CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2014 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.

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Question	Expected Answer	Mark
1 (a) (i)	$2Mg(NO_3)_2 \rightarrow 2MgO + 4NO_2 + O_2$ allow correct multiples	[1]
(ii)	40.3 g MgO, 48.0 dm^3 NO_2, 12.0 dm^3 O_2 **Units must be given** allow ecf from equation in **(i)**	[1]
(b) (i)	Directly heated vessel labelled (magnesium) nitrate(V) with tube at exit Gas stream led into a liquid labelled alkali which will absorb the nitrogen(IV) oxide / NO_2 Collects a gas in a syringe or over a liquid, provided it is properly connected All parts of the apparatus are connected and air-tight **AND** nitrogen(IV) oxide absorption precedes oxygen collection.	[1] [1] [1] [1]
(ii)	States a collector volume with unit **AND** Correct calculation of mass of magnesium nitrate(V) to a volume that would fit the stated volume of collector. allow ecf on **(a)(i)** Units of volume and mass required.	[1]
(c)	Mass of magnesium nitrate(V) (at start) and mass of magnesium oxide (at end). **Or** Mass of heated tube and contents before and after heating and mass of empty tube Mass of container (+ alkali) at start and mass at end Volume of oxygen	[1] [1] [1]
(d) (i)	Heat to constant mass **OR** heat to constant volume	[1]
(ii)	Let the apparatus cool (to room temperature)	[1]
(e)	Use experimental results to produce moles of magnesium nitrate(V) **AND** moles of **one** of the three products. compare with molar ratio in **equation** as given in **(a)(i)**	[1] [1]
(f)	Make sure all apparatus is airtight / no leakage before heating allow other sensible suggestions regarding exposure to nitrogen(IV) oxide or use of apparatus	[1]

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2 (a)

$[M^{n+}(aq)]$ / mol dm^{-3}	EMF / V	$\log[M^{n+}(aq)]$
5.00×10^{-1}	0.94	–0.30
1.00×10^{-1}	0.96	–1.00
4.00×10^{-2}	0.97	–1.40
1.00×10^{-2}	0.99	–2.00
5.00×10^{-3}	1.00	–2.30
2.00×10^{-3}	1.01	–2.70
8.00×10^{-4}	1.02	–3.10
2.00×10^{-4}	1.04	–3.70

Correctly calculated values **[1]**

All data to 2 decimal places **[1]**

(b)

All 8 points present and plotted correctly **[1]**

Best fit continuous straight line **[1]**

(c)

There are no anomalous points **[1]**

Variations in points due to rounding. **[1]**

OR

Variations arise from being to just 2dp.

(d) (i)

Appropriately drawn lines on graph **[1]**

Calculates correctly gradient of the graph **[1]**

Uses –0.06 / n = gradient to calculate n = 2
Correct working must be shown **[1]**

(ii)

Extrapolates graph to obtain intercept on *y*-axis **and** deduces $E^{\ominus}$ for the cell to a minimum of 2 dp
e.g. (+)0.93(V) **[1]**

OR

Calculates a value for $E^{\ominus}$ using the electrode potential expression and candidate's final value for n calculated in **(d)(i)** or candidate's gradient and a data point on the candidate's line.

(e)

$E^{\ominus}$ for M, (0.80 – 0.93) = – 0.13 **AND**
Metal is Pb (allow Sn on – 0.14)
allow ecf from **(d)(ii)** **[1]**

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(f)	$2Ag^{+} + Pb \rightarrow 2Ag + Pb^{2+}$	**[1]**
(g) (i)	To allow movement of ions **OR** to maintain charge / ion balance	**[1]**
(ii)	If lead given in **(e)** then only potassium nitrate is suitable If potassium chloride given as unsuitable, then accept precipitations with silver **OR** lead (ions) If potassium sulfate given as unsuitable, then accept precipitations with lead (ions) **ONLY** If tin given in **(e)** potassium sulfate or potassium nitrate are suitable precipitation would occur just with potassium chloride with silver (ions) **ONLY**	**[1]** **[1]**

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