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**POST-LAB REPORT #3**

**Determination of Molar Mass by Freezing Point Depression**

1. From part B, clearly show with units how you calculated .

Before freezing: = **– 2.157 C/min**  = **44.893 C**

After freezing: = **– 0.3353** **C/min**  = **40.395 C**

= = = 39.5671 C = **39.6 C**

1. From part B, clearly show with units how you calculated the value for freezing point depression = .

Freezing point of lauric acid: Trial 1 = **43.1 C** Trial 2 = **43.1 C**

Average freezing point of lauric acid = = = = **43.1 C**

= = 43.1 C – 39.5671 C = 3.5329 C = **3.5 C**

1. Calculate the molar mass of your unknown. Show the formula used, data, and units in your calculations.

of lauric acid = **3.90 C kg**

Mass solvent = = **1.971 g**

Mass solute = = **0.300 g**

= **3.5 C**

Molar mass = x 1000 = x 1000 = 168.023 g/mol = **170 g/mol**

1. Your unknown is either **camphor** or **naphthalene**. Identify your unknown by comparing its calculated molar mass to the molar masses of these two organic compounds. You will have to look up their chemical formulas and calculate the molar masses for each of the possible compounds, show values.

Camphor (

Molar mass = 10 x 12 g/mol (C) + 16 x 1 g/mol (H) + 1 x 16 g/mol (O) = **152 g/mol**

Naphthalene ()

Molar mass = 10 x 12 g/mol (C) + 8 x 1 g/mol = **128 g/mol**

Unknown is Camphor because its molar mass (170 g/mol) is closest to 152 g/mol.

1. Calculate the percent error in your molar mass. % Error = x 100 where A = Accepted Value and B = Experimental Value.

Molar mass of unknown = **170 g/mol**

Molar mass of Camphor = **152 g/mol**

% Error = x 100 = x 100 = 11.8421 % = **12 %**

1. If a small amount of the solvent fails to dissolve in the solvent–solute solution, will the molar mass that you calculate for unknown solute be too high or too low? Explain clearly using the equation to calculate molar mass.

The molar mass of a substance can be determined by using the change in freezing point of a solution containing a known mass of the substance. This is because the freezing point depression is proportional to the molality of the solution using the formula **T = im** (where i is Van’t Hoff number, m is molality, and is freezing point depression constant for the solute). The number of moles of solute can be calculated from the experimentally determined molality: **n (moles) = m (molality) x** ; therefore, the molar mass of the substance can be calculated **molar mass =** .

If a small amount of the solvent fails to dissolve in the solvent-solute solution, there is less moles dissolved, causing the molar mass to be too high because there is an inverse relationship between moles and molar mass.