• Draw all stereoisomers of the complex ion of [CoCl₂(en)₂]Cl. Label the non-optically active isomer with its systematic name. (en = ethylenediamine = 1,2-ethanediamine = NH₂CH₂CH₂NH₂)

Marks

2

$$\begin{bmatrix} H_2 & Cl & H_2 \\ N_{1,1,1,1} & N_{1,1} & N_{1,1} \\ H_2 & Cl & H_2 \end{bmatrix}$$

$$\begin{bmatrix} H_2H_2N \\ N_{1,1,1} & N_{1,1} & N_{1,1} \\ H_2 & Cl & H_2 \end{bmatrix}$$

$$(optically inactive)$$

$$trans-dichloridobis(ethylenediamine)cobalt(III) ion$$

$$enantiomers$$

• What is a dative bond and does it differ from a covalent bond? Use examples from coordination chemistry and elsewhere to illustrate your answer.

Dative bonds are similar to covalent bonds, but both electrons in the bond are donated by one atom.

They are typically found in coordination complexes where the lone pair on the ligand forms a bond with the metal ion. See the above Co(III) complexes for examples and the BF₃-ether adduct below for a different type of example. In general, dative bonds are weaker, longer and less directional than covalent bonds.

$$F - B \qquad CH_{3} \qquad F - B \qquad CH_{3} \qquad F - B \qquad CH_{3} \qquad dative \ bond \\ covalent \ bonds \qquad dative \ bond \\ both \ electrons \ donated \ by \ O$$