Inorganic Chemistry

B.Sc Part-2, Group-3

Werner's Theory Continue:

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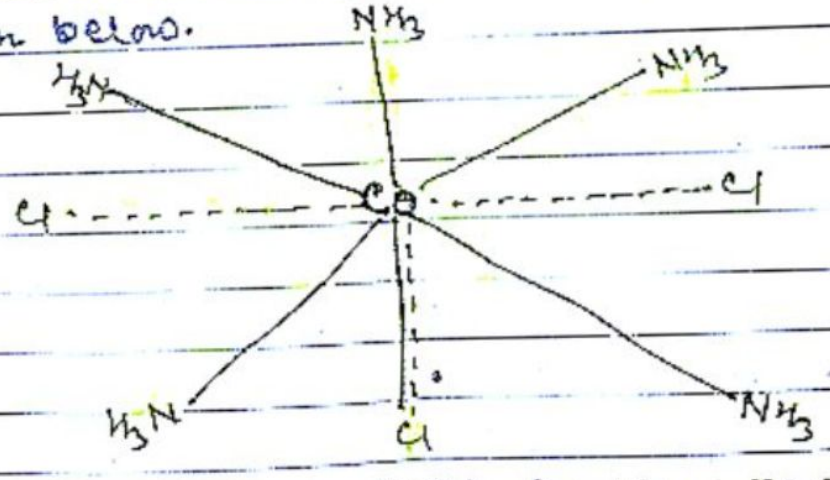
Lecture Note Series :-

*2. $CoCl_3 \cdot 5NH_3$ Complex :- In this complex compounds the coordination no of cobalt remains six but now five positions are occupied by NH_3 molecules and the six position by one of the chloride ion. Here chloride ion exhibits a dual behaviour as it is held by a secondary as well as primary valency. We have indicated here the secondary valency by full line and the primary valency by dotted line. which is shown in figure under given below.



[Structure of $CoCl_3 \cdot 5NH_3$ complex. no of Cl^- Precipitate = 2
Total no of ions = 3]

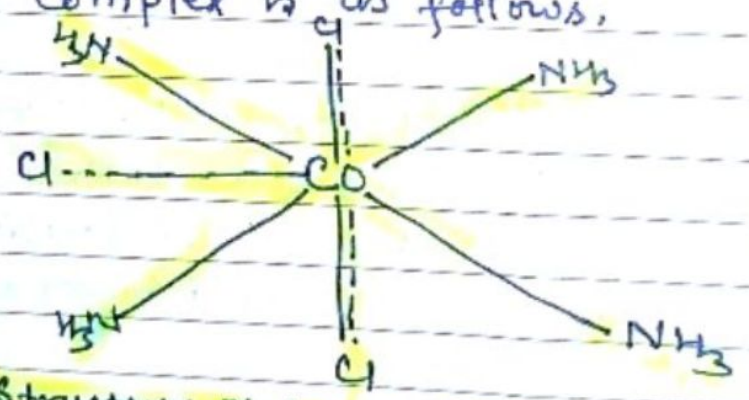
The above figure the full line show the direction of the metal ligand bond whereas the dotted line indicate an ionic bond which is non-directional. This structure satisfied the Three primary and

six secondary valency of cobalt. The addition of $AgNO_3$, however will precipitate only two chloride ions which are linked by purely primary valencies. The total no of ions in this case is 3, two chloride ions and one complex ion as indicated.

Thus the complex may be formulated as $[CoCl(NH_3)_5]Cl_2$.

The dotted lines indicates only the ionic intraction between Co^{3+} and Cl^- ion. They do not show the directions of the primary valencies. The position of Cl^- ion held by primary valencies are determined by the type of the crystal structure adopted by the complex.

*3. $CoCl_3 \cdot 4NH_3$ Complex :- In this complex compound, two chloride ions exhibits dual behaviour of satisfying both primary and secondary valencies. The figure of this complex is as follows,



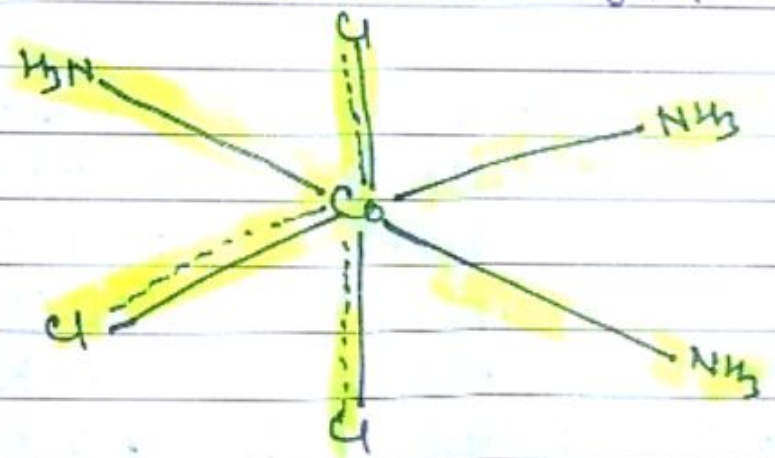
[Structure of $CoCl_3 \cdot 4NH_3$ complex

No of Cl^- ion precipitated = 1

Total no of ion = 02

When Complex react with Silver nitrate only one Chlorine ion give Precipitate. and the total no of ions in this case is 2 (as indicated by determination of cryoscopic measurments) Hence It may be formulated as $[CoCl_2(NH_3)_4]Cl$

*4. $CoCl_3 \cdot 3NH_3$ Complex:- In this complex compound, three chloride ions Stalisfy Primary as well as Secondary valencis. It is clear that addition to Silver nitrate no Cl^- ion will be Precipitated at room temprature. Thus the Complex behaves as a neutral ion conducting molecules and formulated as $[CoCl_3(NH_3)_3]$ and above Statment Satisfied by the given figure.



[Structure of $CoCl_3 \cdot 3NH_3$ Complex, no of Cl^- ions Precipitated is nil. It is neutral molecules.

Notes