CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the October/November 2013 series

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.

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

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Question	Expected Answer	Mark
1 (a) (i)	(The solubility of air) decreases (as the temperature is increased).	1
	Dissolving is exothermic so an increase in temperature will promote the reverse reaction (or backwards or right to left).	1
(ii)	Axes are labelled **AND** graph is a curve/straight line showing a decrease in solubility with temperature.	1
	Graph is scaled and starts at 0 °C on the solubility axis **AND** goes through point (25 °C, 19 cm^3dm^{-3}), **AND** ends at point (100 °C, 0 cm^3dm^{-3}) **AND** provided there is no maximum or minimum in the curve. Units required for this mark.	1
(b)	**(i)** temperature	
	(ii) solubility (of air).	1
		Total 5
2 (a)	Diagram shows a container with both chemicals named and attached to a syringe connected without leaks.	1
	Container shows the catalyst and hydrogen peroxide separated ready to mix.	1
	100 cm^3 of oxygen is 100/24000 = 0.00417 (mol) (0.004166666)	1
	Mol of H_2O_2 is 2 × mole answer above = 0.00834 (0.00833333) (ecf on alternative volume of oxygen used)	1
	Volume of hydrogen peroxide is therefore (answer above × 1000)/0.30 (27.8 cm^3) (27.78 cm^3) (27.7777773 cm^3) Allow 28 cm^3 (units are required) (reverse calculation also accepted)	1
	The reaction is timed from the moment of mixing to the collection of a stated volume of oxygen.	1
(b)	surface area of catalyst.	1
(c)	Axes are labelled (vol and time or min or s etc.) **AND** graph is a curve starting at the origin, shows the steepest slope at the start and slowing down as reaction proceeds	1
	x-axis has numerical scale from the origin to at least 3 min and graph shows no change in volume of oxygen after 2 minutes. The time axis must be scaled and have a unit of min or s.	1

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Question	Expected Answer	Mark
(d)	lead(IV) oxide causes (skin) irritation **AND** wear (safety) gloves OR Either catalyst or both catalysts (or names or powders or solids) are poisonous **AND** wear a face mask **OR** do in a fume cupboard.	1
		Total 10
3 (a)	$M_r(CCl_4) = 154$ **AND** $M_r(C_2H_2Cl_4) = 168$	1
(b) (i)	Mol of $CCl_4 = 0.0469$ **AND** mol of $C_2H_2Cl_4 = 0.0531$ **AND** mole fraction = 0.0469/(0.0469 + 0.0531) = 0.469	1
(ii)	Mol of $CCl_4 = 0.0918$ **AND** mol of $C_2H_2Cl_4 = 0.00821$ **AND** mole fraction = 0.0918/(0.0918 + 0.00821) = 0.918	1
(c)	The *x*-axis must start at zero and be labelled as 'mole fraction' with no units and *y*-axis as temperature or T/^{o}C. Plotted points must cover at least half the grid in both directions. All 16 points plotted correctly **.** The vapour line is a continuous curve of best fit that does not deviate to accommodate an off curve point. The liquid line is a continuous curve of best fit that does not deviate to accommodate an off curve point.	1 1 1 1
(d)	Anomalous point is circled at T = 99.3 ^{o}C (for the vapour curve). Analysis was made at a temperature that was too low.	1 1
(e)	Horizontal line drawn from 0.500 on the liquid mol fraction curve to meet vapour curve. Correctly reads the value from the vapour curve**.**	1 1
(f)	For $C_2H_2Cl_4$ (0.5/120) × 100 = 0.417% OR (1.0/120) × 100 = 0.833% For CCl_4 (0.5/76) × 100 = 0.658% OR (1.0/76) × 100 = 1.316%	1 1
(g) (i)	CCl_4	1
(ii)	Vapour produced when a mixture is heated has a greater proportion of CCl_4 than the mixture/liquid.	1
		Total 15

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