B	C	D
		1 – B /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	– 0.462

(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 ± of ½ 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

2 anomalous points circled at time 100 min and 210 min. [1]

t = 100 min – sample taken out too early **OR** recorded time is later than sample withdrawn.
t = 210 min – sample taken out too late **OR** recorded time is earlier than sample withdrawn. [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]

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