I. Nature of Solutions

A. Substances in a solution can be atoms, molecules or ions.
2. Particles are

B. Two parts of a solution:
1. – substance that is in and is
2. – substance that is in amount and

C. Can substances mix?
1. – a substance in another (Ex: lemonade, soda)
   a. a.k.a.
2. – a substance in another (Ex: vinegar and oil)
   b. a.k.a.

D. Some types of solutions
1. Air (gaseous solution)
2. Solute and solvent are usually in the same state but some can be different.
4. 
5. Solutions
   a. Solutions with
   b. NOTE: aqueous solutions that can are known as...
      i. (because they have ions in solution)
      ii. Examples:

II. The Formation of Solutions

A. How A Solution Forms
1. When solute is placed in solvent they begin to interact.
   a. How they are pulled apart depends on the solute.
      i. are in compounds.
      ii. are in compounds.
      iii. Polar solvents pull apart polar solutes (including ionic ones) and nonpolar solvents pull apart nonpolar solutes.
      iv. 
   b. The each of the dissolved particles.
   c. The solute particles on the outside are dissolved first until...
      i. all the or
      ii. all the

III. Concentration Calculations

A. First, remember density?
1. Density: amount of
2. Formula =
3. The density of water is 1g/mL (1g of H₂O = 1mL of H₂O)
4. Key concept:
B. Six units are used to measure concentration (Use factor label until it matches!)

<table>
<thead>
<tr>
<th>Conc. Unit</th>
<th>Symbol</th>
<th>Equation</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grams per liter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molarity</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>% Composition (by mass)</td>
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<tr>
<td>Parts per Million</td>
<td></td>
<td></td>
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<tr>
<td>Molality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mole Fraction</td>
<td></td>
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</tbody>
</table>

C. To calculate concentration do the following:
1. Determine what concentration you are solving for and write out its units to the right of the equal sign.
2. Write in what is given to the far left (the solute is always on top!)
3. Convert each amount (top and bottom) until it matches the unit needed.
4. Divide!

D. Example: If a solution is prepared from 10.0 grams of NaOH to make 2.00 liters of solution, what is the molarity of the cleaner?

E. Example: If 19.0 g of C₆H₁₂O₆ is dissolved in 2.5 kg of water, what is the molality of the solution?

F. Example: A gas mixture contains 50.4 g of N₂O and 65.2 g of O₂. What is the mole fraction of N₂O? Change grams to moles first.

IV. Factors Affecting Solubility

A. Expressed as a
2. Example: At 25 °C, the solubility of NaCl is 36.2g/100g H₂O.

B. Solubility is affected by:
1.
   a. Only
2.
   a. For solids and most liquids, the
   b. For gases, the
      i. proportional
      ii. Soda goes
   at room temp.
3.
   a. For gases, the
      i. Like opening a bottle of soda.
   b. This
4.
   a. For solids, the
      i. A packet of sugar
      ii. than a sugar cube
   b.
C. Saturation
1. Something is _______ when the solvent can _______
2. A _______ solution has _______
3. _______ = solution that's _______
   a. Supersaturated solutions are used to make rock candy!

D. Calculating Solubility
1. Solve it as a ratio:

2. Example:
   How much NaCl can be dissolved in 50g of water at 25°C?
   
   How about in 25g of water at 100°C?

V. Dilutions
A. To _______ of a solution by _______
   1. To solve for what's needed, the following equation can be used:
      a. _______
      b. also means that _______
   2. Solution 1 is the _______ and solution 2 is _______
      a. NOTE: what you solve for is the _______
      b. You must take into account the original amount of solution you have and _______

VI. Colligative Properties
A. Solute particles can change properties of solutions.
B. Colligative property: a property that _______

C. The following properties change:
   1. _______
      a. Why? The solute and solvent are _______ making it harder for the solution to boil. _______
      b. This _______ a solvent’s _______, thus more energy is needed to _______
   2. _______
      a. Why? The solute _______ in an orderly pattern, making it more _______ difficult to freeze.
Help! I’m Dissolving!!! Chapter 15 - Solutions

D. Calculating these changes…

1. Boiling Point Elevation – the amount by which the
   a. Equation:
      i. 
      ii. 
      iii. 

   b. Example: By how much will the boiling point of water be elevated if 100. grams of sucrose \( \text{C}_{12}\text{H}_{22}\text{O}_{11} \) is added to 500. grams of water. (The \( k_b \) of water is 0.52°C/m).

2. Freezing Point Depression – the amount by which the FP is decreased. Symbol: \( \Delta T_f \)
   a. Equation:
      i. 
      ii. 
      iii. 

   Example: Calculate the freezing point depression of a solution of 100. grams of sodium chloride (NaCl), in 0.500 kg of water. (The \( k_f \) of water is 1.86°C/m)