Chemistry 116
11/6/08
Lecture Notes-JR

Arrhenius model: To decide whether an equation is of this type, decide which chemical on the reactant side is an acid and which is a base.

- The acid always has an H+
- The base always has an OH-
- The reaction always has water as a product
- Always a salt in the product (cation from base, anion from acid)
    - They are exchange reactions: "couples switching partners"

A good question on an exam might be to decide if a given equation is from the arrenius model, bronsted-lowry, or neither.

Bronsted-Lowry: A more general model of acid-base reactions, Arrenius equations are just a more specific form of this category.

- Bases do not necessarily have a removable OH^-. That is, OH^- can be the base, but there are lots of other things that could also be Bronsted-Lowry bases.
- To figure out, just look at base. If there is an OH^-, the equation is Arrhenius model (and also B-L model, since Arrhenius is a subset of it).
- Upon losing an H^+, the overall change becomes more negative.

Conjugate pairs: Related by H^+

- Acid has H^+… conjugate base is missing that H^+.
- Same for reverse, conjugate acid in the product has one more H^+ than the base in the reactants.
- Base accepts an H^+
- Acid has a removable H^+

Examples of Arrhenius bases (substance that produces OH^- when added to water)

- NaOH, $Ba(OH)_2$

Amphiprotic: can donate or accept a proton (H^+). In other words, it can be an acid or a base.

- Water is an example of an Amphiprotic molecule

Ionizations: formation of ions

- In acid ionization: Water (H_2O) act as the base on the reactant side, and H_3O^+ is the conjugate acid of water on the product side
- In base ionization: Water (H_2O) act as the acid on the reactant side, and OH^- is the conjugate base of water on the product side

* Don't include water in acid and base ionization equilibrium constant equations because it is a liquid, and the reaction takes place in the aqueous phase, which is higher entropy than liquid.

Which direction does the equilibrium lie?

- Look at both sides of the equation.
- Find which side the stronger acid is on.
- Whichever side has the stronger acid will react more, pushing the acid in the left or right direction.
- For example, if the stronger acid is on the left side of the equation (reactants), then the equilibrium will lie to the right. On the other hand, if the stronger acid is on the right (products) then the equation will go to the left.

*The *stronger* the acid, the *weaker* the conjugate base.

For any acid-base conjugate pair (such as NH_4^+ and NH_3), K_a is related to K_b by:

- K of water = $K_a \cdot K_b$ (K_a multiplied by K_b)
- K of water is equal to 1.0×10^{-14} when it is 25ºC