

Co-ordination Compounds ^{1.}

Degree-II (H), Paper-III, Group-B

10/11/2020

WERNER'S THEORY (Continued..)

Werner studied the structure and properties of the following four complexes of Co(III) chloride with ammonia which have different colours.

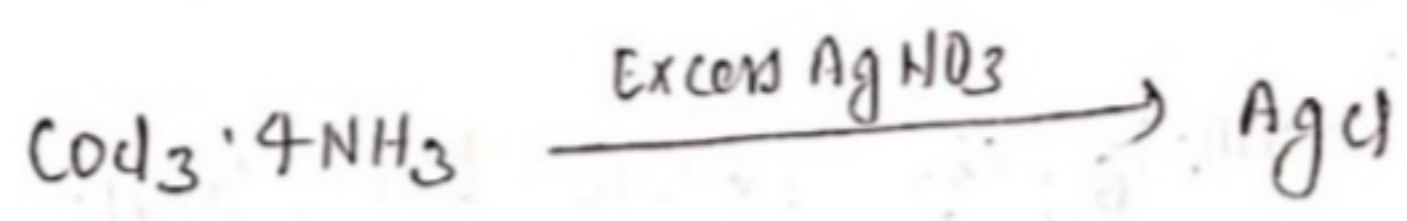
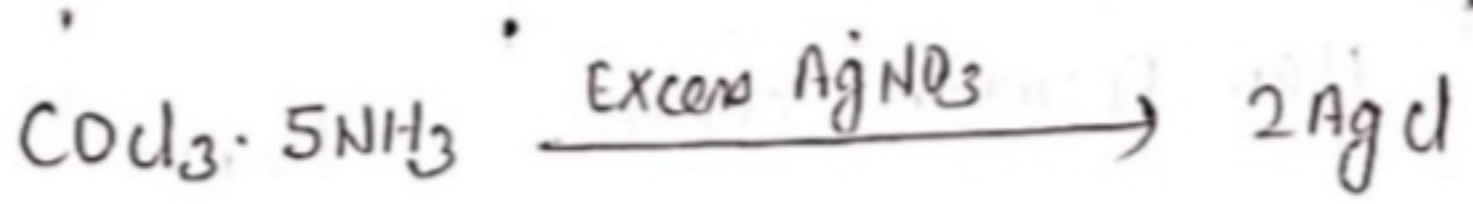
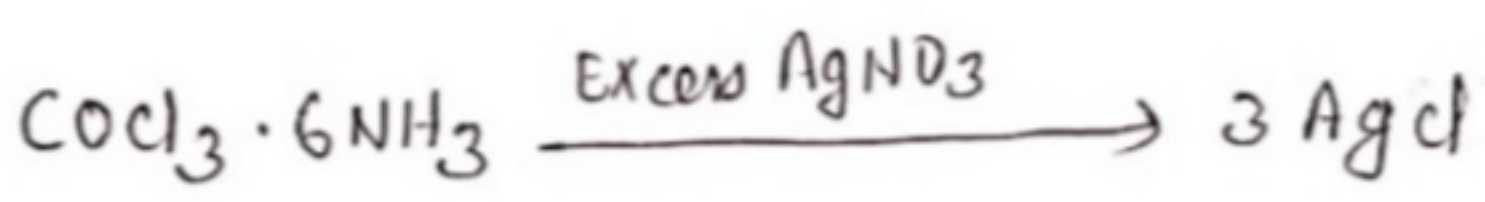
Complexes of Co(III) chloride with Ammonia

Compounds

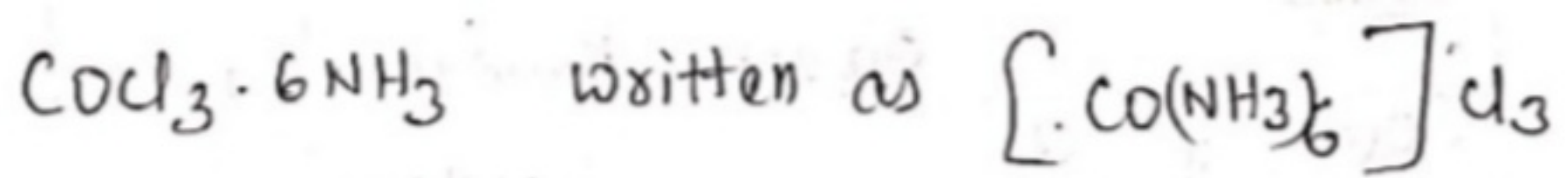
Old formula	New formula	colour	Old name	No. of ions	
				Cation	anion
$\text{CoCl}_3 \cdot 6\text{NH}_3$	$[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$	Yellow	Luteo complex	1	3
$\text{CoCl}_3 \cdot 5\text{NH}_3$	$[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$	Purple	Purpureo complex	1	2
$\text{CoCl}_3 \cdot 4\text{NH}_3$	Trans- $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$	Green	Praseo complex	1	1

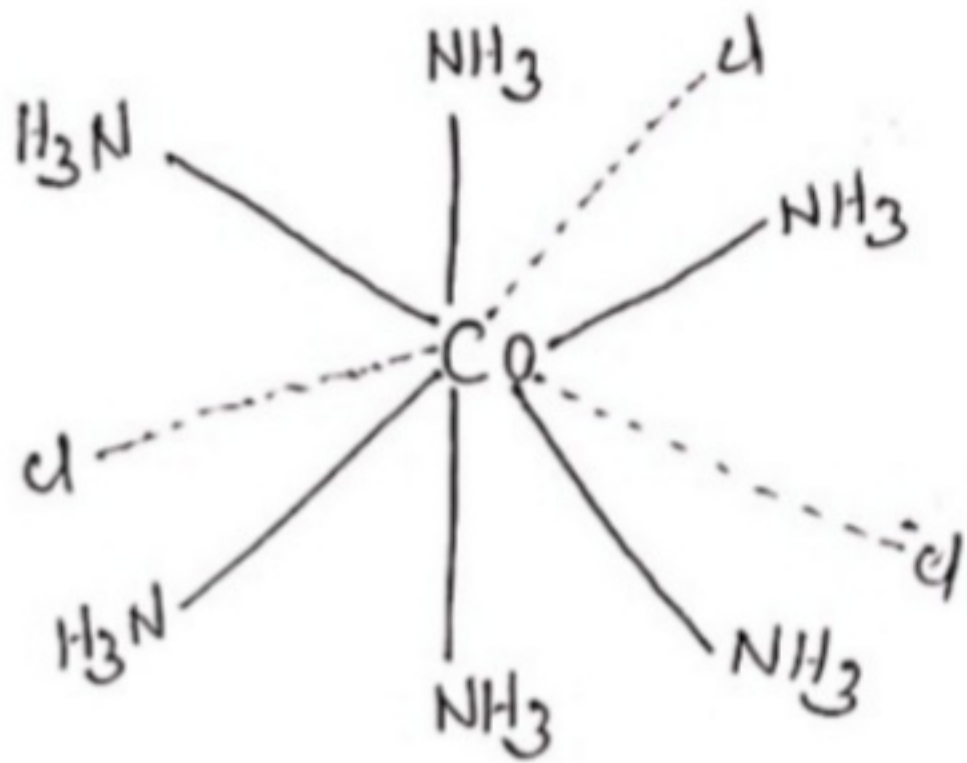
$\text{CoCl}_3 \cdot 4\text{NH}_3$	$\text{cis-}[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$	violet	violet complex	1	1
$\text{CoCl}_3 \cdot 3\text{NH}_3$	$[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$	Blue green	—	—	—

* Werner treated the first four complexes of Co(III) given in above table with excess of AgNO_3 . The white ppt. of AgCl were obtained in different amount.

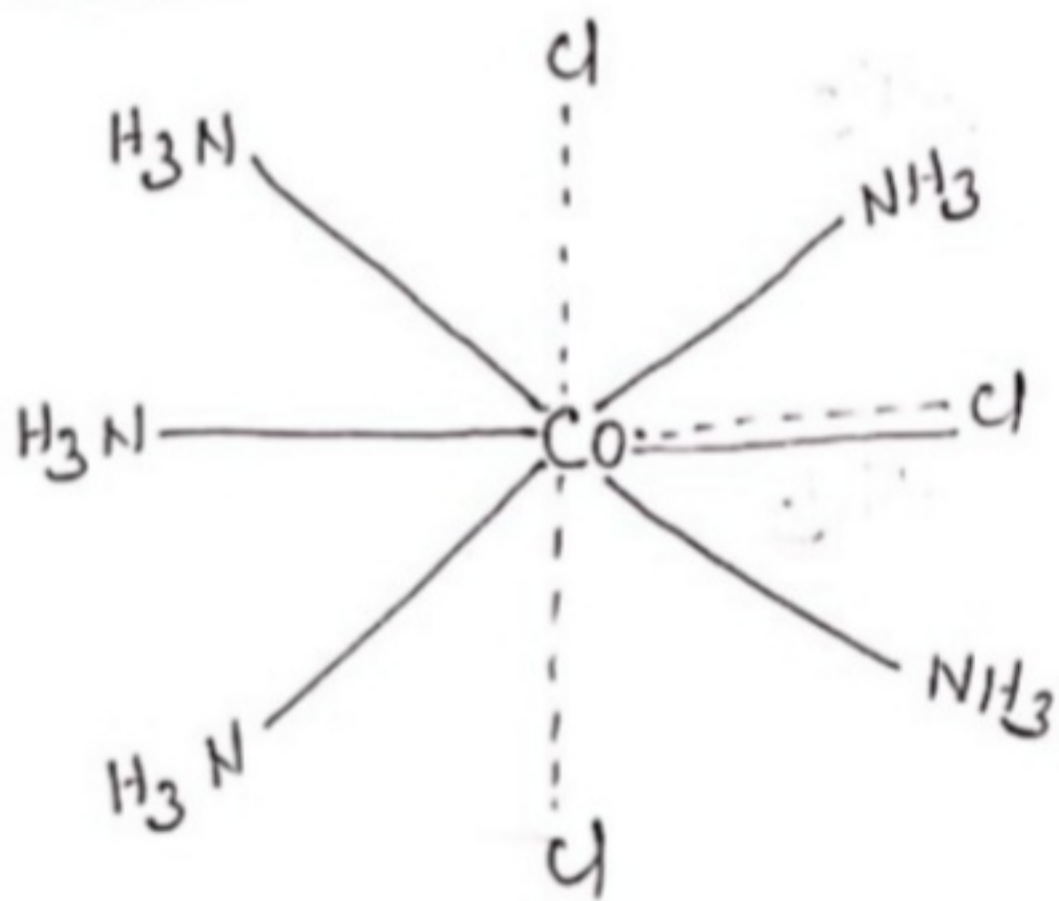


* Werner reported that in $\text{CoCl}_3 \cdot 6\text{NH}_3$ all the three chloride satisfy only primary valency. The primary valency is represented by dotted lines (.....) and secondary valencies are represented by solid line (—).

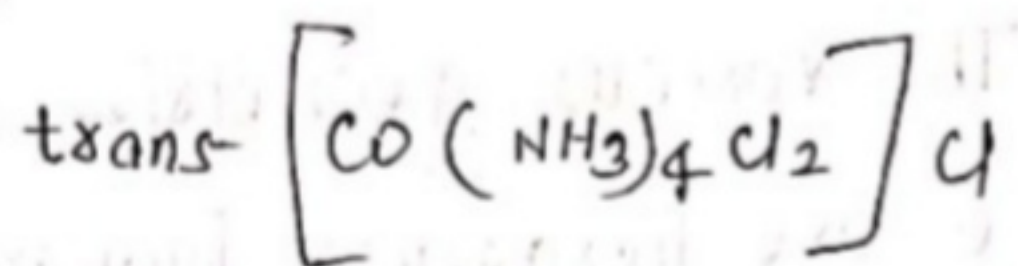


Structure

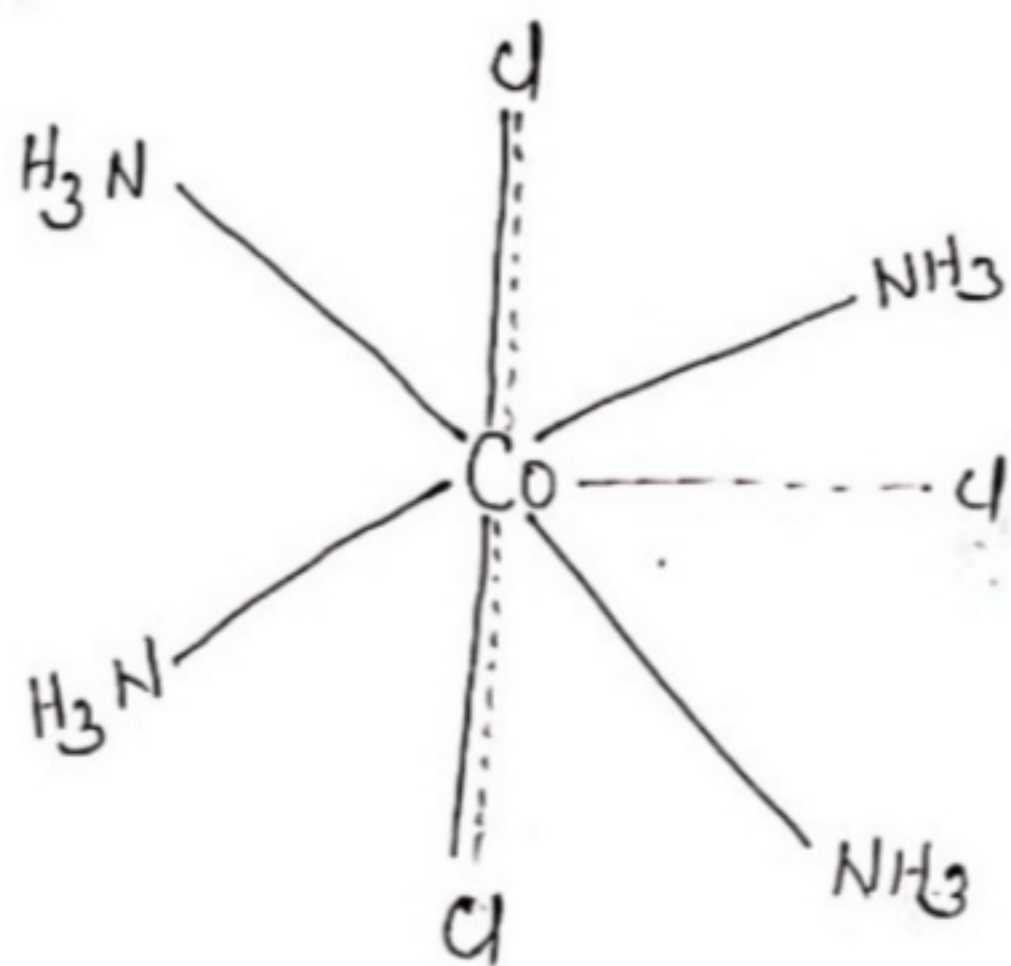
* $\text{CoCl}_3 \cdot 5\text{NH}_3$ written as $[\text{Co}(\text{NH}_3)_5\text{Cl}] \text{Cl}_2$

Structure

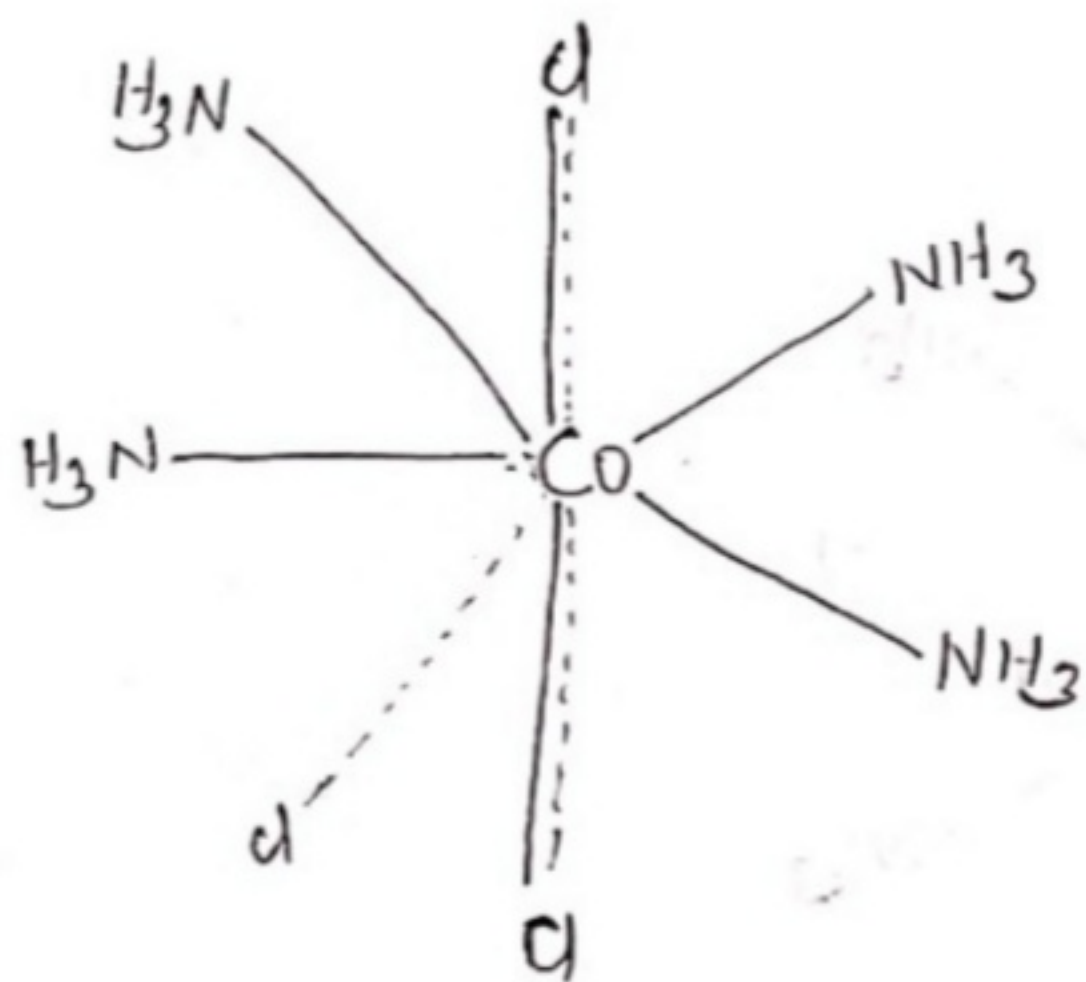
* $\text{CoCl}_3 \cdot 4\text{NH}_3$ written as



4.



* $\text{CoCl}_3 \cdot 4\text{NH}_3$ written as $\text{cis-}[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$



* Werner also attempted to find the geometries of isomers of complexes of $\text{Co}(\text{III})$, $\text{Cr}(\text{III})$, $\text{Co}(\text{II})$, $\text{Pt}(\text{II})$ etc.

* The various geometries for complexes of coordination no. 6 are hexagonal planar, trigonal prismatic and octahedral.

Continued..