Week #12

Unit 12 Activity Sheet

A. For each of the following, circle the solute and underline the solvent.
1. Air is a mixture of primarily 78% nitrogen and 21% oxygen.
2. Household bleach is a 5% solution of NaClO dissolved in water.
3. Vanilla extract consists of vanillin dissolved in ethanol.
4. Household ammonia consists of ammonia gas dissolved in water.
5. A physiological saline solution (normal saline) consists of 0.9 gram of sodium chloride (NaCl) dissolved in water.

B. Molarity Problems. Remember: Molarity: \( M = \frac{\text{moles}}{\text{liter}} \)
1. Calculate the molarity of a sodium hydroxide solution containing 50 grams/liter.
   \[ \text{MW of NaOH} = 40.09\text{g/mole} \]
   \[ \frac{50.09}{1\text{lit}} \times \frac{1\text{mole}}{40.09} = 1.25M \]

2. Calculate the number of grams of H\(_2\)SO\(_4\) required to prepare 100 ml of 6M H\(_2\)SO\(_4\).
   \[ \text{MW of } \text{H}_2\text{SO}_4 = 98.08\text{g/mole} \]
   \[ 6\text{moles} \times \frac{98.08\text{g}}{1 \text{mole}} \times \frac{100\text{ml}}{1 \text{liter}} = 58.8 \text{ grams} \]

3. 10 grams of NaCl are dissolved in enough water to make 200 ml of solution. What is the molarity of the solution?
   \[ \text{MW of NaCl} = 58.5\text{g/mole} \]
   \[ 0.171 \text{ moles} = 0.865M \approx 0.86M \]

4. Gatorade contains 14 grams of sugar per 0.946 liters. Calculate the molarity of sugar in Gatorade.
   (Molecular formula of sugar is C\(_6\)H\(_{12}\)O\(_6\))
   \[ \text{MW of } \text{C}_6\text{H}_{12}\text{O}_6 = 180\text{g/mole} \]
   \[ 14\text{g} \times \frac{1\text{mole}}{180\text{g}} = 7.78 \times 10^{-2}\text{mole} \]
   \[ \frac{7.78 \times 10^{-2}\text{mole}}{0.946 \text{ liters}} = 8.2 \times 10^{-2} \text{ M} \]

5. Calculate the number of grams of solute required to prepare:
   a. 10 liters of 0.50M HCl. \( \text{MW} = 36.46\text{g/mole} \) (don’t worry about sig figs here)
   \[ 0.50 \times \frac{1\text{liter}}{0.50} \times \frac{36.46\text{g}}{1\text{mole}} = 182.3 \text{ grams} \]
   b. 60.0 grams of NaOH in 2 liters of water.
   \[ \text{MW of NaOH} = 40.09\text{g/mole} \]
   \[ 60.0 \text{g} \times \frac{1\text{mole}}{40.09\text{g}} = 1.5\text{moles} \]
   \[ \frac{1.5\text{moles}}{2\text{liters}} = 0.75M \]

C. Percent Solutions.
1. Calculate the percent of solute on a weight/volume basis of the following solutions:
   a. 50g of acetic acid/1 liter.
   \[ \frac{50\text{g}}{1\text{liter}} \Rightarrow \frac{50\text{g}}{1000\text{mL}} \Rightarrow \frac{5\text{g}}{100\text{mL}} = 5\% \text{ acetic acid solution} \]
   b. 7.5 g of sucrose/250 ml.
   \[ \frac{7.5\text{g}}{250\text{mL}} = \frac{x}{100\text{mL}} \Rightarrow x = 3\text{g} \]
   \[ \frac{3\text{g}}{100\text{mL}} \Rightarrow 3\% \text{ sucrose solution} \]
c. 0.5 g of NaCl/500 ml
\[ \frac{0.5g}{500ml} = \frac{x}{100ml} \]
x = 0.1g; \[ \frac{0.1g}{100ml} \Rightarrow 0.1\% \text{ NaCl solution} \]
d. 10 g of NaOH/100 ml
\[ \frac{10g}{100ml} \Rightarrow 10\% \text{ NaOH solution} \]

D. Practice Quiz Problems.

1. "Seeding" of clouds with AgI crystals to produce more rainfall is a practical application of the principle
   a. decomposition
   b. forming a colloidal dispersion
   c. catalysis
   d. hydrate formation
   e. destabilizing a supersaturated solution.

2. All of the following are colligative properties of solution except
   a. vapor pressure
   b. boiling point
   c. freezing point
   d. heat of fusion
   e. osmotic pressure
   
3. It is difficult to cook pasta in water at Lake Tahoe because water boils there below 100°C. This difficulty might be overcome by:
   a. using a higher flame so as to boil the water faster.
   b. using distilled water.
   c. using an aluminum pot so as to distribute the heat more evenly.
   d. using a larger pot
   e. adding salt to the water.
   
4. A solution is cooled without any salt precipitating out. The resulting solution is considered
   a. saturated
   b. supersaturated
   c. unsaturated
   d. dilute
   
5. How many grams of sulfuric acid are required to prepare 1 liter of 6M H₂SO₄?
   a. 294 g
   b. 558 g
   c. 600 g
   d. 98 g
   e. 980 g
   \[ 6 \text{ moles} \times \frac{98.09g}{\text{mole}} = 588.5g \]

6. How many grams of NaCl are required to make 1 liter of a 0.9% solution of saline?
   a. 0.3 g
   b. 0.9 g
   c. 9 g
   d. 10 g
   e. 90 g
   \[ 0.9\% \Rightarrow 0.9g \]
   \[ \frac{100ml}{1000ml} \Rightarrow 9g \]

7. How many grams of HCl are in a 3 M solution of HCl?
   a. 3 g
   b. 36.5 g
   c. 73 g
   d. 109.5 g
   \[ \frac{3 \text{ moles}}{1 \text{ liter}} \times \frac{36.5g}{\text{mole}} = 109.5g \]

* KNOW THE INFORMATION ON THE HANDOUTS!!!!