

APOLLO

How far? The extent of chemical change

HL

Chemistry

First assessment 2025

14 questions | mark schemes

Mark-scheme answers

Chemistry HL | Paper 1A | May 2025 TZ1 | Q29 | 1 marks

29. D

Chemistry HL | Paper 1A | May 2025 TZ2 | Q29 | 1 marks

29. C

Chemistry HL | Paper 1A | May 2025 TZ2 | Q30 | 1 marks

30. A

Chemistry HL | Paper 1A | May 2025 TZ3 | Q29 | 1 marks

29. C

2.	(a)		$1s^2 2s^2 2p^6 3s^2 3p^6 3d^7$ / [Ar] $3d^7$ ✓		1
2.	(b)	(i)	no effect on K AND mixture has more $[\text{CoCl}_4]^{2-}$ /product OR no effect on K AND equilibrium shifts to the right ✓		1
2.	(b)	(ii)	endothermic AND equilibrium shifts to right OR endothermic AND forward reaction is favoured ✓	Accept endothermic as forward reaction removes heat Accept endothermic and more products formed	1

3.	(a)	(i)	$[N_2] = 0.545$ AND $[H_2] = 0.727$ AND $[NH_3] = 0.112$ «mol dm⁻³» ✓ $K = \frac{[NH_3]^2}{[N_2][H_2]^3}$ ✓. «$K = \frac{0.112^2}{0.545 \times 0.727^3} = 0.0599$» ✓.	Award [3] for correct final answer. Award [3] for $K_p = 1.66 \times 10^{-9}$.	3
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2225 – 6221M

Question			Answers	Notes	Total
3.	(a)	(ii)	sharp increase at time volume of container decreased ✓ gradual decrease to second reference point ✓ final constant concentration above initial concentration ✓	Accept straight line or curve for M2.	3
3.	(a)	(iii)	«$\Delta G^\ominus = -RT \ln K$» «$\Delta G^\ominus = -8.31 \times 723 \times \ln(0.0599) = 16900$» ✓ J mol⁻¹ ✓	Award [2] for correct final answer. Accept J for M2. Accept 16.9 with the corresponding unit, kJ mol⁻¹/kJ. If $K=0.200$ used, answer is 9670 J mol⁻¹.	2
3.	(b)	(i)	it donates an electron/lone pair «to Cu ²⁺ » ✓	Accept diagram showing coordination bond from lone pair on N to Cu ²⁺ .	1

Question			Answers	Notes	Total
3.	(b)	(ii)	«NH₃ (aq) + H₂O (l) ⇌ NH₄⁺ (aq) + OH⁻ (aq)» ALTERNATIVE 1: $K_b = 10^{-4.75} = 1.8 \times 10^{-5}$ ✓ «$1.8 \times 10^{-5} = [\text{OH}^-]^2 / 0.350$» $[\text{OH}^-] = 0.0025$ «mol dm⁻³» ✓ pH «= $14.00 - (-\log 0.0025)$ »= 11.40 OR pH «= $-\log (1.00 \times 10^{-14} / 0.0025)$ »= 11.40 ✓ ALTERNATIVE 2: «$[\text{OH}^-]^2 = K_b \times [\text{NH}_3]$» pOH = $0.5 \text{ p}K_b - 0.5(\log [\text{NH}_3])$ OR pOH = $(0.5 \times 4.75) - (0.5 \times \log 0.350)$ ✓ pOH = 2.60 ✓ pH = $14.00 - 2.60 = 11.40$ ✓	Award [3] for correct final answer. Do not award ECF for M3 if pH < 7.	3
				Accept 2-bromo-3,3-dimethylbutane or	

Mark-scheme answers

Chemistry HL | Paper 1A | Nov 2025 TZ1 | Q30 | 1 marks

30. B

Chemistry HL | Paper 1A | Nov 2025 TZ1 | Q31 | 1 marks

31. D

Chemistry HL | Paper 1A | Nov 2025 TZ3 | Q23 | 1 marks

23. C

Chemistry HL | Paper 1A | Nov 2025 TZ3 | Q29 | 1 marks

29. C

Chemistry HL | Paper 1A | Nov 2025 TZ3 | Q30 | 1 marks

30. D

Chemistry HL | Paper 1A | Specimen 2025 | Q28 | 1 marks

28. A

Chemistry HL | Paper 1A | Specimen 2025 | Q30 | 1 marks

30. C

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

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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 ✓ $[\text{OCl}^-] = [\text{HOCl}]$ OR $[\text{H}^+] = K_a$ ✓		2
1.	(f)	i	$\text{NH}_3(\text{aq}) + 2\text{HOCl}(\text{aq}) \rightarrow \text{NHCl}_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$ ✓		1
1.	(f)	ii	pH > 5/high ✓ low concentration of $\text{Cl}_2/\text{HOCl}/\text{NH}_3$ ✓	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

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Question	Answers	Notes	Total
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