Metal-Ligand Complexes of Cobalt(III)

There are a number of different compounds we can prepare by reacting together cobalt(III), Co^{3+}, ammonia, NH_3, and the chloride ion, Cl^-. The following table provides data on several such compounds.

An empirical formula provides the simplest stoichiometry for a compound, but does not provide information about the bonding within the compound. The chloride ions in these compounds are either bound to Co^{3+} as ligands or present as anions to balance the charge of a cation; the latter type of chloride ions are free chlorides. Dissolving an ionic compound in water produces ions, the number of which is determined by conductivity. The colors of the compounds appear in the last column.

compound	empirical formula	free chlorides	ions/cobalt	color
a	$CoCl_3(NH_3)_6$	3	4	orange-yellow
b	$CoCl_3(NH_3)_5$	2	3	purple
c	$CoCl_3(NH_3)_4$	1	2	violet
d	$CoCl_3(NH_3)_4$	1	2	green
e	$CoCl_3(NH_3)_3$	0	0	green

What patterns do you see in this data? What questions do this data raise for you?