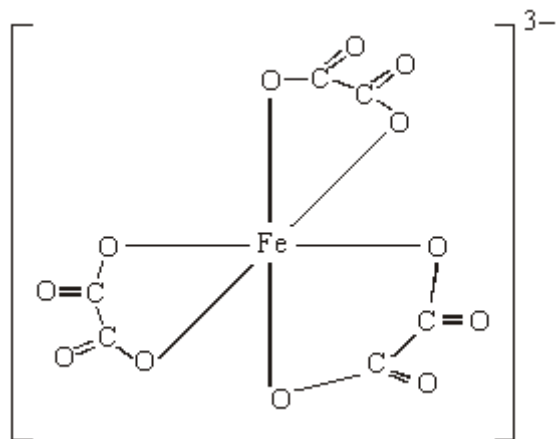


- M1.** (a) (i) Two **(1)** lone pair donor / electron pair donor **(1)** atoms
 Allow:- forms two co-ordinate bonds **(1)**
 NOT atom with two lone pairs

(ii)



Correct ligand structure **(1)**

penalise any error

Six correct O-Fe bonds **(1)**

Correct charge **(1)**

N.B. Penalise the second mark if arrow from Fe shown

N.B. Ignore charges on atoms

($\begin{array}{c} \text{O} \\ || \\ \text{C} \end{array}$ not essential)

5

- (b) (Substitution of a monodentate ligand by a) bi or multidentate ligand **(1)** giving a more stable complex **(1)** or with an increase in entropy / disorder or forming a ring / cage complex / structure (crab like)

2

- (c) (i) $[\text{AgCl}_2]^-$ or AgCl_2^- **(1)**

- (ii) Chloride or Cl^- big or large or repel **(1)**
 NOT Cl_2 or Cl^\cdot or Cl

- (d) (i) (Both) ions are negative or ions repel or High E_a (1)
- (ii) *Meaning of the term autocatalytic:* A product of the reaction acts as a catalyst (1)
NOT a self catalysing reaction (0)
Catalyst: Mn^{2+} or Mn^{3+} (1)
- (iii) Mn^{2+} converted into Mn^{n+} or Mn^{2+} oxidised (1)
 Mn^{n+} /oxidised species then oxidises/reacts with $C_2O_4^{2-}$ (1)

5

[14]

M2.D

[1]

- M3.** (a) $C_2O_4^{2-}$ or $H_2NCH_2CH_2NH_2$ (1) 1
- (b) $[AgCl_2]^-$ or $[Ag(CN)_2]^-$ or $[Ag(NH_3)_2]^+$ (1) 1
- (c) e.g. $[Co(H_2O)_6]^{2+} + 4Cl^- \rightarrow [CoCl_4]^{2-} + 6H_2O$
 Correct complex species (1), Balanced (1), Only allow if species correct 2

- (d) e.g. $[\text{Co}(\text{H}_2\text{O})_6]^{2+} + 6\text{NH}_3 \rightarrow [\text{Co}(\text{NH}_3)_6]^{2+} + 6\text{H}_2\text{O}$
 Correct complex species (1), Balanced (1), Only allow if species correct 2
- (e) *Equation:* $[\text{Co}(\text{H}_2\text{O})_6]^{2+} + \text{EDTA}^{4-} \rightarrow [\text{Co}(\text{EDTA})]^{2-} + 6\text{H}_2\text{O}$ (1)
Explanation: More molecules on right hand side (1)
 Entropy increases (1) 3

[9]

- M4.** (a) A shared electron pair or a covalent bond (1)
 Both electrons from one atom (1)
OR when a Lewis base reacts with a Lewis acid
Mark points separately 2
- (b) *Brønsted-Lowry acid:* A proton or H^+ donor (1)
Not H_3O^+
Lewis acid: A lone or electron pair acceptor (1) 2
- (c) Two atoms or two points of attachment (1)
 Each donating a lone electron pair (1)
OR forms 2 (1) co-ordinate bonds (1)
OR donates two (1) pairs of electrons (1) 2
- (d) *Change in co-ordination number:* 6 to 4 (1)
Reason for change: chloride ligands are larger than water ligands (1) 2
OR greater repulsion between chloride ligands
DO NOT allow chlorine or Cl

(e) Same number **(1)**, and same type of bonds **(1)**, broken and made

2

(f) $\text{ClNH}_3\text{CH}_2\text{CH}_2\text{NH}_3\text{Cl}$ **(1)**

OR $(\text{NH}_3\text{CH}_2\text{CH}_2\text{NH}_3)^{2+} 2\text{Cl}^-$

Allow $\text{C}_2\text{H}_{10}\text{N}_2\text{Cl}_2$ and $\text{NH}_3\text{ClCH}_2\text{CH}_2\text{NH}_3\text{Cl}$

1

[11]