

Markscheme

Specimen paper

Chemistry

Higher level

Paper 1 – Section B

7 pages

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Question			Answers	Notes	Total
1.	(a)		Reactant: Cl_2 0 Products: HOCl +1 HCl -1 ✓ ✓	Award [2] for three correct. Award [1] for any two correct.	2
1.	(b)		equilibrium shifts to the right/product AND $\text{HCl}/\text{HOCl}/\text{H}^+$ removed/neutralized «by NaOH» ✓	Accept any suitable equation to illustrate the neutralization reaction.	1
1.	(c)	i	Any one of: pressure not given ✓ use of different units OR different ways of measuring ✓ different precisions/significant figures OR uncertainties not given ✓		1 max
1.	(c)	ii	$0.177 \text{ «dm}^3\text{»} \times 2.86 \text{ «g dm}^{-3}\text{»} / 0.506 \text{ «g»}$ OR $\frac{0.506 \text{ «g»}}{70.9 \text{ «g mol}^{-1}\text{»} \times 0.100 \text{ «dm}^3\text{»}}$ ✓ $0.0714 \text{ «mol dm}^{-3}\text{»}$ ✓	Award [2] for correct final answer. Accept use of $PV = nRT$ to calculate the solubility. Using $P = 100 \text{ kPa}$ gives a solubility of $0.0703 \text{ «mol dm}^{-3}\text{»}$.	2
1.	(c)	iii	«as temperature increases solubility decreases» dissolution is exothermic «hence equilibrium shifts to reactants side at higher temperatures» OR thermal energy overcomes intermolecular forces between chlorine and water OR negative entropy change «of dissolution» becomes more dominant at higher temperatures ✓	Accept “kinetic energy increases with temperature «so more gas molecules escape»”.	1

1.	(d)		Any one of: toxic ✓ gas ✓ difficult to handle/store ✓		1 max
1.	(e)	i	0 – 6 ✓	Accept any number or range below pH 6.5.	1
1.	(e)	ii	7.5 ✓ [OCl ⁻] = [HOCl] OR [H ⁺] = K _a ✓		2
1.	(f)	i	NH ₃ (aq) + 2HOCl(aq) → NHCl ₂ (aq) + 2H ₂ O(l) ✓		1
1.	(f)	ii	pH > 5/high ✓ low concentration of Cl ₂ /HOCl/NH ₃ ✓	Do not accept general statements such as “less urination in the pool”.	2
1.	(g)		Any two of lower water evaporation ✓ reduce energy consumption/less energy needed to heat the water ✓ higher solubility of chlorine «so less chlorine lost»✓	Accept “less chlorine needed AND fewer bacteria”.	2 max

Question			Answers	Notes	Total
2.	(a)		Any two for [1 max] type of orange juice temperature light intensity «initial» surface area OR «initial» volume AND flask ✓		1 max
2.	(b)	i	Any one of: to perform multiple titrations ✓ too concentrated «so using too much iodine solution» ✓ end-point colour easier to see ✓		1 max
2.	(b)	ii	flask has to be opened to withdraw samples «so not 0 h» OR air was present in the flask at the start «so the ascorbic acid was exposed to air» ✓		1
2.	(b)	iii	titrate only once after two weeks OR fill flask with nitrogen/argon/inert gas OR withdraw samples with syringe «without opening flask» ✓		1
2.	(c)		$\frac{0.1 \text{ cm}^3}{15.0 \text{ cm}^3} \times 100 = 0.7 \text{ \%}$ ✓		1
2.	(d)	i	$\frac{(5.3 \times 10^{-3} \text{ mol dm}^{-3} - 1.1 \times 10^{-3} \text{ mol dm}^{-3})}{14 \text{ d}} = 3.0 \times 10^{-4}$ ✓ mol dm ⁻³ d ⁻¹ ✓	Accept values in the range $2.9 \times 10^{-4} - 3.1 \times 10^{-4}$. Accept values converted to other units, such as $3.4 \times 10^{-9} - 3.6 \times 10^{-9} \text{ mol dm}^{-3} \text{ s}^{-1}$ or $0.29 - 0.31 \text{ mmol dm}^{-3} \text{ d}^{-1}$.	2

2.	(d)	ii	«support» longer daily exposure leads to lower concentration of ascorbic acid OR 0 h decreases the least ✓ «doesn't support» no direct evidence of oxidation by oxygen ✓		2
2.	(d)	iii	should be stored in sealed container OR should be consumed in a few days after opening ✓		1
2.	(e)		<i>Any one of:</i> effect of temperature/light AND would show the value of refrigeration/darkness ✓ effect of preservative ✓ compare types of orange juice «e.g. fresh, from concentrate, etc.» ✓		1 max

Question			Answers	Notes	Total
3.	(a)		tangent drawn at $t = 0$ ✓ « $\frac{40.0 \text{ cm}^3}{35.0 \text{ s}} = \gg 1.14 \text{ «cm}^3 \text{ s}^{-1}\gg$ » ✓	Accept values in the range $1.04 - 1.24 \text{ cm}^3 \text{ s}^{-1}$.	2
3.	(b)		any value between 35 and 50 s ✓	Only a simple estimation is required.	1
3.	(c)		Any two: drink releases gas more slowly at higher pressure ✓ gas occupies lower volume at higher pressure ✓ gas is more soluble «in carbonated drink» at higher pressure ✓		2 max
3.	(d)		« $\frac{33.0 \text{ cm}^3 - 11.5 \text{ cm}^3}{33.0 \text{ cm}^3} \times \frac{100}{4} = \gg 16.3 \text{ «% per 100 g}\gg$ » ✓	Accept values in the range 15.8 – 16.7 «% per 100 g».	1
3.	(e)		horizontal line ✓ closed system ✓		2

