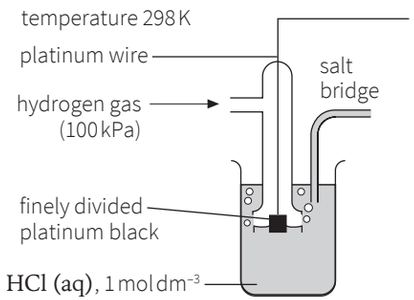
A Level AQA Chemistry

Chapter 8 – answers

Question	Answers	Extra information	Mark	AO Spec reference
01.1	298 K, 100 kPa 1.00 mol dm^{-3}		1 1	3.11.1 AO1
01.2	Because it used as a comparison		1	3.11.1 AO1
01.3		1 mark basic structure 1 mark platinum electrode 1 mark H_2 gas 100 kPa 298 K 1 mark H^+(aq) 1.0 mol dm^{-3}. (allow named monoprotic strong acid)	1 1 1 1	3.1.11.1 AO1
01.4	Fe(s) | Fe^{2+}(aq) | | Fe^{3+}(aq) | Fe^{2+}(aq)	1 mark for correct species 1 mark for || and state symbols	2	3.1.11.1 AO1
01.5	0.77 − (−0.44) = 1.21 V		1	3.1.11.1 AO2
01.6	Zn(s)	Allow words	1	3.1.11.1 AO3
01.7	Fe(s) + Cu^{2+} (aq) → Fe^{2+}(aq) + Cu(s) Fe(s) + $2H^+$(aq) → Fe^{2+}(aq) + H_2(g) Fe(s) + Fe^{3+}(aq) → $2Fe^{2+}$(aq)	Must have state symbols	1 1 1	3.1.11.1 AO3
02.1	SO_4^{2-}(aq) = Six/(+)6/VI SO_2(g) = Four/(+)4/IV		1 1	3.1.7 AO1

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02.2	Fe^{2+}	Do not accept 'Iron'	1	3.1.7 AO1
02.3	$Fe(s) + 2H^+(aq) \rightarrow Fe^{2+}(aq) + H_2(g)$ +0.44 V		1 1	3.1.11.1 AO2
02.4	Identifies nitric acid/HNO_3 $3Cu(s) + 2NO_3^-(aq) + 8H^+(aq) \rightarrow 3Cu^{2+}(aq) + 2NO(aq) + 4H_2O(l)$ 0.96 − 0.34 = 0.62 V	1 mark for choosing correct equations and direction 1 mark for balancing	1 2 1 1	3.1.11.1 AO2/3
03.1	Manganate would oxidise/ react with Cl^- As $E^{\ominus}$ for MnO_4^- is more positive than Cl_2/1.51−1.36 = +0.15 V		1 1	3.1.11.1 AO2/3
03.2	Solution is dark so have to use the top of the meniscus or burette with white markings		1	3.2.5.5 AO3
03.3	Results within 0.1 cm^3 of each other		1	3.2.5.5 AO1
03.4	Moles $KMnO_4$ = 0.025 × 0.01925 = 4.81×10^{-4} mol Ratio Fe: MnO_4^- 5:2 Moles Fe in 25 cm^3 = 0.0012… Mole Fe in sample = 0.0012… × 10 = 0.012 Mass $FeSO_4$ = 0.012 × (55.8 + 32.1 + (4 × 16)) = 1.8228 g Percentage = (1.822/2.00) × 100 = 91.14%	Can be awarded from balanced equation Accept rounding to 0.18	1 1 1 1 1 1	3.2.5.5 3.1.2.5 3.1.7 AO2
04.1	Positive electrode $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$ Negative electrode $H_2 + 2OH^- \rightarrow 2H_2O + 2e^-$ $2H_2 + O_2 \rightarrow 2H_2O$	Ignore state symbols	1 1 1	3.1.11.2 AO1

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04.2	E.m.f. will decrease		1	3.1.11.2 AO1
04.3	Poisons the catalyst		1	3.1.11.2 AO3
04.4	Low pressure High temperature normally pressure is higher as temperature increases	Ignore catalyst reference 3 mark must demonstrate understanding of link between temperature and pressure Accept 'due to Gay-Lussac's law' or $p \propto T$ etc.	1 1 1	3.1.6.1 AO3
05.1	ClO_3^- = 5/five/V Cl^- = −1		1 1	3.1.7 AO1
05.2	$3SO_3^{2-}(aq) + ClO_3^-(aq) \rightarrow 3SO_4^{2-}(aq) + Cl^-(aq)$ Oxidising agent ClO_3^- Reducing agent SO_3^{2}	Ignore state symbols	1 1 1	3.1.7 AO1
05.3	Diagram must include: Overall structure (2 beakers, salt bridge, electrodes, voltmeter) Electrodes labelled at platinum Solutions labelled as 1.00 mol dm^{-3}		4	3.1.11.1 AO1
05.4	1.45 − 0.17 = 1.28 V		1	3.1.11.1 AO2
06.1	Loses/donates electrons		1	3.1.7

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06.2	$2Au^{+}(aq) + Fe(s) \rightarrow 2Au(s) + Fe^{2+}(aq)$ $1.68 - (-0.44) = 2.12$	Must have state symbols	1 1	3.1.11.1 AO1/2
06.3	It is reduced by water $2Au^{+}(aq) + H_2O \rightarrow 2Au\ (s) + 2H^{+}(aq) + ½O_2(g)$	Reject 'water/hydrogen is more reactive than gold' arguments. The answer must refer to electrode potentials.	1 1	3.1.11.1 AO3
06.4	$Fe(s)\vert\ Fe^{2+}(aq)\vert\vert\ Cu^{2+}(aq)\vert\ Cu(s)$		1	3.1.11.1 AO1
06.5	Contains unreactive ions Which allow charge to flow without reactants meeting		1 1	3.1.11.1 AO1
07.1	Iron(II)/ Fe^{2+}		1	3.1.7 AO1
07.2	$Pt\vert Cl^{-}\ (aq)\vert Cl_2(g)\vert\vert\ F_2O(g)\vert F^{-}(g)\vert\ Pt$	1 mark for reagents 1 mark for Pt	1 1	3.1.11.1 AO1
07.3	$2BrO_3^{-}(aq) + 10Cl^{-}(aq) + 12H^{+}(aq) \rightarrow 5Cl_2(g) + Br_2(aq) + 6H_2O(l)$ Brown liquid/Solution Green gas	Allow multiples Ignore state symbols 1 mark for correct choice and direction 1 mark for balancing Allow smell/naming of chlorine	2 1 1	3.1.11.1 AO1/3

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07.4	Fe(II) sulfate $2Fe^{2+}(aq) + Cl_2(g) \rightarrow 2Fe^{3+}(aq) + 2Cl^-(aq)$	Also allow nitrate. Do not allow just Fe^{2+}	1 1	3.1.11.1 AO3
08.1	$Cd + 2OH^- + 2NiO(OH) + 2H_2O \rightarrow Cd(OH)_2 + 2Ni(OH)_2 + 2OH^-$	Correct direction Balanced	1 1	3.1.11.1 AO1
08.2	0.52 – (–0.88) = 1.40 V		1	3.1.11.1 AO2
08.3	$Cd(OH)_2 + 2Ni(OH)_2 + 2OH^- \rightarrow Cd + 2OH^- + 2NiO(OH) + 2H_2O$	Accept reverse of **08.1**	1	3.1.11.2 AO1
08.4	Electrode potential becomes more negative Equilibrium shifts to the right to reduce the OH^- concentration	Allow less positive but do not allow more/less unqualified	1 1	3.1.6.1 AO3

Skills boxes answers

1. No voltage would be measured. A complete circuit is needed. A salt bridge must be added.
2. The concentration of Al^{3+} would be 2.00 mol dm^{-3} because the formula of aluminium sulfate is $Al_2(SO_4)_3$. Therefore, a 0.500 mol dm^{-3} solution of aluminium sulfate is required.
3. A platinum electrode is required for a half-cell of ions in two different oxidation states, not an electrode made of iron.
4. The temperature should be 25°C or 298 K.
5. The temperature needs to be 298 K (not 298°C, which would be 571 K).
6. The reading will change with time, so the reading needs to be taken quickly. In reality, voltmeters have very high resistances so the decline is unlikely to be very fast.