

| Question | Part | Sub Part | Marking Guidance  | Mark | Comments   |
|----------|------|----------|---|------|--|
| 7        | (a)  |          | $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$  | 1    | Only allow if species has 6 ligands but allow if M1 not given because charge missing |
|          |      |          | octahedral  | 1    |  |
| 7        | (b)  |          | $\text{CoCO}_3$   | 1    | Mark independently   |
|          |      |          | Purple solid (allow pink)   | 1    | Allow pink precipitate   |
| 7        | (c)  |          | $[\text{Co}(\text{H}_2\text{O})_6]^{2+} + 6\text{NH}_3 \rightarrow [\text{Co}(\text{NH}_3)_6]^{2+} + 6\text{H}_2\text{O}$ |      | Allow $[\text{Co}(\text{NH}_3)_5\text{H}_2\text{O}]^{3+}$                            |
|          |      |          | Formula of product  | 1    |  |
|          |      |          | Balanced equation   | 1    |  |
| 7        | (d)  |          | $[\text{Co}(\text{NH}_3)_6]^{3+}$   | 1    | Allow $[\text{Co}(\text{NH}_3)_5\text{H}_2\text{O}]^{3+}$                            |
|          |      |          | Oxidising agent   | 1    |  |
| 7        | (e)  |          | $[\text{Co}(\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2)_3]^{2+}$  | 1    | Allow use of en $[\text{Coen}_3]^{2+}$   |
|          |      |          | Entropy change for reaction is positive   | 1    | Mark independently   |
|          |      |          | Because 4 mol reactants form 7 mol products (or increase in number of particles)  | 1    | Or bidentate replaces unidentate   |
| 7        | (f)  |          | $[\text{CoCl}_4]^{2-}$  | 1    | Allow $\text{Cl}^-$ is bigger<br>Allow chlorine and Cl but NOT chlorine molecules.   |
|          |      |          | $\text{Cl}^-$ ligand too big to fit more than 4 round $\text{Co}^{2+}$  | 1    |  |