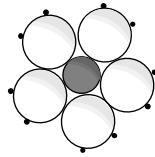


Speciation of cations in aqueous solution II

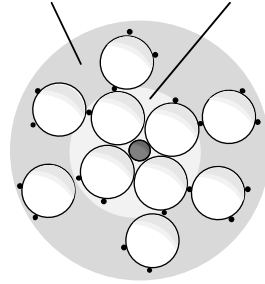
One simple form of coordination is **hydration**, where the ligands are water molecules and the ligand atoms are the O²⁻s of the water molecules. The number of water molecules serving as ligands is the **hydration number**, a specific sort of coordination number.

Hydrated cations (aquo-ions):



Cation of low ionic potential (e.g., K⁺) with low hydration number

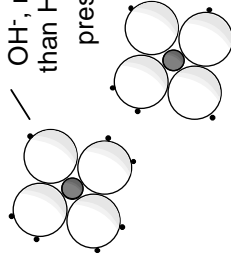
Note that the smaller cation has the larger hydrated radius.



Cation of higher ionic potential (e.g., Be²⁺) attracts more H₂O's and so has higher hydration number.

Hydroxo-complexes:

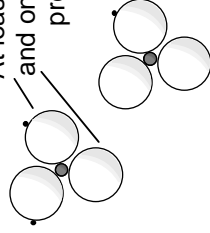
At least one OH⁻, rather than H₂O, is present



Cation of intermediate ionic potential (e.g., Al³⁺ as Al(OH)²⁺ or Al(OH)₂⁺)

Oxo-hydroxo-complexes:

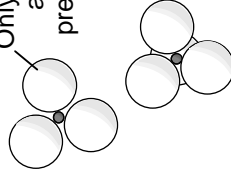
At least one OH⁻ and one O²⁻ are present



Cation of high ionic potential (e.g., C⁴⁺ as H₂CO₃ or HCO₃⁻)

Oxo-complexes:

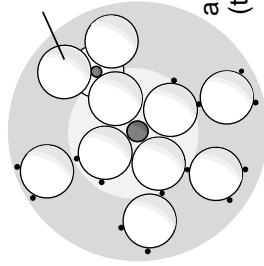
Only O²⁻s are present



Cation of highest ionic potential (e.g., N⁵⁺ and S⁶⁺ as NO₃⁻ and SO₄²⁻)

Increasing ionic potential of cation (cation increasingly repels H⁺ ions and/or increasing pH (H⁺ ions leave complex for solution) (See "Aqueous speciation of some hard cations across the periodic table")

Inner sphere complexes:



Ligands other than H₂O must interact with the hydration sphere as they coordinate with a cation. If they penetrate all the way to the cation, they form an **inner-sphere complex**. On the other hand, if they don't break through the inner sphere, they form an **outer-sphere complex**.

Outer-sphere complex:

