WORKSHOP 9: NAME_________________________
Solutions Section _____________

1. Calculate the % by mass of solute in a solution containing:
   a. 8.32 g Lithium Arsenate in 45.0 g solution.

   b. 813.0 g Hydroiodic acid in 2811 g water.

2. How many grams of sodium silicate are in 783.0 g of 27.0% sodium silicate solution?

3. Describe how you would prepare 500.0 g of 2.55% potassium oxalate solution. Show calculations, and tell in words, how much solute (potassium oxalate) and how much solvent (deionized water) you would mix. (Attach an extra page for your description, if necessary.)

4. Calculate the molarity (M) of a solution containing:
   a. 1.52 moles of potassium hydroxide in 345.0 mL of solution.

   b. 47.8 g aluminum hydroxide in 5.67 liters of solution.

5. How many grams of calcium arsenate are in 170.0 mL of 11.3 M calcium arsenate solution?

6. How many moles of Perchloric acid are present in 25.00 mL of 0.324 M Perchloric acid solution?

7. Describe in detail how you would prepare 0.675 liters of 1.50 M potassium sulfite solution
   a. from 6.00 M potassium sulfite solution by dilution with water
   b. from pure solid potassium sulfite

8. Aluminum hydroxide will react with sulfuric acid to yield aluminum sulfate and water.
   a. Write the balanced equation for this reaction.
   b. How many grams of aluminum hydroxide will react with 75.0 mL of 0.319 M sulfuric acid solution?
   c. If 0.875 g of aluminum hydroxide reacts exactly with 22.00 mL of a sulfuric acid solution, what is the molarity of the sulfuric acid solution?

Solutions (Part 2) Units of concentration:

% (by mass) = (g solute / g solution) x 100 **ppm = (g solute/g solution) x 10^6**

or g solute / 100 g solution

or g solute / 10^6 g solution

or 1 ppm = 1 mg solute / L solution

Note: ppm units are usually used for very dilute solutions where the density is 1.00 g/mL

Molarity: M = moles solute / L solution
Normality: N = equivalents/L Normality is a unit used mostly for acids or bases to emphasize the amount of available H^+ or OH^- in solution, whether ionized or not.

A 0.5 M solution of HCl is 0.5 N
A 0.5 M solution of H_2SO_4 is 1.0 N
A 0.5 M solution of $Ca(OH)_2$ is 1.0 N..

pH = -log[H^+] The bracket refers to the molarity of an individual ion or molecule such as the hydrogen ion. Actually in water, H^+ is H_3O^+ the hydronium ion but for convenience we usually just refer to it as H^+

pOH = -log[OH^-] pH + pOH = 14.0 at pH 7 , the [H^+] and [OH^-] are equal.

A strong acid such as HCl is completely dissociated in water, thus in a 0.01 M solution of HCl, [H^+] = 0.01 M and [Cl^-] = 0.01 M, and the pH would be -log (0.01) = 2

A weak acid such as HF may be about 10% dissociated, so in a 0.01 M solution of HF, the concentration of H^+ would be 10% of 0.01 = 0.001 M, so the pH = 3.

Problems

1. What is the molarity of a concentrated 37.0 % hydrochloric acid solution, given that the density of the solution is 1.11 g/mL?

2. What is the molar mass of a weak acid, given that 1.00 g of the acid reacts in a 1:1 mole ratio with 25.0 mL of 0.200 M KOH?

3. What is the pH of a 0.020 M weak acid solution which is 5.0% dissociated?

4. A dilute solution of HCl has a pH of 4.0. What is the molarity of the HCl?

5. In any aqueous solution, pH + pOH = 14.0. What is the pH of a 0.0010 M solution of NaOH ?

6. Optional: Using pH indicator paper – if available, test the pH of various common liquids such as vinegar, soda, milk, Windex, other cleaning solutions.