

E5 Lewis Acids and Bases

Session one

Pre-lab (p.141) due at start of lab.

Hour 1: Discussion of E4

Hours 2 & 3: Lab (Parts 1 and 2A)



Session two

Lab: Parts 2B, 3 and 4

Acids

Bronsted: Acids are proton donors.

Problem

- Compounds containing cations other than H^+ are acids!

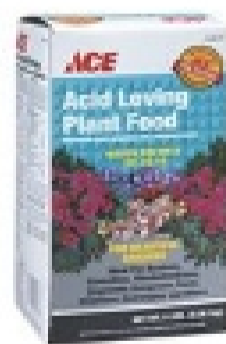
DEMO



Acids

- Cations other than H^+ generate hydronium ions in aqueous solution!

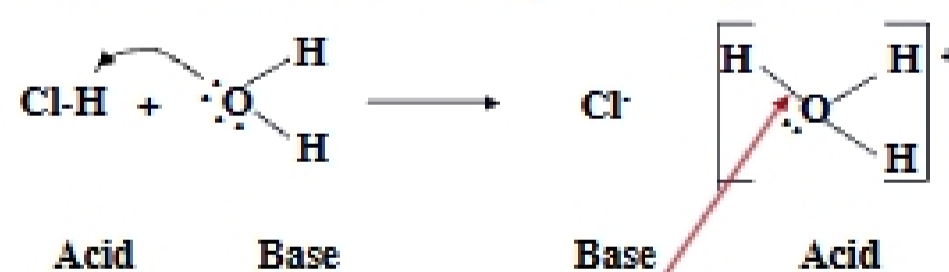
Example: $Al^{3+} (aq) \approx pH 3!$



Deodorants and acid loving plant foods contain aluminum salts

Lewis Definition of Acids and Bases

Define acid/base without using the word proton:



- A BASE DONATES unbonded ELECTRON PAIR/S.
- An ACID ACCEPTS ELECTRON PAIR/S.

Aquo Complex Ions

▪ When a salt dissolves, the metal ions in the salt solution react with/bond to water molecules to form aquo complex ions.

Example:

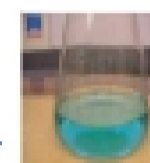


Aquo Complex Ions

Examples



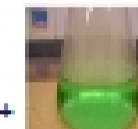
$[\text{H}(\text{H}_2\text{O})]^+$
Hydronium ion



$[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$
Tetra aquo copper(II) ion



$[\text{Pb}(\text{H}_2\text{O})_4]^{2+}$
Tetra aquo lead ion



$[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
Hexa aquo nickel ion

▪ Colored aquo complex ions contain a transition metal ion with incompletely filled d orbitals.

Part 1. Acidity of Cations

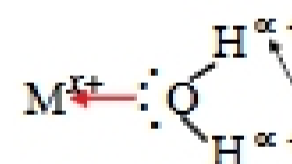
▪ Study the reaction of metal aquo complex ions with the Lewis base H_2O to produce hydronium ions.

▪ Collect pH data for different metal aquo complex ions in aqueous solution.

- pH versus periodic table position of ion's metal?
- pH versus metal ion size and charge?



Metal Ion Acid Strength



- The acid strength of a metal ion is dependent on its ability to attract electrons (oxidizing agent strength)
- The greater the acid strength of a metal ion the more polarized the bonded water molecules (and electron deficient the protons) in the aquo complex ion.