K - More on Equilibrium and Acids/Bases

I. Equilibrium "**K**"onstant

A. Definitions:

1. Equilibrium concentration [ ]:
2. Equilibrium constant
3. Equilibrium Constant Expression
   a. For the rxn: $aA + bB \leftrightarrow cC + dD$

   b.
4. Write expression for the following reaction: $2\ HI_{(g)} \leftrightarrow H_{2\,(g)} + I_{2\,(g)}$

B. Solving for Equilibrium Constant

1. Write equilibrium expression for the reaction.
2. Plug in all the equilibrium concentrations and solve!
3. Example: $2\ HI_{(g)} \leftrightarrow H_{2\,(g)} + I_{2\,(g)}$

What is the K_{eq} when: $[HI] = 0.0175$ M $[H_2] = 0.0045$ M $[I_2] = 0.00125$ M?

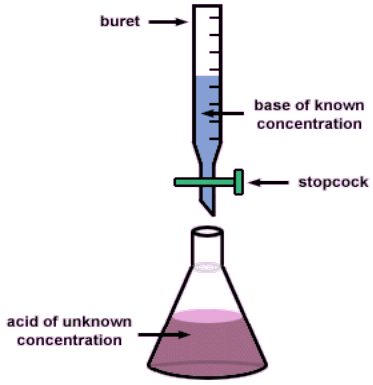
4. Equilibrium Involving
   a. in the equilibrium constant expression.
   b. and, thus,

C. Solving for equilibrium concentrations.

1. Write equilibrium expression.
2. Plug and solve for unknown.
3. Example: $CaCO_{3\,(s)} \leftrightarrow Ca^{2+}{}_{(aq)} + CO_3^{2-}{}_{(aq)}$

If enough $CaCO_3$ is added so that the equilibrium $[CO_3^{2-}]$ is 0.10M. What is the resulting $[Ca^{2+}]$ if K_{eq} is 3.9×10^{-9}?

II. Acid Base Application



A. Titrations

1. A method used to experimentally
   a. by
   b. phenolphthalein is usually used (for acids/bases)
   c. signals that
2. <u>Equivalence point</u>: where the
3. Equation: where and
   a. A is for acid and B is for base.
   b. When calculating, make sure that the (L or mL)
   c. NOTE: , therefore:
      i.
      ii.
      iii.
   d. Example: When 42.5 mL of a 1.03 M solution of NaOH is added to 50.0mL of vinegar (acetic acid, CH_3COOH), the phenolphthalein turns pink. What is the concentration of the acetic acid in vinegar?

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B. Buffer: solution that when acids and bases are added

1. How to make a buffer

a. Mix a:

i.

ii.

b. (reaction)

2. How does it work?

a. consider a buffer composed of sodium acetate, $NaC_2H_3O_2$,(dissociating into $C_2H_3O_2^-$) and acetic acid, $HC_2H_3O_2$

i.

ii.

III. K with Acids and Bases!

A. First, a little pHun (note: H^+)...EQUATIONS FOR pH!

1.

a. What is the pH of a 0.0100 M nitric acid solution, HNO_3? Nitric acid is a strong acid.

b. pH=

2.

a. What is the pOH of a 0.050 M solution of NaOH?

b. pOH=

3. Therefore,

a. What is the hydronium (H_3O^+) concentration of a solution with a pH of 3.4?

b.

4. Relating pH and pOH

a.

b.

c.

d. What is the pH of a solution that has a pOH of 3.1?

e. What is the pOH of a solution that has a pH of 5.6?

5. Relating $[H^+]$ and $[OH^-]$

a. although very slightly

b. H_2O <--> $H^+ + OH^-$

c.

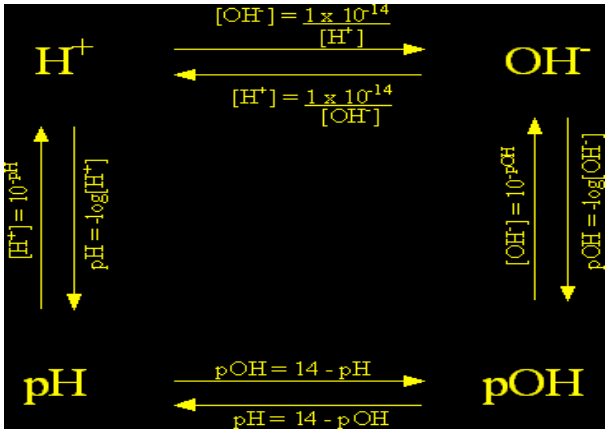
d. , therefore:

i.

ii.

e. What is the concentration of $[H_3O^+]$, if the NaOH is 0.0156 M?

6. Putting it all together:



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7. Examples:
   a. What is the pH and pOH of a solution with an$[H^+]$ of 0.000345M?

   b. What is the $[H^+]$ and $[OH^-]$ of a solution with a pOH of 4.32?

B.
1. How easily an acid/base dissociates.
2. The
3. This value is

Equation: $HF_{(aq)} \leftrightarrow H^+_{(aq)} + F^-_{(aq)}$

4. Example:Write the dissociation equation and the constant expression for $HC_2H_3O_2$.

C. What is really happening with weak acids/bases?
1. There are three steps to consider
   a. Initially, an acid is placed into solution
   b. Then, the acid dissociates slightly and the concentration changes
   c. The concentration changes until the reaction reaches equilibrium.
2. This is shown through an ICE chart
3. Create an ICE chart for a 0.100M sol'n of HF.

D. Solving with K_a and pH
1. Write the dissociation equation.
2. Write the acid dissociation constant expression.
3. Plug in what you know.
   a. Remember that
4. Ex: What is the K_a of a 0.100M solution of HCOOH when its pH is 2.38.

5. Shortcut:
   a.
   b.
   c.

6. Ex: What is the K_a of a 0.0100M solution of HF when its pH is 3.20.

Sidebar: Colligative Properties

A. Colligative Property:

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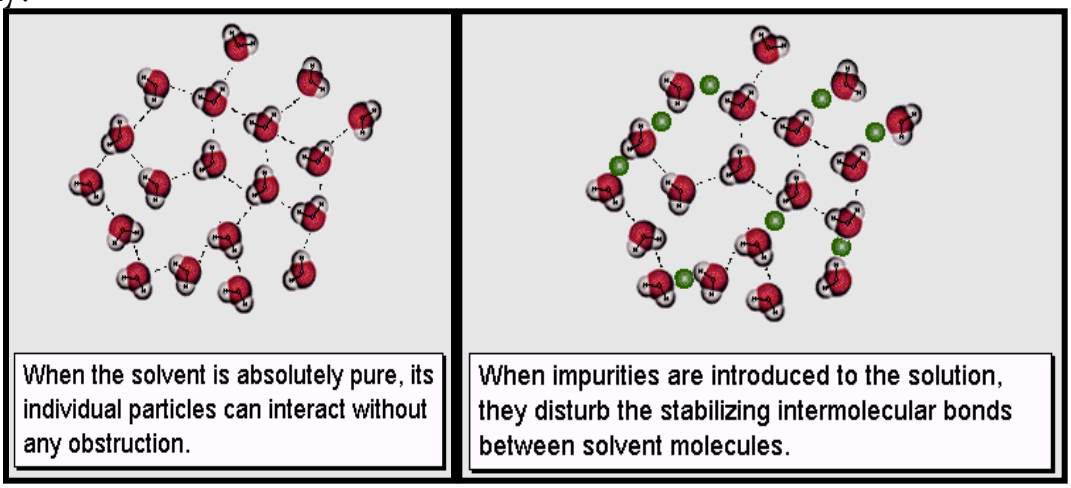
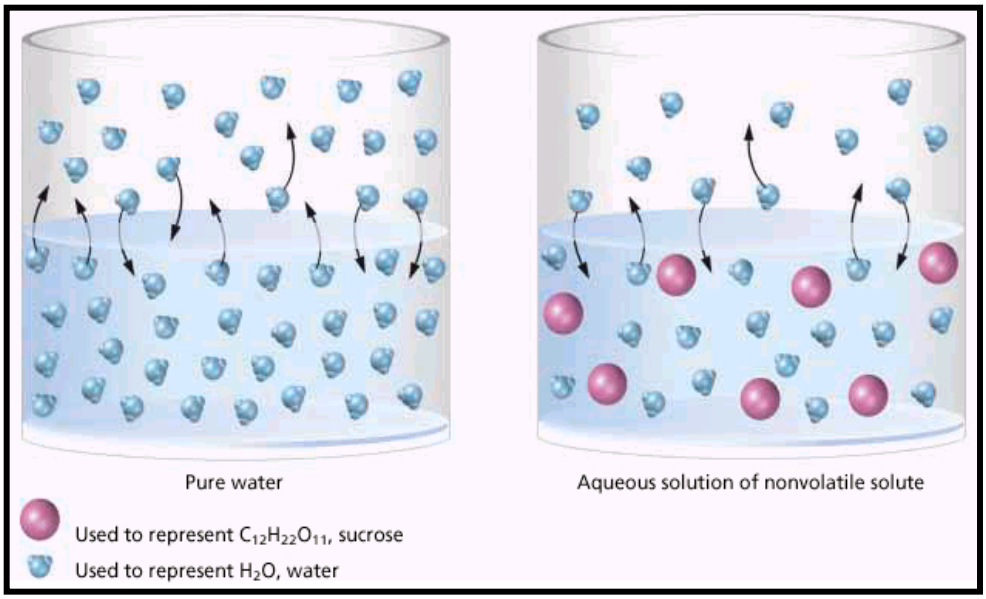
1. property that , not their
2.

B. Types

1.
   a.
   b. Why?



2.
   a.
   b. Why?



Solute particles are to the particles than the particles are to themselves.

C. Applications

1.
2.
3.