CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2014 series

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 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 May/June 2014 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

CAMBRIDGE
International Examinations

Question	Expected Answer	Mark	
1 (a)	Water can hydrogen bond with ammonia **(ORA for trichloromethane)**	[1]	
	Water / oxygen / ammonia / nitrogen has a lone pair (of electrons) **(ORA for trichloromethane)**	[1]	
	OR		
	trichloromethane has dipole-dipole interactions only		[2]
(b)	$(K_{partition} =) \dfrac{[NH_{3(water)}]}{[NH_{3(trichloromethane)}]}$		
	AND $(K_{partition}) > 1$ **ORA**	[1]	[1]
(c)	It is not important as the concentration is independent of volume	[1]	[1]
(d)	$2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$	[1]	[1]
(e) (i)	Calculates the concentration of ammonia (in the aqueous layer) is (approximately) 1 mol dm^{-3} **OR** between 0.96 mol dm^{-3} and 1.04 mol dm^{-3} ecf from **(d)**	[1]	
	Should be diluted by 5	[1]	[2]
(e) (ii)	Pipette 50 cm^3 of the 5.00 mol dm^{-3} aqueous ammonia into a 250 cm^3 volumetric (graduated) flask ecf from **(e)(i)** other flask sizes and methods of accurate volume measurement allowed	[1]	
	Make up to the mark with water. Shake **OR** invert the flask **OR** mix.	[1]	[2]
(f)	Allow suitable methods for avoiding the inhalation of ammonia **AND/OR** trichloromethane fumes	[1]	[1]
(g)	methyl orange / screened methyl orange Allow other indicators with suitable pH range	[1]	
	As it is weak base-strong acid titration	[1]	[2]
(h)	The concentration / solubility in the aqueous layer is much larger so determination of its concentration would be less prone to error Allow sulfuric acid immiscible with trichloromethane layer	[1]	[1]
(i)	Calculates the moles of ammonia in the aqueous layer ecf from **(d)**	[1]	
	Subtracts from the original to obtain moles in the trichloromethane	[1]	[2]

© Cambridge International Examinations 2014

2	**(a)**	2 marks awarded unless: **(i)** The curve is clearly not smooth or has a point of inflexion or is in the wrong position **(ii)** A point is clearly not in the correct position	**[2]**	**[2]**
	(b)	Point at 120 s is the most anomalous Difficult to measure very small concentrations / volume **OR** concentration / volume measured before the recorded time **OR** time recorded later than the measured concentration	**[1]** **[1]**	**[2]**
	(c)	**EITHER** Draws appropriate construction lines Read two half-lives from graph as between 95 and 105 s Because half-lives are equal, identifies the reaction as first order **OR** Draws tangents to the curve at the points Correctly calculates gradients of the two lines OR the ratio of gradients Because shallower gradient is half of the steeper gradient, the reaction is first order	**[1]** **[1]** **[1]** **[1]** **[1]** **[1]**	**[3]**
	(d) (i)	Draws suitable tangent at t = 0 Calculates gradient correctly for any line drawn at t = 0.	**[1]** **[1]**	**[2]**
	(ii)	Calculates correctly a value for: k = ans(**d(i)**) / $(27 \times 10^{8})(4 \times 10^{11})$ gives units as cm^3 $molecules^{-1}$ s^{-1}	**[1]** **[1]**	**[2]**
	(e)	Gives initial rate (gradient) as ans(**d(i)**)/(6.02×10^{23}) Completes calculation correctly	**[1]** **[1]**	**[2]**
	(f)	The ozone concentration should remain (nearly) constant during the experiment So that the rate depends only on the concentration of NO	**[1]** **[1]**	**[2]**

© Cambridge International Examinations 2014