Question	Expected Answers	Marks
1(a)	From orange to green (accept green/blue but not blue)	2
(b) (i)	Diagram to show Salt bridge Voltmeter Solution containing both $Cr_2O_7^{2-}$ and Cr^{3+} Platinum electrode	 1 1 1 1
(ii)	Pressure 101 kPa/1 Atm/100kPa Temperature 298K/25^0 C Concentration of each solution 1 mol.dm^{-3}	 1 1 1
(c)	$3H_2 + Cr_2O_7^{2-} + 8H^+ \rightarrow 2Cr^{3+} + 7H_2O$ Correct species both sides Balancing (do not allow if electrons or H^+ not cancelled)	 1 1
(d)	Equilibrium involving $Cr_2O_7^{2-}$ moves to RHS Therefore SEP more positive or $Cr_2O_7^{2-}$ gains electrons more readily / is more easily reduced / becomes a better oxidising agent	 1 1
		Total:13

Question	Expected Answers	Marks
2 (a)	M_r NH_4VO_3 = 116.9 (accept 117) Number of moles = 2.23 / 116.9 = 0.0191 Accept 0.02 for 1 mark only	1 1
(b)	Sulphur dioxide is toxic (do not allow hazardous/harmful/irritant unless qualified)	1
(c) (i)	1.91×10^{-3}	1
(ii)	$\frac{38.1 \times 0.02}{1000} = 7.62 \times 10^{-4}$	1
(iii)	$\frac{1.91 \times 10^{-3}}{7.62 \times 10^{-4}} = 2.5$	1
(d)	1 mol manganate (VII) changes OS by 5 to change OS of 2.5 moles of vanadium Therefore vanadium in solution X changes OS by 2	1 1
(e)	Not all sulphur dioxide is removed Sulphur dioxide reacts with manganate (VII)	1 1
(f)	As a catalyst In the Contact Process	1 1
		Total: 12

Question	Expected Answers			Marks
3 (a)	Formula	Co-ordination number	O.S.	
	$[Ni(H_2O)_6]^{2+}$	6	+2	2
	$CuCl_2^-$	2	+1	2
(b)	Both types of isomerism involve fixed geometry/have different arrangement in space/both are stereoisomers			1
	Cis – trans:			
	Suitable ligands with correct formulae			1
	2 diagrams			2
	correctly labelled cis and trans			1
	Optical:			
	Non-superimposable mirror images			1
	Rotate (plane) polarised light			1
	Need for correct formula bidentate ligand / 4 different ligands arranged tetrahedrally / any other asymmetric complex			1
	2 diagrams			2
	correct charges on all formulae			1
	QWC The response must be well organised and logical. It must contain a minimum of 3 technical terms from the following list: Stereoisomerism, non-superimposable, mirror images, bidentate, ligand, plane polarised, asymmetric, chiral, enantiomers, octahedral, square planar, tetrahedral.			Max 9 for (b)
				1
				Total: 14

Question	Expected Answers	Marks
4 (a)	A redox reaction involves oxidation and reduction Chooses: $2Cu^{+} \rightarrow Cu^{2+} + Cu$ Identify species oxidised and reduced by use of oxidation numbers or electron transfer	1 1 1
(b)	Chooses: $CoCl_4^{2-} + 6NH_3 \rightarrow [Co(NH_3)_6]^{2-} + 4Cl^{-}$ Replacement of existing ligand By a stronger ligand / a different ligand present in higher concentration Allow <u>stepwise</u> replacement of one ligand by another for 2 marks	 1 1 1 Total: 6