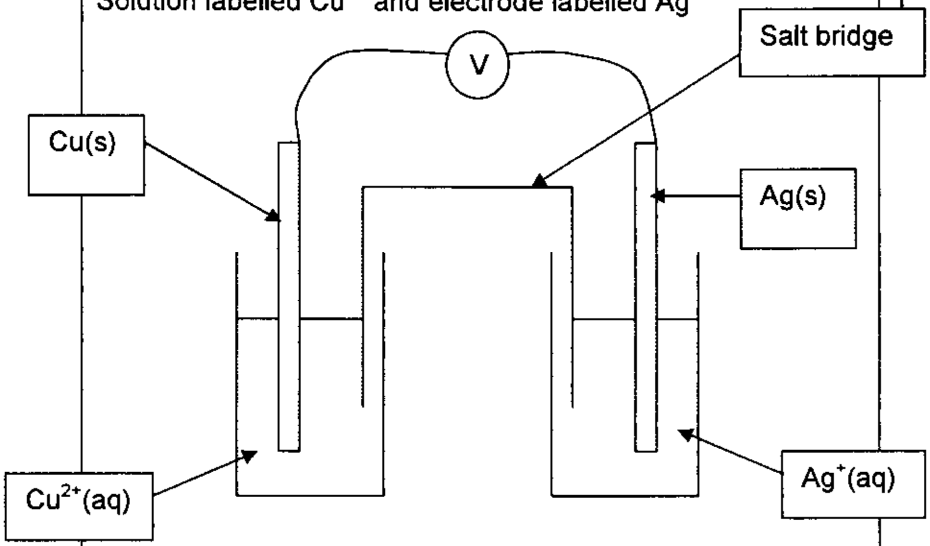
Mark Scheme 2815/06
June 2006

Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit ( ) = words which are not essential to gain credit ___ = (underlining) key words which **must** be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument	
Question	**Expected Answers**	**Marks**
1 (a)	Emf / voltage / potential difference Half cell combined with standard hydrogen electrode Standard conditions 298K, 1 mol dm^{-3}, 1 atm (all 3 required for 1 mark)	1 1 1
(b)(i)	Diagram shows: Voltmeter + salt bridge + complete circuit Solution labelled Cu^{2+} and electrode labelled Ag 	1 1
(ii)	Direction from Cu(s) to Ag(s) (must be in / close to wire)	1
(iii)	0.80 – 0.34 = 0.46 V	1
(iv)	$Cu + 2Ag^{+} \rightarrow Cu^{2+} + 2Ag$	1
(c)	Standard Electrode Potential for chlorine is more positive than Fe^{3+} therefore it is a better oxidising agent than Fe^{3+} (do not accept E° is larger or smaller) Standard Electrode Potential for iodine is less positive than Fe^{3+} therefore it is a poorer oxidising agent than Fe^{3+} (Accept release of electrons/equilibrium arguments)	1 1
		Total: 10

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Question	**Expected Answers**	**Marks**
2 (a)	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^8$ (Do not accept $[Ar]3d^8$)	1
(b)	Blue / violet / indigo / lilac (not purple / magenta / mauve) Because spectrum shows absorbance in yellow / orange / red (allow green if part of a list)	1 1
(c) (i)	Ring around O^- Ring around N (Accept ring around O of C=O as an alternative to O^-)	1 1
(ii)	<u>Lone pair</u> (of electrons) / <u>non-bonding pair</u>	1
		Total: 6

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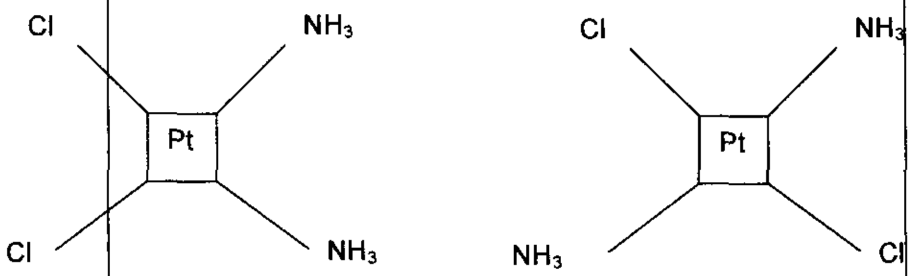
Question	Expected Answers	Marks
3 (a) (i)	Number of dative bonds / co-ordinate bonds formed with the transition metal (Do not accept number of ligands but allow number of lone pairs bonded to....)	1
(ii)	Square planar	1
(b) (i)	Ligand substitution	1
(ii)	$x = -2$ $y = 0$	1 1
(i)	*cis* isomer drawn *trans* isomer drawn (ignore any charges) 	1 1
(ii)	*cis* / *trans* or geometric	1
(iii)	Binds with DNA (not binds with cell) Prevents replication/prevents cell dividing/prevents tumour growth (*do not allow kills cell*)	1 1
		Total: 10

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Question	Expected Answers	Marks
4 (a)	Yellow → (green)→ blue → green → lilac (violet) VO_3^- (Mix) VO^{2+} V^{3+} V^{2+} 1 mark for VO^{2+} 1 mark for V^{3+} 2 marks for 4 correct colours with correct oxidation state 1 mark for 3 correct colours (*First green (mix) can be missed out without penalty*)	 1 1 2
(b)	Moles V^{2+} = 25.0 x 0.100 / 1000 = 0.0025 mols Moles MnO_4^- = 30.0 x 0.0500 / 1000 = 0.00150 mols 1 mole of MnO_4^- changes its Oxidation State by 5 to change the Oxidation State of 1.67 moles of V^{2+} Oxidation State of V^{2+} changes by 5 / 1.67 = 3	1 1 1 1
(c)	$3MnO_4^- + 5V^{2+} + 3H_2O \rightarrow 3Mn^{2+} + 5VO_3^- + 6H^+$ (1 mark for correct species, 1 mark for balanced)	 2
		Total: 10

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Question	**Expected Answers**	**Marks**
5	$[Co(H_2O)_6]^{2+}$ is pink / $[Co(NH_3)_6]^{2+}$ is light brown / $[CoCl_4]^{2-}$ is blue	1
	$[Co(H_2O)_6]^{3+}$ is blue / $[Co(NH_3)_6]^{3+}$ is dark brown	1
	Allow 1 mark for a correct +2 oxidation state ion with a correct colour and 1 mark for a correct +3 oxidation state ion with a correct colour	
	Ions can be octahedral *e.g.* $[Co(H_2O)_6]^{2+}$	1
	or tetrahedral *e.g.* $[CoCl_4]^{2-}$ *(need example in both cases)*	1
	Equation for suitable ligand exchange reaction *e.g.* $[Co(H_2O)_6]^{2+} + 4Cl^- \rightleftharpoons [CoCl_4]^{2-} + 6H_2O$	1
	$[Co(H_2O)_6]^{3+}$ is unstable / powerful oxidising agent and readily decomposes into $[Co(H_2O)_6]^{2+}$	1
	$[Co(NH_3)_6]^{3+}$ is much more stable than $[Co(H_2O)_6]^{3+}$	1
	NH_3 is a stronger ligand than H_2O / forms stronger dative covalent bonds than H_2O	1
	One mark awarded for correct spelling punctuation and grammar in at least two complete sentences	1
		Total: 9