

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 <u> </u> = (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 Comprising half cell combined with standard hydrogen electrode Conc = 1 mol.dm ⁻³ ; Pressure (of H ₂) = 1 atm; Temp = 298K (all of above=1mark)	1 1 1
(b)	+0.16 V (unit required)	1
(c) (i)	$2\text{MnO}_4^- + 10\text{Cl}^- + 16\text{H}^+ \rightarrow 2\text{Mn}^{2+} + 5\text{Cl}_2 + 8\text{H}_2\text{O}$ correct species on both sides of equation equation balanced (ignore electrons for first mark, penalise for balance)	1 1
(ii)	Chlorine -1 → 0 Manganese +7 → +2 Link to c(i) and allow ecf	1 1
(iii)	Chloride ion oxidised (not chlorine) Manganate(VII) ion reduced (not manganese)	1 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		

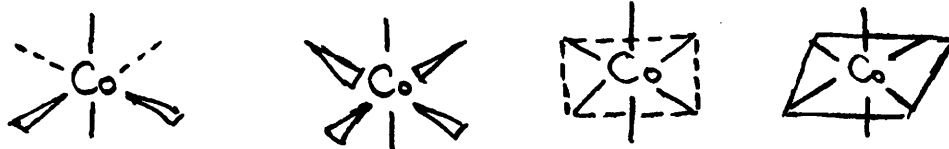
Question	Expected Answers	Marks
2 (a) (i)	Zinc	1
(ii)	Coins + resist corrosion (not rusting) / hard wearing Or statues + resist corrosion/ attractive patina Or electrical connections + good conductor Or musical instruments + attractive / sonorous Or plumbing fixtures + hard / corrosion resistant	1
(b) (i)	Sodium carbonate/sodium hydroxide/other suitable named alkali (accept correct formulae) Do not accept 'alkali' on its own	1
(ii)	Starch	1
(iii)	<u>Just</u> 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 $0.002 \times 63.5 \text{ g of Cu} = 0.127 \text{ g}$ 250 cm^3 of solution contains $10 \times 0.127 \text{ g} = 1.27 \text{ g}$ $\% \text{ Cu} = 1.27/1.65 \times 100 = 77.0\%$ (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)	<p>[Co(H₂O)₆]²⁺ is octahedral; [CoCl₄]²⁻ is tetrahedral Drawings must be 3 dimensional</p> <p>(See additional sheet for acceptable 3-d diagrams)</p>	2
(ii)	Pink → blue	2
(iii)	<p>Add water. (Allow other suitable suggestions, e.g. add lead nitrate to precipitate Cl⁻ as PbCl₂)</p>	1
(c)	<p>[Co(NH₃)₆]²⁺ E° for forward reaction is least positive Reverse reaction (oxidation) more likely to occur</p>	1 1 1
(d)	<p>Ammonia is a stronger ligand than water / ammonia forms stronger bonds / ammonia is a stronger base / ammonia can donate its lone pair more easily</p>	1 Total: 10

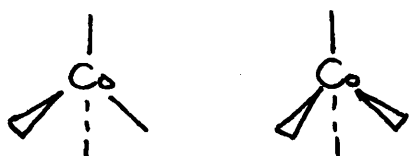
2815/06 Transition Elements June 2005 - Additional Sheet.

Question 3

(b) (i) Acceptable shapes for $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ include:

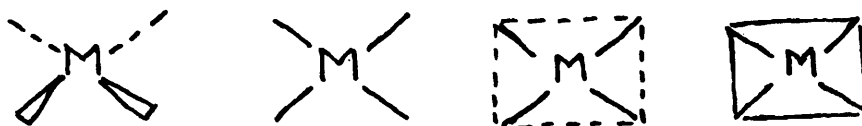


Acceptable shapes for $[\text{CoCl}_4]^{2-}$ include:



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)	<u>Cis</u> platin	1
(ii)	Binds to DNA Prevents cell from replicating / cells die	1 1
(b)	<p>(Cis/trans) + Examples (must be 3-d drawings) Correctly labelled as cis and trans (allow this mark if diagrams are planar) Cis has same atoms at 90° + Trans has same atoms at 180° (need reference to bond angles for mark) (Optical) + examples (must be 3-d drawings) Rotate plane polarised light (by same number of degrees) in opposite directions Non-superimposable mirror images NB If use $\text{H}_3\text{N CH}_2 \text{ CH}_2 \text{ NH}_3$ penalise only once (see additional sheet for acceptable 3-d diagrams)</p> <p>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</p>	<p>2 1 1 2 1 1 1</p> <p>1</p> <p>Total: 12</p>