SOLUTION CONCENTRATION	**MOLALITY (m)**
DEFINITION	Molality (**m**) is the number of moles of solute per kilogram of solvent. Note that a lower case "**m**" is used for molality concentrations, whereas a capital "**M**" is used for molarity. The difference between molality and molarity is that molality refers to moles of solute **per kilogram of solvent**, whereas molarity refers to moles of solute **per liter of solution.**
EQUATIONS	**molality (m) =** $\frac{\textbf{Moles of Solute}}{\textbf{Kilograms of Solvent}}$ **grams = (m)(GMM)(kg of solvent)** m = **molality** in moles/kg of solvent GMM = **molecular mass of solute** in grams/mol kg of solvent = **mass of solvent in kg** grams = **mass of solute** in gram
GUIDELINES	1. Remember the letter **m** means moles/kg of solvent. 2. Be careful if volumes of solvent are given; you may have use density to help solve the problem. (Water isn't always the solvent) 3. Use a common set of units in problem solving. 4. The equations above can be solved for any of the variable through algebraic rearrangement. Four (4) variables means you can write four equations etc. 5. Molality is a very useful concentration unit in the area of colligative properties.
EXAMPLES	1. If 49.0 g of H_2SO_4 are added to 250 g of water, what is the molality of the solution? $m = \frac{\text{grams}}{(\text{GMM})(\text{kg of solvent})} = \frac{49\text{g}}{(98\frac{\text{g}}{\text{mole}})(0.250\text{ kg})} = 2.0\text{ m}$ 2. Calculate the mass of solute needed to add to 500 g of water to make a 0.350 m $SnBr_2$ solution. $g = (m)(GMM)(kg\text{ of solvent})$ $g = (0.350\frac{\text{moles}}{\text{kg}})(278\frac{\text{g}}{\text{mole}})(0.500\text{ kg}) = 48.65\text{ g}$ 3. What is the mass of water in a 2.5 m solution of calcium nitrate, $Ca(NO_3)_2$, if the mass of the solute is 8.2 g? $\text{kg of solvent} = \frac{\text{grams of solute}}{(m)(GMM)}$ $\text{kg of solvent} = \frac{8.2\text{ g}}{(2.5\frac{\text{moles}}{\text{kg of solvent}})(164\frac{g}{mole})} = 0.02\text{kg}$

A. Calculate the molality (m) of the following solutions:

_____1. 144 g of $C_6H_{12}O_6$ in 1000 g of H_2O

_____2. 48 g of CH_3OH in 200 g of H_2O

_____3. 600 g of C_3H_7OH in 600 g of H_2O

_____4. 180 g of C_3H_7OH in 1000 g of H_2O

_____5. 19.2 g CH_3OH in 500 g of H_2O

_____6. 370 g C_4H_9OH in 400 g of H_2O

_____7. 87 g of $Mg(OH)_2$ in 500 g of H_2O

_____8. 16.64 g of $BaCl_2$ in 400 g of H_2O

_____9. 6.75 g $C_6H_{12}O_6$ in 325 g of H_2O

_____10. 31 g of $C_2H_4(OH)_2$ in 200 g of H_2O

B. Solve the following problems:

_____11. Determine the grams of solute required to prepare a 3.00m solution of KOH containing 1500 g of water.

_____12. Determine the grams of solute required to prepare a 0.500m solution of CH_3COOH containing 750 g of water.

_____13. Calculate the mass of water required to make a 0.500m solution that contains 20.0 g of NaCl.

_____14. How many grams of solute are required to prepare a 1.25m solution of NaCl containing 250.0 g of water?

_____15. What is the molality of a solution that contains 5.10 moles of KNO_3 in 4470 g of water?