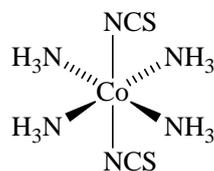
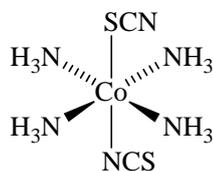
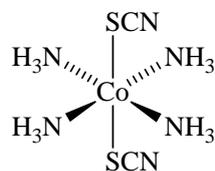
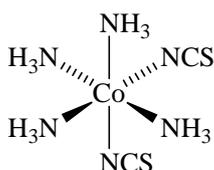
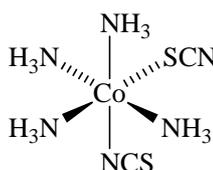
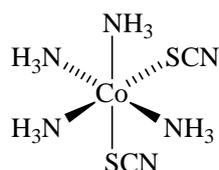


- Write out the full name in standard notation of  $[\text{Co}(\text{NH}_3)_4(\text{SCN})_2]\text{Cl}$  and draw all the possible isomers of the complex ion.

**tetraamminedithiocyanatocobalt(III) chloride**



*trans-isomers*



*cis-isomers*

2 thiocyanato ligands

1 thiocyanato ligand &  
1 isothiocyanato ligand

2 isothiocyanato ligands

Describe and contrast the nature of the chemical bonds:

- between N and H in  $\text{NH}_3$ ;
- between Co and  $\text{NH}_3$ ; and
- between  $[\text{Co}(\text{NH}_3)_4(\text{SCN})_2]^+$  and  $\text{Cl}^-$  in this compound.

**N–H bonds are covalent in  $\text{NH}_3$ . These bonds are relatively short, strong and highly directional. They involve the sharing of electrons from both atoms involved in the bond.**

**$\text{Co}:\text{NH}_3$  coordination bonds are due to the donation of the lone pair of electrons on N to the  $\text{Co}^{3+}$ . These bonds are highly polar and are generally weaker, longer and less directional than covalent bonds.**

**$[\text{Co}(\text{NH}_3)_4(\text{SCN})_2]^+$  and  $\text{Cl}^-$  are ionically bonded in the solid state due to Coulombic attraction between the oppositely charged ions. These bonds are strong but not directional (i.e. they occur between every pair of ions in the solid with a strength that decreases with their separation).**