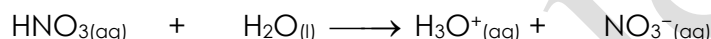
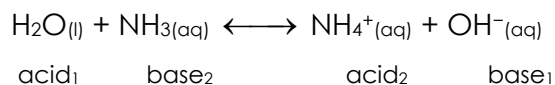


Acids and Bases Lesson 2

Conjugate Acid-Base Pairs

- Acid-base reactions involve the exchange of hydrogen ions. When an acid loses a hydrogen ion it becomes a _____, and when a base accepts a hydrogen ion it becomes an _____.
- Structures that differ in only one hydrogen ion are called _____ acid-base pairs.
- The stronger the acid, the _____ will be its conjugate base, and vice versa.
- In these reactions, not only the reactants but also the _____ are acids and bases.



- Acid₁ is the conjugate acid of base₁, and base₂ is the conjugate base of acid₂.
- Notice, as well, that the formula for the conjugate base always has one more _____ charge than the formula for the corresponding acid.

Notice that water is acting as an acid in the first reaction, but as a base in the second one.

Acid	Base Conjugate	Base	Acid Conjugate
HCl		OH ⁻	
H ₂ O		HSO ₄ ⁻	
H ₃ O ⁺		NO ₃ ⁻	
NH ₄ ⁺		H ₂ O	

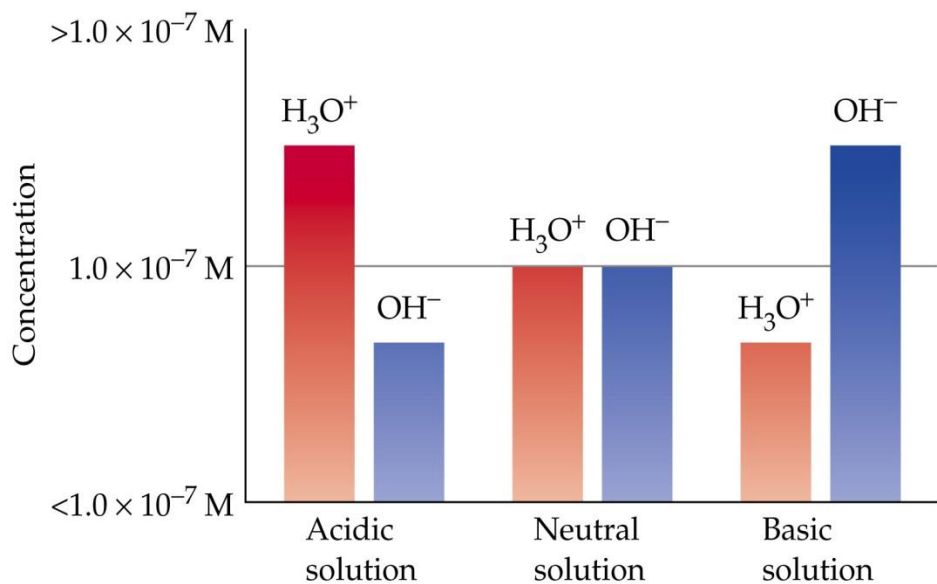
See Conjugate Acids and Bases Assignment

Dissociation of Water

- Write out the chemical equation for the dissociation of water:
- The equilibrium constant expression for the self-ionization of water can be written as follows:
- Since K_w is so small, H₂O is favored over H⁺/OH⁻ production (ie. Not a lot of water dissociates)
Determine [H₃O⁺] and [OH⁻] for pure water

- The ion product constant is valid for all aqueous solutions. If an acid is added to pure water, the hydronium ion concentration will _____. Since the value of K_w is constant, the concentration of the hydroxide ion will _____.

[H₃O⁺] does not have to equal [OH⁻], they just need to multiply to give 1.0×10^{-14}



Example: What are the hydronium ion and hydroxide ion concentrations in a 0.050 M aqueous solution of hydrogen chloride at 25°C?

Equation:

HCl almost completely dissociates,

Use K_w expression to calculate $[\text{OH}^-]$

Example: What are the hydroxide ion and hydronium ion concentrations in an aqueous solution containing 0.010 M barium hydroxide?

Equation:

Since $\text{Ba}(\text{OH})_2$ is a strong base, it completely dissociates:

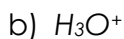
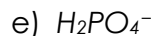
Use K_w expression to determine $[\text{H}_3\text{O}^+]$

Ex. What is $[\text{H}^+]$ in an aqueous solution in which $[\text{OH}^-] = 1.0 \times 10^{-3}$?

Name: _____

Conjugate Acid/Base Pairs

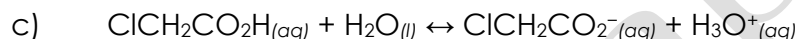
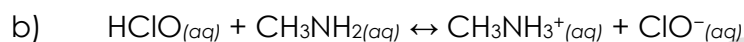
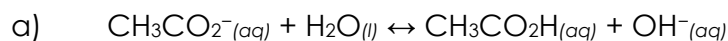
1. What is the conjugate base for each of the following acids?



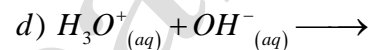
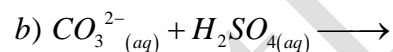
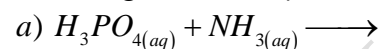
2. What is the conjugate acid for each of the following bases?



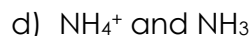
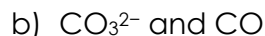
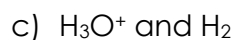
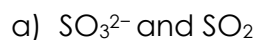
3. For each of the following reactions identify, where possible, the acid-base conjugate pairs:



4. Complete the following acid-base reactions, assuming that only one hydrogen ion is exchanged. Identify the conjugate acid-base pairs by writing them below the equations.



5. Which of the following do not represent a conjugate acid-base pair:



Name: _____

Dissociation of Water

1. Calculate the H_3O^+ and OH^- concentrations in the following solutions. Each is either a strong acid or a strong base.
 - a. 0.05 M sodium hydroxide
 - b. 0.0025 M sulfuric acid
 - c. 0.013 M lithium hydroxide
 - d. 0.150 M nitric acid
 - e. 0.0200 M calcium hydroxide
 - f. 0.390 M perchloric acid
2. What will $[\text{H}^+]$ be if 0.010 mole of solid NaOH is added to 1.0L of water?
3. What will $[\text{OH}^-]$ be if 0.010 mole HCl is added 1.0L of water?

4. (HARDER) Determine the $[H^+]$ and $[OH^-]$ if 50.0mL 0.200M HCl and 49.0mL 0.200M NaOH are combined.

5. Find the $[H^+]$ and $[OH^-]$ of a solution made by dissolving 12.00g of $Ba(OH)_2$ in enough water to make 350mL of solution.