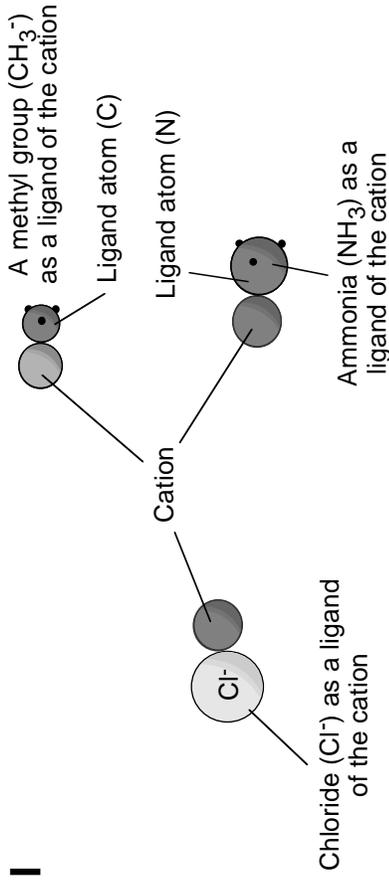


## Speciation of cations in aqueous solution I

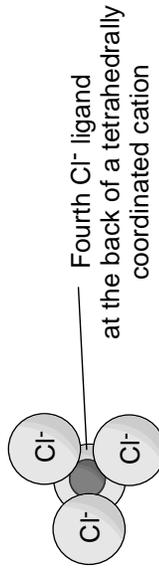
Ions dissolved in solution rarely travel alone as solitary ions. Instead, they are linked to other atoms by electrostatic attractions or bonds that may be in part covalent. The atom, ion, or molecule to which they are linked is a **ligand**. If the ligand consists of more than one atom, the specific atom with which the ion is linked is the **ligand atom**.

Because ions can combine with different ligands (like chloride, methyl, or ammonia in the sketch at right), we speak of the different species of complexed ions and thus "**speciation**". The combining of an ion with a ligand is called "**coordination**". Thus the ion in the sketch has coordinated with chloride, methyl, and ammonia here to form three different coordination compounds or species.

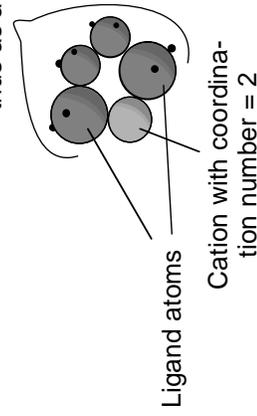
A ligand with more than one ligand atom is a **multidentate ligand**. A coordination compound made by a multidentate ligand is a **chelate** ("key'late").



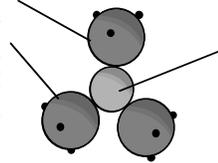
An ion's **coordination number** is the number of ligand atoms with which it coordinates. In the overly simple examples above, the coordination number is one. In the example below, it is four.



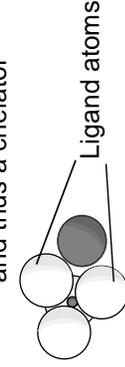
Ethylenediamine or "en" ( $\text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2$ ) as a bidentate ligand and thus as a chelator.



Ammonia ( $\text{NH}_3$ ) as a monodentate ligand



Sulfate ( $\text{SO}_4^{2-}$ ) as a bidentate ligand and thus a chelator



Cation coordinated with two ethylenediamines (coordination number = 4)