Name _____ Period _____

INTRODUCTION TO MOLALITY

Another common concentration unit is **molality (*m*)**, which is defined as the moles of solute divided by the mass of solvent (in kilograms).

$$m = \frac{\text{mol solute}}{\text{kg solvent}}$$

Unlike molarity, which is the moles of solute divided by the *volume of solution*, **molality** is a direct comparison between solute and solvent. It is most commonly used when calculating the boiling point elevation and freezing point depression of a solution.

Helpful Hints:

- When solving molality problems, make sure to identify the solute and solvent.
- If you are given the **volume** of solvent (instead of the mass), you can solve for grams using the **density**. *Example:* since the density of water = 1.00 g/mL, one mL of water weighs one gram.
- The equation above can be manipulated to solve for **any** of the three variables (similar to the density equation).
- Remember the following conversions:

$\text{moles} = \frac{\text{grams}}{\text{molar mass}}$	$\text{grams} = (\text{moles})(\text{molar mass})$

Problems:

1. 10.5 grams of sodium chloride (NaCl) is dissolved in 500 grams of water. What is the molality of the solution?

2. 14.5 grams of potassium sulfate (K_2SO_4) is dissolved in 677 mL of water. What is the molality of the solution? (The density of water is 1.00 g/mL).

3. Determine the number of grams of solute needed to make each of the following solutions:

    a. 4.5 molal solution of H_2SO_4 in 1.00 kg H_2O. *(Note: a 4.5 "molal" solution is a solution with a molality = 4.5)*

    b. 1.00 molal solution of HNO_3 in 0.250 kg H_2O.

    c. 3.50 molal solution of $MgCl_2$ in 0.450 kg H_2O.

4. How many kilograms of H_2O must be added to 75.5 grams of $Ca(NO_3)_2$ to form a 0.500 molal solution?

5. How many grams of glucose ($C_6H_{12}O_6$) must be added to 750 g of H_2O to make a 1.25 molal solution?

6. 45.0 grams of camphor ($C_{10}H_{16}O$) is dissolved in 425 mL of ethanol (C_2H_6O), which has a density of 0.785 g/mL. Calculate the molality of this solution.