Chemistry Guided Notes
Unit 3: Solutions

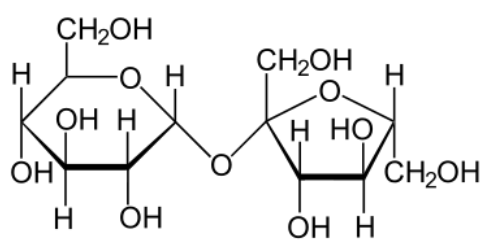
Name: ______________________________
Date: ________________ Period: _______

Components of Solutions

- Defining Solutions
  - Solute- ____
  - Solvent-____
  - Solution- ____
  - The parts of a solution are ____
  - Solutions may exist as a homogeneous mixture of _______________________________
- Solvation
  - Water molecules are in constant ____
  - When a solid is added, the water molecules bump into the solid crystals
  - There is an __________________ between the ________________ of the water molecule and the ions or molecules , that is greater than the attraction between the ions or molecules
  - The water molecules surround the ions, those ions move away from the crystals, exposing the ions or molecules underneath
  - Diagrams:

Solution of Ions in Water

Solution of Molecules in Water

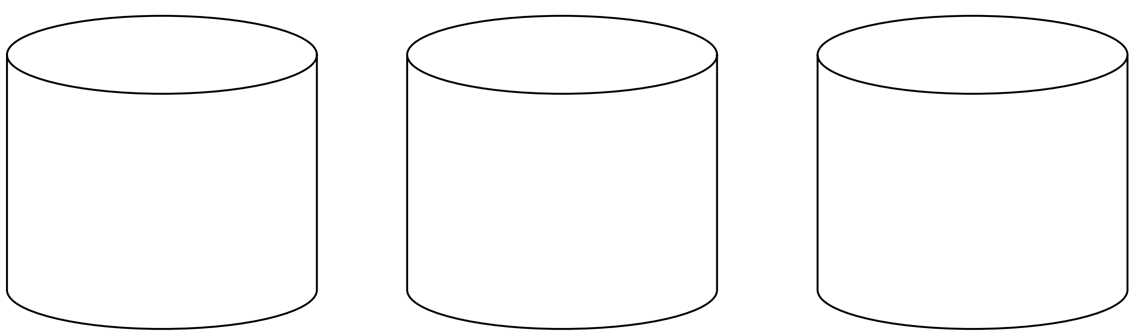


Describing Solutions Qualitatively

- Saturated Solutions
    - Solutions that contain ____
      ____
    - Any excess solvent that is added will ____
    - Saturated Solutions exist in a dynamic equilibrium- ____
      ____

- Unsaturated Solutions
    - Solutions that contain ____
      ____
    - Any excess solvent that is added will ____

- Supersaturated Solutions
    - Solutions that contain ____
      ____
    - Supersaturated solutions are formed by ______________ the solvent to a temperature where it will hold more solute, then ______________ it slowly
    - Supersaturated solutions are very unstable- adding a "seed" crystal or disturbing the solution will often cause the solute to "fall out" of solution



Describing Solutions Quantitatively

- Transmittance and Absorbance
    - Percent Transmittance- ____
    - Percent Absorbance- ____
    - Measured using an instrument called a ____

- Molarity
  - Molarity is a unit of concentration defined as ____
  - Formula for Molarity (M):

  - Example- CalcuatingMolarity: A 100.5mL intravenous solution contains 5.10g of glucose ($C_6H_{12}O_6$). What is the molarity of this solution? The molar mass of glucose is 180.6g/mole.

  - Example- Preparing a Molar Solution: How many grams of $CaCl_2$ would be dissolved in 1.0L of a 0.10M solution of $CaCl_2$?

- Dilution
  - Dilution is the process of making a solution ____
  - Dilution Formula:

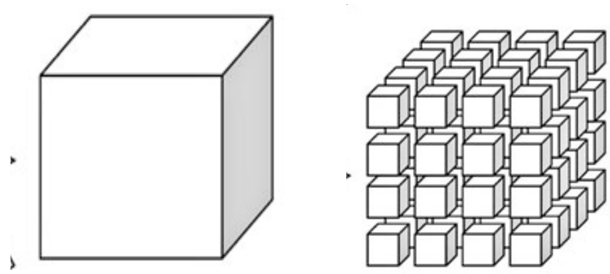
  - Example- Dilution: What volume in milliliters of 2.00M calcium chloride ($CaCl_2$) stock solution would you use to make 0.50L of 0.300M calcium chloride solution?

- Molality
  - Molality is a unit of concentration defined as ____
  - Formula for Molality (m):

  - Example-Calculating Molality: In the lab, a student adds 4.5g of sodium chloride (NaCl) to 100.0g of water. Calculate the molality of the solution.

Factors that Effect Solubility

- Agitation
  - Agitation is the process of increasing the ______________________________
  - In general as agitation increases, ______________________________
- Temperature
  - Adding temperature ______________________________
  - In general as temperature increases, ______________________________
  - Gases are an exception, as the temperature of a liquid-gas solution is increased, the solubility of the gas ____________________
- Surface Area
  - Surface area is the amount of solute ______________________________
  - In general as surface area increases, ______________________________
  - Surface area example:



- Type of Solvent
  - The general rule is ______________________________
  - Polar solvents dissolve ______________________________
  - Nonpolar solvents dissolve ______________________________
  - Soluble- ______________________________
  - Insoluble- ______________________________
  - Miscible- ______________________________
  - Imiscible- ______________________________
- Amount of Solute
  - The amount of solute that is able to dissolve is dependent on all the other factors
  - Eventually, ______________________________
  - Dynamic Equilibrium- ______________________________
    ____

Reading Solubility Curves

- Solubility curves display the density vs. temperature of several solutions
- Reading a Solubility Curve
  - Each line represents a solution that is ***saturated solution***
  - Saturated solutions exist in a ***dynamic equilibrium*** where solvation and crystallization are occurring at the same rate
  - Any point above the line where all the solute is dissolved at a certain temperature represents a ***supersaturated solution***
  - Any point below the line where all the solute is dissolved at a certain temperature represents an ***unsaturated solution***
  - Solutes whose curves move upward with increased temperature are typically ***solids***because the solubility of solids generally increases with temperature
  - Solutes whose curves move downward are typically ***gases*** because the solubility of gases generally decreases with increasing temperature

Electrolytes

- Electrolytes
  - Electrolytes are ionic compounds that ____

    ____
  - Dissociation is the ____
  - Dissociation of NaCl:

Colligative Properties

- Colligative Properties
  - Colligative properties are properties of solutions that are ______________________________

    ____
- Boiling Point Elevation: A colligative property
  - Boiling point elevation is the ____
  - The value of the boiling point elevation is ______________________________
    meaning the greater the number of solute particles, ______________________________
  - Formula for Boiling Point Elevation:

    - K_b= ______________________________
    - The boiling point of pure water=______________________
    - K_b for water =______________________
    - *m*= ______________________________

- Freezing Point Depression: A colligative property
  - Freezing point depression is the ____
  - The value of freezing point depression is ____________________________________ ________meaning the greater the number of solute particles, ______________________________ ________
  - Formula for Freezing Point Depression:

    - K_f= ____
    - The freezing point of pure water= ____________________
    - K_f for water =____________________________________
    - *m*= ____
- Example-Changes in Boiling and Freezing Point: What are the boiling point and freezing point of a 0.029*m* aqueous solution of sodium chloride (NaCl)?

<u>Reaction Equilibrium and Le Chatlier's Principle</u>

- Chemical Equilibrium
  - Many chemical reactions exist in a dynamic equilibrium meaning _________________________ ____
- Le Chatlier's Principle: ____ ____
  - In general…
    - We say a reaction __________________________ when it is moving from reactant to product
    - We say a reaction __________________________ when it is moving from products to reactants
  - Changes in Concentration of Reactants or Products
    - Adding reactants: ____
    - Adding products: ____
    - Removing reactants: ____
    - Removing products: ____

- Changes in Pressure and Volume
    - When pressure of a gas is increased, volume is ____
    - When pressure of a gas is decreased, volume is ____
    - Increasing pressure of a container in which two or more gases are reacting
        - ____
        - ____
        - ____
    - Decreasing the pressure of a container in which two or more gases are reacting
        - ____
        - ____
        - ____
- Changes in Temperature
    - Exothermic Reactions
        - ____
        - Represented by the symbol $\Delta H°$, which for an exothermic reaction will have a ______ ____
        - Increasing the temperature of an exothermic reaction ____________________________ ____
        - Decreasing the temperature of an exothermic reaction ____________________________ ____
    - Endothermic Reaction
        - ____
        - Represented by the symbol $\Delta H°$, which for an endothermic reaction will have a _____ ____
        - Increasing the temperature of an endothermic reaction ___________________________ ____
        - Decreasing the temperature of an endothermic reaction ___________________________ ____

❖ Examples:

- Use Le Chatlier's principle to predict how each of these changes would affect the ammonia equilibrium system: $N_2 + 3H_2 \rightarrow 2NH_3$
    - Removing hydrogen ____
    - Adding ammonia ____
    - Adding hydrogen ____
- Predict how this equilibrium would respond to increasing temperature:

$$CO + Cl_2 \rightarrow COCl_2 \qquad \Delta H° = -220\ kJ$$