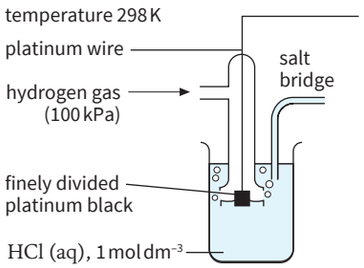
A Level OCR Chemistry

Chapter 18 – answers

Question	Answers	Extra information	Mark	AO Spec reference
1(a)(i)	298 K, 100 kPa 1.00 mol d^{m-3}		1 1	5.2.3 AO1
1(a)(iii)		**1** mark for basic structure **1** mark for platinum electrode **1** mark for H_2 gas 100 kPa 298 K **1** mark for H^+ (aq) 1.0 mol dm^{-3} H^+ allow any other monoprotic strong acid	1 1 1 1	5.2.3 AO1
1(b)(i)	$Fe(s)\|Fe^{2+}(aq)\|\|Fe^{3+}(aq)\|Fe^{2+}(aq)$	**1** mark for correct species **1** mark for || and state symbols	1 1	5.2.3 AO1
1(b)(ii)	0.77 − (−0.44) = 1.21 V		1	5.2.3 AO2
1(c)	$Zn(s)$		1	5.2.3 AO3
1(d)	$Fe(s) + Cu^{2+}(aq) \rightarrow Fe^{2+}(aq) + Cu(s)$ $Fe(s) + 2H^+(aq) \rightarrow Fe^{2+}(aq) + H_2(g)$ $Fe(s) + Fe^{3+}(aq) \rightarrow 2Fe^{2+}(aq)$	Must have state symbols	1 1 1	5.2.3 AO3
2(a)	$SO_4^{2-}(aq)$ = Six/(+)6/VI $SO_2(g)$ = Four/(+)4/IV		1 1	2.1.5 AO1

A Level OCR Chemistry

Chapter 18 – answers

Question	Answers	Extra information	Mark	AO Spec reference
2(b)	Fe^{2+}	Do not accept 'Iron'	1	2.1.5 AO1
2(c)	$Fe(s) + 2H^+(aq) \rightarrow Fe^{2+}(aq) + H_2(g)$ + 0.44V		1 1	5.2.3 AO2
2(d)	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	5.2.3 AO2/3
3(a)	Manganate would oxidise/ react with Cl^- As $E^{\ominus}$ for MnO_4^- is more positive than Cl_2/1.51 − 1.36 = +0.15		1 1	5.2.3 AO2/3
3(b)	Solution is dark so have to use the top of the meniscus or burette with white markings		1	5.2.3 AO3
3(c)	Results within 0.1 cm^3 of each other		1	5.2.3 AO1
3(d)	Moles $KMnO_4$ = 0.025 × 0.01925 = 4.81×10^{-4} Ratio $Fe : MnO_4^-$ 5 : 2 Moles Fe in 25 cm^3 = 0.0012 Moel 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%	Can be awarded from balanced equation Accept rounding to 0.18	1 1 1 1 1 1	5.2.3 2.1.5 AO2
4(a)(i)	ClO_3^- = 5/five/V Cl^- = −1		1 1	2.1.5 AO1
4(a)(ii)	$3SO_3^{2-}(aq) + ClO_3^-(aq) \rightarrow 3SO_4^{2-}(aq) + Cl^-(aq)$ Oxidising agent ClO_3^- Reducing agent SO_3^{2-}	Ignore state symbols	1 1 1	2.1.5 AO1

A Level OCR Chemistry

Chapter 18 – answers

Question	Answers	Extra information	Mark	AO Spec reference
4(b)(i)	Diagram must include: Overall structure (2 beakers, salt bridge, electrodes, voltmeter) Electrodes labelled as platinum Solutions labelled as 1.00 mol dm^{-3} sulfate/sulfite and chloride/chlorate respectively	 Allow formulas	 1 1 1	5.2.3 AO1
4(b)(ii)	1.45 − 0.17 = 1.28 V		1	5.2.3 AO2
5(a)	Loses/donates electrons		1	2.1.5
5(b)	$2Au^{+}(aq) + Fe(s) \rightarrow 2Au(s) + Fe^{2+}(aq)$ 1.68 − (−0.44) = 2.12	Must have state symbols	1 1	5.2.3 AO1/2
5(c)	It is reduced by water $2Au^{+}(aq) + H_2O \rightarrow 2Au(s) + 2H^{+}(aq) + ½\ O_2(g)$		1 1	5.2.3 AO3

A Level OCR Chemistry

Chapter 18 – answers

Question	Answers	Extra information	Mark	AO Spec reference
5(d)(i)	$Fe(s)\,|\,Fe^{2+}(aq)\,||\,Cu^{2+}(aq)\,|\,Cu(s)$		1	5.2.3 AO1
5(d)(ii)	Contains unreactive ions Which allow charge to flow without reactants meeting		1 1	5.2.3 AO1
6(a)	Iron(II)/Fe^{2+}		1	2.1.5 AO1
6(b)	$Pt\,|\,Cl^-(aq)\,|\,Cl_2(g)\,||\,F_2O(g)\,|\,F_2(g)\,|\,Pt$	**1** mark for reagents **1** mark for Pt	1 1	5.2.3 AO1
6(c)	$2BrO_3^-(aq) + 10Cl^-(aq) + 12H^+(aq) \rightarrow 5Cl_2(g) + Br_2(aq) + 6H_2O(l)$ Brown liquid/Solution Green gas	Allow multiples Ignore state symbols **1** mark for correct choice and direction **1** mark for balancing	1 1 1 1	5.2.3 AO1/3
6(d)	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	5.2.3 AO3
7(a)(i)	$Cd + 2OH^- + 2NiO(OH) + 2H_2O \rightarrow Cd(OH)_2 + 2Ni(OH)_2 + 2OH^-$	Correct direction Balanced	1 1	5.2.3 AO1
7(a)(ii)	0.52 − (−0.88) = 1.40V		1	5.2.3 AO2
7(a)(iii)	$Cd(OH)_2 + 2Ni(OH)_2 + 2OH^- \rightarrow Cd + 2OH^- + 2NiO(OH) + 2H_2O$		1	5.2.3 AO1
7(b)	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	3.2.3 AO3

A Level OCR Chemistry

Chapter 18 – answers

Skills box answers:

a) No voltage would be measured. A complete circuit is needed. A salt bridge would need to be added.

b) The concentration of Al^{3+} would be 2 mol dm^{-3} because the formula of aluminium sulfate is $Al_2(SO_4)_3$. Therefore, 0.5 mol dm^{-3} solution of aluminium sulfate is required.

c) A platinum electrode would be required not one made of iron.

d) The temperature should be 25 °C or 298 K.

e) The temperature needs to be 298 K not 298 °C (which would be 571 K)

f) The reading will change with time, so the reading needs to be taken quickly. In reality, voltmeters have very high resistances, so this is unlikely happen very quickly.