Mark Scheme 2815/06
June 2005

TRANSITION ELEMENTS

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 of a cell / voltage / potential difference / cell potential	1
	Comprising half cell combined with standard hydrogen electrode	1
	Conc = 1 mol.dm^{-3}; Pressure (of H_2) = 1 atm; Temp = 298K	1
	(all of above=1mark)	
(b)	+0.16 V (unit required)	1
(c) (i)	$2MnO_4^- + 10Cl^- + 16H^+ \rightarrow 2Mn^{2+} + 5Cl_2 + 8H_2O$	
	correct species on both sides of equation	1
	equation balanced	1
	(ignore electrons for first mark, penalise for balance)	
(ii)	Chlorine -1 → 0	1
	Manganese +7 → +2	1
	Link to c(i) and allow ecf	
(iii)	Chloride ion oxidised (not chlorine)	1
	Manganate(VII) ion reduced (not manganese)	1
(d)	0.16 V too small/rate too slow/insufficient activation energy/not standard conditions	1
(e)	Peak between 500-550 nm	1
		Total: 12

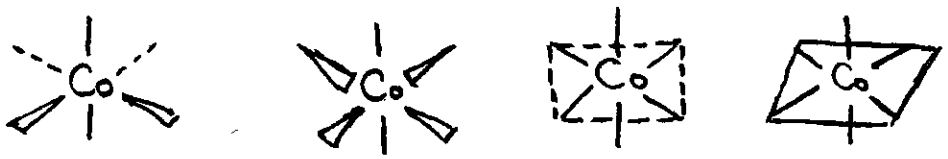
Question	Expected Answers	Marks
2 (a) (i)	Zinc	1
(ii)	Coins + resist corrosion (not rusting) / hard wearing Or statues + resist corrosion/ attractive patina Or electrical connections + good conductor Or musical instruments + attractive / sonorous Or plumbing fixtures + hard / corrosion resistant	1
(b) (i)	Sodium carbonate/sodium hydroxide/other suitable named alkali (accept correct formulae) Do not accept 'alkali' on its own	1
(ii)	Starch	1
(iii)	Just before the end point/when solution turns pale straw	1
(c) (i)	0.002 mol	1
(ii)	One (1)	1
(iii)	0.002 mol	1
(iv)	0.002 mols Cu^{2+} contains 0.002 x 63.5 g of Cu =0.127 g 250 cm^3 of solution contains10 x 0.127 g = 1.27 g % Cu = 1.27/1.65 x 100 = 77.0% (Allow 76.9-77.0; allow ecf)	1 1 1 **Total: 11**

Question	Expected Answers	Marks
3 (a)	Number of coordinate / dative covalent bonds attached to metal ion / number of lone pairs accepted (not number of ligands)	1
(b) (i)	$[Co(H_2O)_6]^{2+}$ is octahedral; $[CoCl_4]^{2-}$ is tetrahedral Drawings must be 3 dimensional (See additional sheet for acceptable 3-d diagrams)	2
(ii)	Pink → blue	2
(iii)	Add water. (Allow other suitable suggestions, e.g. add lead nitrate to precipitate Cl^- as $PbCl_2$)	1
(c)	$[Co(NH_3)_6]^{2+}$ $E^{\ominus}$ for forward reaction is least positive Reverse reaction (oxidation) more likely to occur	1 1 1
(d)	Ammonia is a stronger ligand than water / ammonia forms stronger bonds / ammonia is a stronger base / ammonia can donate its lone pair more easily	1
		Total: 10

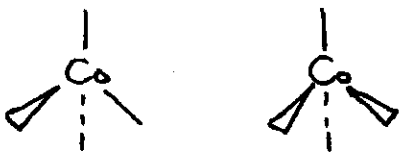
2815/06 Transition Elements June 2005 - Additional Sheet.

Question 3

(b) (i) Acceptable shapes for $[Co(H_2O)_6]^{2+}$ include:

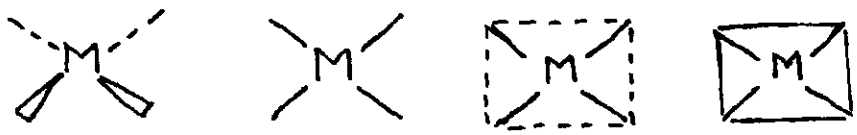


Acceptable shapes for $[CoCl_4]^{2-}$ include:



Question 4

(b) Any examples which show the principle of cis/trans isomerism and optical isomerism are fine but, all diagrams must be 3-d. The shapes, shown in Q3 are allowed for octahedral or tetrahedral. For square planar complexes used to illustrate cis/trans isomerism the following illustrations are fine. For optical isomerism, there must be a mirror line and the isomers must be non-superimposable object/mirror images.



Question	Expected Answers	Marks
4 (a) (i)	Cis platin	1
(ii)	Binds to DNA	1
	Prevents cell from replicating / cells die	1
(b)	(Cis/trans) + Examples (must be 3-d drawings)	2
	Correctly labelled as cis and trans (allow this mark if diagrams are planar)	1
	Cis has same atoms at 90^0 + Trans has same atoms at 180^0 (need reference to bond angles for mark)	1
	(Optical) + examples (must be 3-d drawings)	2
	Rotate plane polarised light (by same number of degrees) in opposite directions	1
	Non-superimposable mirror images	1
	NB If use $H_3N\ CH_2\ CH_2\ NH_3$ penalise only once (see additional sheet for acceptable 3-d diagrams)	
	QWC – to be awarded for the correct use of scientific terms, to include at least 3 of the following: Cis & trans, optical, plane, polarised, non-superimposable, mirror images, geometric, bidentate, ligand, octahedral, square planar, tetrahedral	1
		Total: 12