Name _____ **Date** _____ **Grade** _____

Work Session 14: Concentrations

Molarity: $M = \frac{\text{mol}_{\text{solute}}}{\text{Liter}_{\text{solution}}}$ for dilution: $M_1V_1 = M_2V_2$

1. How many grams of H_3PO_4 are required to prepare 3.00 L of 0.300 M solution? (88.2 g)

2. How many liters of 0.555 M KOH solution can be made from 224 g of KOH? (7.20 L)

3. If 50.0 ml of 16 M HNO_3 are diluted to 400. ml, what is the M of the diluted solution? (2.0 M)

4. To what volume must 0.050 L of 0.30 M HCl be diluted to obtain a 0.060 M solution? (0.25 L)

Molality: $m = \dfrac{\text{mol}_{\text{solute}}}{\text{kg}_{\text{solvent}}}$ also $m = \dfrac{\text{g}_{\text{solute}}}{\text{MM}_{\text{solute}} \cdot \text{kg}_{\text{solvent}}}$

5. What is the molality of a solution consisting of 24.5 g of H_3PO_4 and 100. g of H_2O? (2.50 *m*)

6. How many kilograms of water are required to make a 0.25 *m* solution with 234 g of NaCl? (16 kg)

7. How many grams of K_2SO_4 and how many grams of water are required to make 250.0 g of a 0.2000 *m* solution?(8.4, 241.6)
(Hint: First find % K_2SO_4 in a 0.2000 *m* solution)

8. What is the mole fraction of solvent and solute in a solution of 234 g NaCl in 3.00 kg of water? (0.0234, 0.977)

9. What is the mole fraction of H_2SO_4 in an 8.60% aqueous solution of H_2SO_4? (0.017)

CHEM-01A
Work Session 14: Concentrations

Parts per million: $ppm = \frac{g_{substance}}{10^6 \; g_{solvent}}$; for water solutions: $ppm = \frac{mg_{substance}}{Liter_{water}}$ (1 liter of water weighs 1 million milligrams)

10. If drinking water contains 1 ppm of fluoride, what is the molarity of F^- in the water? How many grams of NaF would be required for a day's worth of water for a household? Assume 400 gallons are used. (1 gal = 3.8 L) (5.3×10^{-5}M; 3.4g)

11. The local tap water contains about 100 ppm of Ca^{++}. Convert this to percent Ca^{++}. (g per 100 g water). Also, what is the molarity of the Ca^{++}? (0.010%, 2.5×10^{-3})

Converting from molarity to other solution strength units using density. Since D = g/ mL or g/cm^3, the mass of a liter of the solution can be calculated. Once the mass of the solution is calculated, the mass of the solvent can be calculated by subtracting the mass of the solute from the mass of the solution.

12. A concentrated solution of H_2SO_4 has a molarity of 15.5 M, and a density of 1.760 g/ml. How many grams of H_2SO_4 are in a liter of the solution? How much does a liter of the solution weigh? How many grams of water are in a liter of the solution? What is the mole fraction of the H_2SO_4 in this mix? What is the molality of the H_2SO_4?
(1519g, 1760g, 241g, 0.54, 64.3*m*)