M1.(a) (i) EDTA⁴⁻ + $[Cu(H_2O)_6]^{2+} \rightarrow [Cu(EDTA)]^{2-} + 6H_2O$

1

(ii) (Mol EDTA = $(6.45/1000) \times 0.015 =)9.68 \times 10^{-5} \text{ mol Cu(II)}$

1

Conc. Cu(II) = $((9.68 \times 10^{-5}) / 0.025 =) 0.00387 \text{ mol dm}^{-3}$ Correct answer without working gains M2 only.

1

(b) Samples may not be consistent throughout the river OR
 Concentration may vary over time
 Ignore comments on technique.

1

(c) [Ag(NH₃)₂]⁺
Accept name eg diamminesilver(I) ion.

1

aldehyde

Allow CHO.

[6]

1

M2. (a) Partially filled/incomplete d sub-shell/orbital/shell

Ignore reference to f orbitals

Do not allow d block

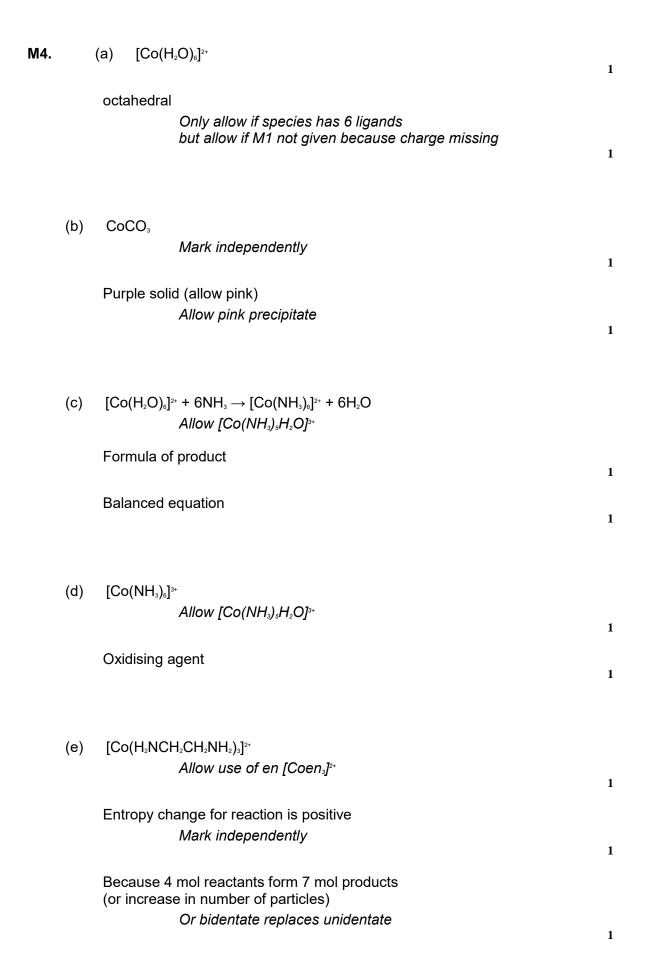
Do not allow half-filled d orbitals

1

(b) Has ligand(s)

		Allow molecules/ions with lone pairs	1
	linke	ed by co-ordinate bonds Allow dative/donation of lone pair	1
(c)	(Blue) light is absorbed (from incident white light)		
	Due to electrons moving to higher levels/electrons excited Allow $d \rightarrow d$ transitions		
	Red light (that) remains (is transmitted)/light that remains (transmitted light) is the colour observed Allow red light reflected		
(d)	(i)	Circle round any O- List principle	1
		Circle round either N	1
	(ii)	EDTA ⁴⁻ + [Co(H₂O)₅] ²⁺ → [CoEDTA] ²⁻ + 6H₂O Allow missing square brackets Ignore state symbols	1
	(iii)	Increase in entropy/ΔS positive Or increase in disorder	1
		Because 2 mol (of particles/molecules/species/entities) form 7 mol Allow 'increase in number' as stated in words or as shown by any numbers deduced correctly from an incorrect equation Do not allow increase in ions/atoms	1
(e)	(i)	Co-ordinate/dative/dative covalent bond Allow pair of electrons donated by nitrogen/ligand	

	Do not allow pa	ir of electrons donated from Iron/Fe	1	
	Covalent bond Shared electron	n pair	1	
	body) Do not allow tra	O ₂ ment that implies oxygen carried (around the ensport of carbon dioxide (CO ₂). This also mark (list principle)	1	
			1	
	Displaces <u>oxygen</u> Or prevents tran QoL	nsport of <u>oxygen</u>	1	[16]
М3.	Linear complex e.g. [Ag(NH ₃) ₂]+ (1) Tetrahedral complex e.g. [CoCl ₄] ²⁻ (1) Octahedral complex e.g. [Fe(H ₂ NCH ₂ CH ₂ NH ₂) ₃] ³⁺			
	Species (1) Charge (1)			[4]



(f) [CoCl₄]²⁻

1

Cl- ligand too big to fit more than 4 round Co²⁺

Allow Cl- is bigger

Allow chlorine and Cl but NOT chlorine molecules.

1

[13]