CONCEPT: PERCENT COMPOSITION

In addition to molarity and molality we can express the concentration of solutions in a few other ways.

$$\text{Weight Percent}\left(\frac{w}{w}\right) = \frac{\text{mass of solute}}{\text{mass of solution}} \text{x } 100 \qquad \text{Volume Percent}\left(\frac{v}{v}\right) = \frac{\text{volume of solute}}{\text{volume of solution}} \text{x } 100$$

$$\text{Weight / Volume Percent}\left(\frac{w}{v}\right) = \frac{\text{mass of solute, g}}{\text{volume of solution, mL}} \text{x } 100$$

EXAMPLE 1: A 5.12 L sample of solution contains 0.230 g of potassium sulfate, K_2SO_4. Determine the weight percent of K_2SO_4 if the density of the solution is 1.30 g/mL. (MW of K_2SO_4 is 174.26 g/mol).

EXAMPLE 2: When lead levels in blood exceed 0.80 ppm (parts per million) the level is considered dangerous. 0.80 ppm means that 1 million g of blood would contain 0.80 g of Pb. Given that the density of blood is 1060.0 kg/m^3, how many grams of Pb would be found in 550.00 mL of blood with a Pb level of 0.583 ppm?

PRACTICE: PERCENT COMPOSITION CALCULATIONS 1

EXAMPLE 1: A 8.13% $Al_2(SO_4)_3$ solution (MW of $Al_2(SO_4)_3$ is 342.17 g/mol) has a measured density of 1.235 g/mL. Calculate the molar concentration of sulfate ions in the solution.

EXAMPLE 2: The density of a 33.8% solution of sodium acetate, $NaC_2H_3O_2$, is 1.10 g/mL. A reaction requires 68.8 g $NaC_2H_3O_2$. What volume of the solution do you need if you want to use a 50% excess of $NaC_2H_3O_2$? (MW of $NaC_2H_3O_2$ is 82.034 g/mol).

PRACTICE: Determine the number of mmoles of sulfuric acid that would be found within a 120 g sample that is 79.9% sulfuric acid.

a) 0.960 mmol b) 980 mmol c) 0.33 mmol d) 1.7 mmol

CONCEPT: DILUTIONS

A dilution involves the addition of water to a concentrated solution. Typically, a given volume of a concentrated solution is placed in a *volumetric flask* and with water being added to a determined mark.

$$\mathbf{M_1V_1 = M_2V_2}$$

$M_1 = M_{conc}$ = Molarity or Concentration before diltution

$V_1 = V_{conc}$ = Volume before dilution

$M_2 = M_{dil}$ = Molarity or concentration after dilution

$V_2 = V_{dil}$ = Volume after dilution

_____ is a larger concentration than _____ .

_____ is a larger volume than _____.

$V_2 = V_1$ + _____.

EXAMPLE: How many grams of 53.1 weight % NaCl (MW of NaCl is 58.443 g/mol) should be diluted to 2.50 L to make 0.15 M NaCl?

PRACTICE: If 920 mL of water is added to 78.0 mL of a 1.28 M $HBrO_4$ solution what is the resulting molarity?

PRACTICE: DILUTIONS CALCULATIONS 1

EXAMPLE 1: A student prepared a stock solution by dissolving 25.00 g of NaOH in enough water to make 150.0 mL solution. The student took 20.0 mL of the stock solution and diluted it with enough water to make 250.0 mL solution. Finally taking 75.0 mL of that solution and dissolving it in water to make 500 mL solution. What is the concentration of NaOH for this final solution? (MW of NaOH: 40.00 g/mol).

EXAMPLE 2: The density of 63.7 wt% NaOH is 0.915 g/mL. How many milliliters of water should be diluted to 850.0 mL to create 0.425 M NaOH?