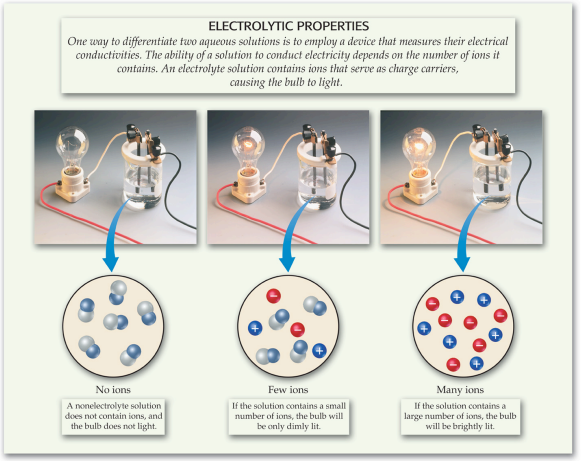
Help! I'm Melting, wait...I'm dissolving! Notes (Ch. 4)

Aqueous Solutions

I. Most reactions happen _____.
II. Aqueous means _____.
III. A solution is a _____.
IV. Dissolving occurs when water _____ and/or _____.
V. Electrolytes: _____.
  A. In solution, ionic compounds dissolve into
  _____.
  B. molecular compounds_____ because there
  _____. (_____).
VI. Strength of electrolytes:
  A. strong electrolytes _____ because _____.
  (_____)
  B. weak electrolytes _____ because _____.
  (_____)
  C. nonelectrolytes _____ because _____.
  (_____)



Predicting Reactions

I. Very important part of the AP (10% of FR).
II. Involves writing _____.
III. There are basically five types of reactions:
  A. Double Replacement (_____)
  B. RedOx (_____)
  C. Organic (just need to _____)
  D. Lewis acid-base (_____)
  E. Complex ion (pretty _____)
IV. We will focus on just the first two for now.
  A. Double replacement - precipitation reactions.
    1. Precipitates form if one of the products is _____.
    2. To do this, we need to memorize our _____!
    3. Solubility Rules (This is what's soluble):
      a.

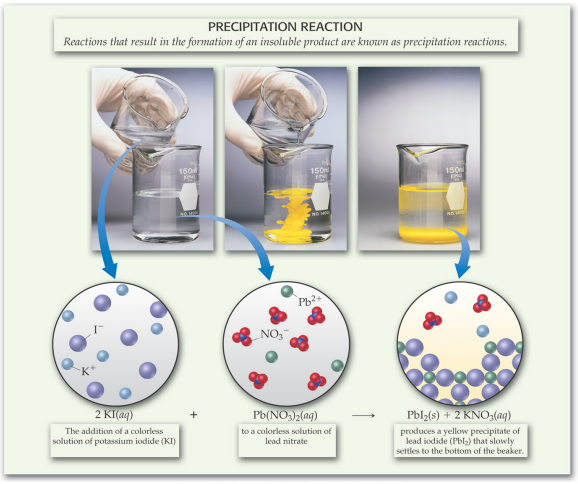
      b.

      c.

      d.

      e.

      f. Everything else _____.



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4. Practice:
   a. In AP, if something dissociates (can dissolve) you need to write it as _____.
   b. Write the chemical symbols for the following. If can be dissociated, write as separate ions. Add state symbols.
      i. solution of sodium chloride
      ii. solution of silver nitrate
      iii. solution of silver chloride
      iv. solid sodium chloride
5. Examples
   a. Predict whether a reaction will occur from the following pairs of compounds:
      i. potassium nitrate and barium chloride

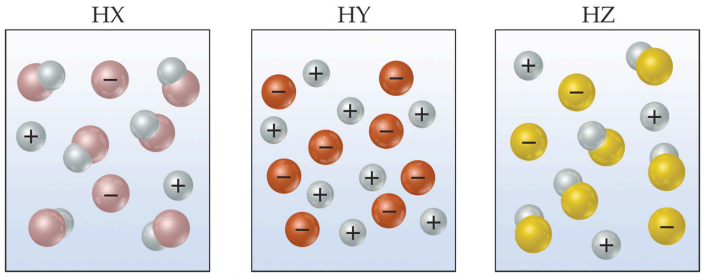
      ii. sodium sulfate and lead (II) nitrate

      iii. potassium hydroxide and iron (III) nitrate

B. Acid/Base Reactions (technically _____ reactions)
1. Acids (start with _____):
   a. Strong acids _____ completely and are _____ electrolytes
   b.
   c. _____.
   d. if _____ it will be strong.
2. Bases (end in _____):
   a. Strong bases _____ completely and are _____ electrolytes
   b. _____ (_____)
   c. _____ (_____)

SAMPLE EXERCISE 4.5 Comparing Acid Strengths

The following diagrams represent aqueous solutions of three acids (HX, HY, and HZ) with water molecules omitted for clarity. Rank them from strongest to weakest.



3. IMPORTANT: If it is a weak acid or base, _____.

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4. Practice: Write the chemical symbols for the following. If can be dissociated, write as separate ions.
   a. dilute hydrochloric acid
   b. concentrated barium hydroxide
   c. concentrated hydrofluoric acid
   d. dilute ammonia

C. Some things to remember:
1. If something is solid, it _____ (it's still _____!)
2. Some chemicals decompose into _____:
   a.
   b.
   c.
   d.
3. Some ARE gases:

Net Ionic Equations

I. A chemical equation that shows which species is _____.
II. If a compound is _____, write it as _____.
(except:_____)
III. How to:
A. Write _____.
B. For all _____, write them as _____. (what you have now is known as the _____ equation)
1. Make sure that they are consistent with _____.
C. Cancel out the ions that _____. (aka _____)
D. Write in the _____. (_____)

IV. Examples
A. Potassium chloride and silver nitrate in solution

B. Potassium hydroxide and iron (III) nitrate in solution.

C. Sodium sulfate and lead (II) nitrate in solution

D. Solid hydrochloric acid is placed in silver nitrate solution.

E. Solutions of ammonium nitrate and sodium hydroxide are mixed

F. Equimolar concentrations of hydrobromic acid and sodium sulfite are mixed.

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Redox Reactions

I. Redox = _____.

A. They involve the _____.

II. Oxidation states (numbers)

A. Real charge of atom **assuming** all bonds are _____.

B. a.k.a _____

C. How to find oxid. number:

1. Ox # is zero for an atom in its elementary or diatomic state.
2. Ox # for any monoatomic ion is the charge of the ion (_____).
3. Ox # for oxygen is -2, except peroxides = -1. Ex: _____.
4. Ox # for hydrogen is +1, but in metal hydrides it is -1. Ex: _____.
5. All other ox # are assigned so the total of the ox # are equal to the net charge of the ion or molecule.

D. Examples: Find the ox # of each element in the following:

HNO_3 CO_2 SF_6 SO_3^{2-} NO_3^-

III. Terminology

A.

1. **L**oss of $\mathbf{e^-}$ = **O**xidation. Species becomes more _____. Ex: $x \rightarrow x^+ + e^-$
2. **G**ain of $\mathbf{e^-}$ = **R**eduction. Species becomes more _____. Ex: $y^+ + e^- \rightarrow y$

B. EVERY redox reaction must have least _____ as well as _____.

C. Example: $Cu_{(s)} + Ag^+_{(aq)} \rightarrow Cu^{2+}_{(aq)} + Ag_{(s)}$

D. Oxidizing and reducing agents

1. _____ – reactant that causes _____ and is _____. (___)
2. _____ – reactant that causes _____ and is _____. (___)

IV. How to balance Redox Reactions

A. Combination Method - Steps:

1. Give ox # of all substances.
2. Link substances that have changed in ox # and determine if they have oxidized or reduced.
3. List # of e- lost or gained.
4. Make # of e- equal for both rxns by mulitplying. Use the multiplier as coefficient for the linked substances.
5. Then balance the rest of the reaction.

B. Acidic and Basic solutions

1. Acidic solutions are full of H^+ and H_2O
   a. After you have balanced the equation:
      i. Add H_2O to balance the oxygens.
      ii. Add H^+ to balance out the H's you added.
2. Basic solutions are full of OH^- and H_2O
   a. Balance the reaction as above, including the H^+ and H_2O molecules.
      i. Then, add OH^- to H^+ and H_2O to make them basic.
      ii. If necessary, cancel out any leftover H_2O's

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V. Types of Redox reactions (predicting!)

A. Single Replacement reactions (_____):

1. $Ca_{(s)} + H_2O_{(l)}$ -->

(NOTE!!!)

2. $Zn_{(s)} + CuSO_{4\,(aq)}$ -->

3. $Cl_{2\,(g)} + KBr_{(aq)}$ -->

B. _____ (usually mentioned as "_____" or "_____")

1. $CH_4 + O_2$ -->

2. $Mg + O_2$ -->

C. _____

1. Means that an element is _____.

2. $Cl_{2\,(g)} + 2OH^-_{(aq)} \rightarrow OCl^-_{(aq)} + Cl^-_{(aq)} + H_2O_{(l)}$

D. Synthesis reactions

1. _____ with _____:

a. solid dinitrogen pentoxide is added to water.

E. When "_____" or "_____" is mentioned, it's probably _____.

F. Practice:

1. solid copper is added to a dilute nitric acid solution.

2. a solution of potassium permanganate is mixed with an alkaline solution of sodium sulfite.

3. ethanol is completely burned in air.

4. sodium metal is added to water

5. Hydrogen peroxide solution is added to an acidified solution of iron (II) sulfate.

VI. Heated Reactions

A. Type of redox reaction.

1. When one reactant is being (and oxygen is not mentioned), it usually into "common products".
   a. ammonium carbonate
   b. potassium chlorate
   c. sodium bicarbonate
2. When two elements are , they usually
   a. lithium and nitrogen gas
   b. magnesium and nitrogen gas

VII. Molarity

A. Most common concentration unit in chemistry is molarity

B. Molarity = $\frac{\text{moles of solute}}{\text{liter of solution}}$ or $\frac{\text{millimole}}{\text{milliliter}}$

C. Examples:

1. How many moles of HCl are in 2.0L of a 0.500M solution?

2. How many moles of each ion is there in a 0.50L of a 0.080M solution of potassium sulfate?

3. How many moles of nitric acid are there in 75mL of a 6.0M nitric acid solution?

NOTE: millimoles (mmol) can be used in calculations.

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VIII. Dilutions

A. Used to make dilute solutions from concentrated solutions.

B. Equation:

1. Titration equation is similar:

2. More on this next semester

C. Be careful! V =

D. Examples:

A. Prepare 500.mL of a 1.0M HCl solution from concentrated 12M HCl solution.

B. If you have 50.0mL of a 6.0M concentrated sulfuric acid solution, how much 2.0M dilute acid solution can you make?