Name: _____ Period:_____

Unit 11 Solutions- Guided Notes

Mixtures:

- What is a mixture and give examples?
- What is a pure substance?
- What are alloys?
- What is the difference between heterogeneous and homogeneous mixtures?

Solutions:

- What is a solution?
- Solute=
- Solvent=
- So, if I mix cream into my coffee, which is the solute and which is the solvent?
- Once the solute is evenly dissolved, what do you call the new coffee?

Characteristics of Solutions:

- List some characteristics and properties of solutions:

States of Matter of Solutions:

- Solutions are considered to be in _____ state of matter but can be made up of any combination of states of matter for their _____ and _____
- Can you think of an example of each?
  - Liquid in a Liquid: _____
  - Gas in a Liquid: _____
  - Gas in a Gas: _____
  - Solid in a Liquid: _____
  - Solid in a Solid: _____

Solubility:

- _____ refers to a solute's ability to be dissolved by the solvent.
- A substance is _____ if it is able to be dissolved in a given solvent.
- A substance is said to be _____ if it stays in its original state in the solvent (aka it does not dissolve)
- *Liquids* that dissolve in one another are called _____ and *liquids* that do not dissolve in one another are called _____

Solubility and Polarity:

- _____ means having opposite ends (a _____ end and a _____ end)
  - _____ substances include: ionic compounds, acids, and polar covalent compounds
  - _____ substances include: non-polar covalent molecules and diatomic molecules
  - Water is a _____ substance
- "Like dissolves like"
  - _____ substances dissolve other _____ substances
  - _____ substances dissolve _____ substances
  - _____ will not dissolve _____ and vice versa
- Water is the _____ (meaning it can dissolve most substances) because it is _____
- Why do you think that oil and water won't mix?

  - _____ is non-polar, so it is able to dissolve grease.

Dissolving:

- Remember: polar substances, like ionic compounds and water, are composed of a _____ end and a _____ end
- There are 2 phases of dissolving:
  - _____- the process of attraction and association of molecules of a solvent with molecules or ions of a solute
  - _____- Separation of solute molecules and spreading of solute through solution with more solvent surrounding
- For example when sodium chloride (NaCl) dissolves in water, sodium chloride separates into sodium ions and chlorine ions in the solution

Describing Solutions:

- Concentration=
- What is the difference in dilute and concentrated?

Saturation:

- Do you think you could dissolve a whole bag of sugar in a cup of water? Why or why not?

  - What is a saturation limit?
  - Can saturation limits change? How?

- What is a *saturated solution*?

  - How can you tell a solution is saturated?

- What is an *unsaturated solution?*

  - How can you tell a solution is unsaturated?

- What is a *supersaturated solution?*
  - How does a solution become supersaturated?

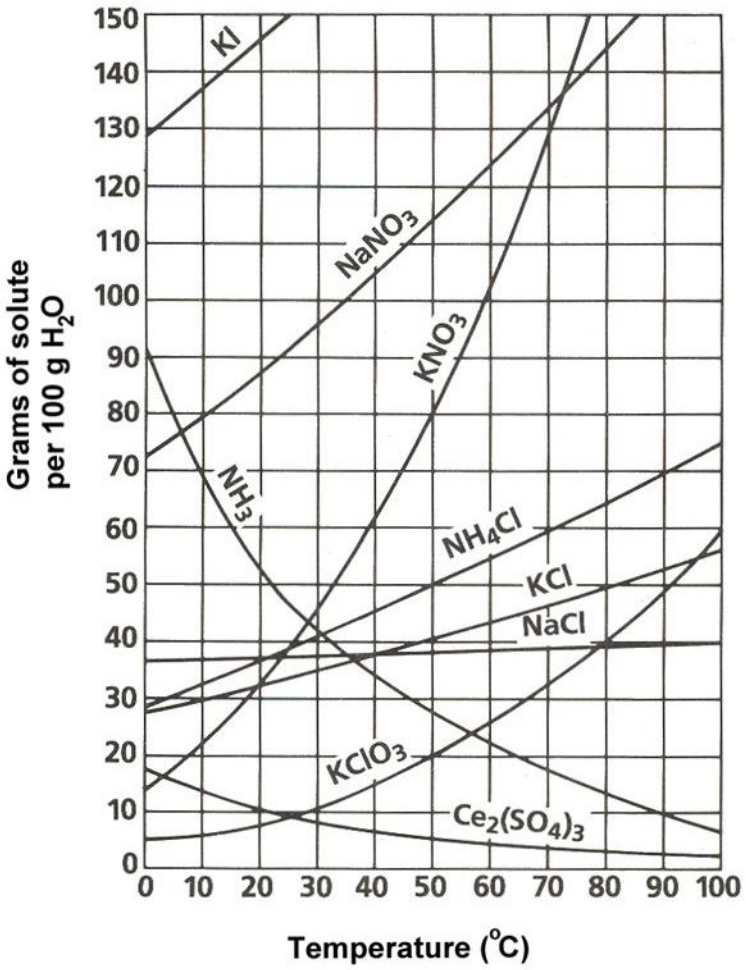
  - How can you tell a solution is supersaturated?

Solubility Curves:

- A solubility curve is a _____ representation of solubility of substances
- Solubility curves show how much of a _____ can be dissolved in 100g or 100mL of _____ at a given temperature
- What happens to solubility of a substance as temperature increases? _____
    - Do any substances break this rule?
    - Why?

- On a solubility curve, the _____ indicate the concentration of a **saturated solution** – the _____ amount of solute that will dissolve at that specific temperature.
- Values on the graph _____ a curve represent **<u>unsaturated solutions</u>** - _____ solute could be dissolved at that temperature.
- Answer the questions and include units

1. Which solute is most soluble at 10°C?
   _____
2. Which solute is least soluble at 40°C?
   _____
3. How much solute is in a saturated solution of ammonia at 25°C? _____
4. If KNO_3 has 70g of solute dissolved at 60°C is the solution saturated, unsaturated, or supersaturated? _____
5. If a solution of NaCl has 20g of solute dissolved at 90°C is the solution saturated, unsaturated, or supersaturated? _____



<u>Rate of Dissolution:</u>

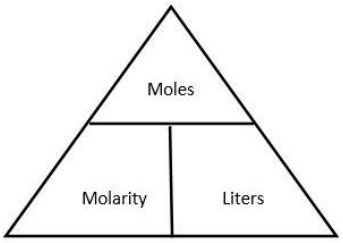
- Rate of dissolution is how _____ something dissolves
- If you are making some sweet tea and you are trying to dissolve a lot of sugar, how can you make the process of the sugar dissolving faster?

- 3 factors affect the rate of dissolving: _____, _____, and _____
    1. _____- the dissolving process occurs at the surface of the solid being dissolved. The more surface exposed the _____ the dissolving. Which would dissolve faster: a cube of sugar or crushed sugar?
    2. _____- agitation such as _____, _____, or _____ removes newly dissolved particles form the solid surface and continuously exposes the surface to fresh solvent.
    3. _____- higher temperature causes the solvent to move more rapidly, thus increasing the rate of dissolving for _____, but decreasing the dissolving rate of _____
        a. Solubility for _____ decrease when temperature is increased because the molecules move too _____ and escape rather than dissolve
        b. This is shown on a solubility curve by _____

Measuring Concentration:

- A _____ solution or a _____ solution is a solution whose concentration is *accurately known*.
- There are multiple ways to measure concentration mathematically
  - _____: (very similar to percent composition)
  - _____: has to do with acids and bases
  - _____: important for colligative properties
  - _____: the most common way to express concentration

Molarity



- Most commonly used expression of concentration
- Molarity (M)=
- Number of _____ of solute dissolved in a liter of solution
- Represented by _____ and units are _____ (Molar)
- To make a 1M solution of aqueous NaCl, measure 1 mole (which has a mass of 53g) of NaCl and add 1 Liter of water.
  - 1 mole /1 L = 1 Molar (M)
- Molarity Practice:
  1. If 5.7 g KNO_3 was dissolved in 233 mL of water, what is the molarity of the solution? (Hint you have to convert grams to moles and mL to L)
  2. What is the molarity of a solution that contains 42g of KCl in a 7.98L sol'n?
  3. How many grams of NaOH are required to prepare 200mL of a 0.45M solution?
  4. How many liters of a 0.85M solution of sodium sulfate contains 0.35 moles of sodium sulfate?
  5. How would you prepare 0.55 L of a 0.7M solution of sodium chloride?
  6. How would you prepare 800 mL of a 1.2M solution of lithium hydroxide?

Colligative Properties:

- _____ is the number of particles a solute breaks into when it dissolves.
- _____ is a property that is dependent only on the number of solute particles present in solution (aka depends on the molality and dissociation factor)
  - Examples of colligative properties are _____ and _____
- An increase or decrease in concentration will effect colligative properties

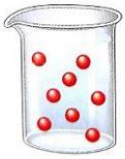
- When concentration is increased
  - The freezing point is always _____ this is called freezing point depression
  - And the boiling point is always _____ this is called boiling point elevation
  - Which would freeze faster a 0.50M solution of salt water or a 1.0M solution of salt water?
  - Which would boil faster?
  - Why do we salt the roads when is snows?
    - When salt is added to the roads the concentration (increases/decreases). This causes the (freezing point/boiling point) to (increase/decrease). This helps because…
  - Why do we add salt to the pot of boiling water when we cook noodles?
    - When salt is added a pot of boiling water when cooking noodles the concentration (increases/decreases). This causes the (freezing point/boiling point) to (increase/decrease). This helps because…

<u>Dilutions:</u>

- If you made a solution of sweet tea (solute= _____ and solvent=_____), if it was not sweet enough, how could you increase the concentration?
  - If it was too sweet, how could you decrease the concentration?
- _____ is the process of adding _____ to a solution to _____ the concentration of solution
- The actual number of *moles of the solute* never changes
- Only the *amount of solvent* changes to reduce the _____ of the solution.
- The pictures to the right show a solution throughout a dilution process:
  1. Which solution is the most concentrated?
  2. Which is the most dilute?
  3. What happens to the volume as we dilute the solution?
  4. What happens to the amount of solvent throughout the dilution?
  5. What happens to the amount of solute throughout the dilution?
  6. What happens to the concentration of the solution throughout the dilution?

Solution 1
Volume = 1.0 L

Solution 2
Volume = 2.0 L



Solution 3
Volume = 4.0 L

<u>Dilution Calculations:</u>

- When you need to dilute a solution, you know 3 of the following 4 things:
  - the molarity of what you started with (_____),
  - the new molarity of the solution you want to make (_____)
  - The volume of the solution you start with (_____)
  - The volume of the new solution (_____)
- Use the dilution equation $M_1V_1 = M_2V_2$ to solve for the last variable.
- Volume can be in units of _____ or _____.

1. Calculate the molarity that results when 250 mL of water **is added** to 125 mL of .251 M HCl.
2. Suppose you wished to make a 0.879 L of 0.250 M aqueous silver nitrate by dilution a stock solution of a 0.675M aqueous silver nitrate. What will the volume of the stock solution would you need to use?
3. Calculate the new concentration when 50.0mL of water is added to 735mL of 1.25M NaCl.
4. How much water would need to be added to 750mL of a 2.8 M HCl solution to make a 1.0M solution?