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- Briefly outline three kinds of isomerism that can arise in coordination complexes, illustrating each type of isomerism with structural formulas. Give the systematic name for any one of your structures.

**Structural isomers have the atoms connected differently:**

**(i) coordination isomers have different ligands attached. For example, $CrCl_3 \cdot 6H_2O$ can potentially exist as:**

| | |
|---|---|
| **$[Cr(OH_2)_6]Cl_3$** | **hexaquachromium(III) chloride** |
| **$[CrCl(OH_2)_5]Cl_2 \cdot H_2O$** | **pentaquachloridochromium(III) chloride-1-water** |
| **$[Cr\ Cl_2(OH_2)_4]Cl \cdot 2H_2O$** | **tetraquachloridochromium(III) chloride-2-water** |
| **$[Cr(H_2O)_3Cl_3] \cdot 3H_2O$** | **triaquachloridochromium(III) chloride-3-water** |

**(ii) linkage isomers have different atoms on a ligand attached. For example, $NO_2^-$ can bond through the N atom, to make nitro complexes, or through an O atom, to make nitrito complexes:**

| | |
|---|---|
| **$[Co(NH_3)_5(NO_2)]Cl_2$** | **pentaminenitrocobalt(III) chloride** |
| **$[Co(NH_3)_5(ONO)]Cl_2$** | **pentaaminenitritocobalt(III) chloride** |

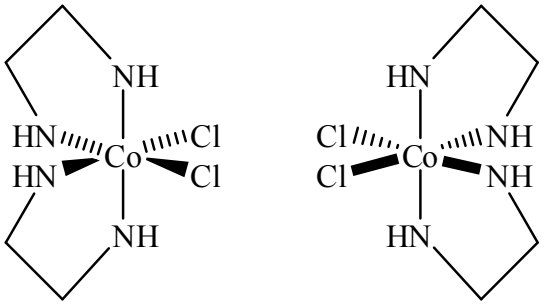
**Stereoisomers have the atoms connected in the same way but have different spatial arrangements:**

**(i) geometrical isomers have different arrangements in space. Examples include *cis* and *trans* isomers such as those of $Pt(NH_3)_2Cl_2$:**


***cis*-diamminedichloridoplatinum(II)**


***trans*-diamminedichloridoplatinum(II)**

**(ii) optical isomers are non-superimposable mirror images. For example, the *cis* isomer of $[CoCl_2(NH_2CH_2CH_2NH_2)_2](NO_3)$ can exist in two forms**




**dichloridobisethylenediaminecobalt(III) nitrate**