1972

EXPERIMENTAL MEASUREMENTS

| COMPOUND | Moles of Chloride Precipitated by $AgNO_3$ per mole $CrCl_3 \cdot 6H_2O$ | Moles of Water Removed by drying agent per mole of $CrCl_3 \cdot 6H_2O$ | Number of ions per "molecule" of complex (from electrical conductivity) |
|---|---|---|---|
| Violet | 3 | 0 | 4 |
| Light Green | 2 | 1 | 3 |
| Dark Green | 1 | 2 | 2 |

For each of the three compounds having the same formula, $CrCl_3 \cdot 6H_2O$, account for the experimental measurements given above. Show the structural formula for each of the compounds, and relate the structure to the measurements.

1983 C

The transition metal complex ion, $[Co(NH_2CH_2CH_2NH_2)_2Cl_2]^+$, has an octahedral shape and exists as two geometrical isomers.

(a) Draw the structural formulas for the two geometrical isomers.

(b) One of the geometrical isomers exists as two optical isomers. Draw the structural formulas for the two optical isomers.

(c) How many moles of AgCl would be immediately precipitated when excess $AgNO_3$ solution is added to an aqueous solution contain 1 mole of $[Co(NH_2CH_2CH_2NH_2)_2Cl_2]Cl$, the chloride salt of the transition metal complex? Explain your reasoning.

Answer:

(a) Representation of the cobalt complex as an octahedral complex.
Ethylenediamine shown as a bidentate ligand.
Representation of the <u>cis</u> isomer.
Representation of the <u>trans</u> isomer.

(b) The cis isomer has optical isomers.
Showing structures for the optical pair.

(c) One mole of AgCl precipitates. One chloride is shown as ionically bonded and precipitates as AgCl at once.
Each of the other chlorides shares a pair of electrons with the cobalt and thus does not readily form an AgCl precipitate.

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