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Name: Natalia Reyes Becerra

Potentially useful information:	$\Delta T_b = K_b m \quad \Delta T_f = K_f m \quad \text{molality } (m) = \frac{n_{solute}}{\text{kg solvent}}$

A 151 mg sample of caffeine is dissolved in 10.0 g of camphor $\left(K_f = 39.7 \frac{°C}{m}\right)$, and it decreases the freezing point of camphor by 3.07 °C.

Using the freezing point depression data, show that the molar mass of caffeine ($C_8H_{10}N_4O_2$) is approximately 195 g/mol.

$m = \frac{\text{mol solute}}{\text{kg solvent}}$ $\quad \frac{10.0 \text{ g camphor}}{1} \Big| \frac{1 \text{ kg}}{1000 \text{ g}} = .0100 \text{ kg}$

$\Delta T = K_f m$

$3.07 = (39.7)\left(\frac{x \text{ mol}}{0.0100 \text{ kg}}\right)$

$x \text{ mol} = 7.73 \times 10^{-4} \text{ mol}$

$\frac{151 \text{ mg}}{1} \Big| \frac{1 \text{ g}}{1000 \text{ mg}} = 0.151 \text{ g caffeine}$

$\frac{0.151 \text{ g}}{7.73 \times 10^{-4} \text{ mol}} = \boxed{195 \text{ g/mol caffeine}}$

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Name: Erin Gerardo

Potentially useful information:	$\Delta T_b = K_b m \quad \Delta T_f = K_f m \quad$ molality $(m) = \frac{n_{solute}}{\text{kg solvent}}$

A 151 mg sample of caffeine is dissolved in 10.0 g of camphor $\left(K_f = 39.7\frac{°C}{m}\right)$, and it decreases the freezing point of camphor by 3.07 °C.

Using the freezing point depression data, show that the molar mass of caffeine ($C_8H_{10}N_4O_2$) is approximately 195 g/mol.

$$\frac{3.07°C}{39.7} = \frac{39.7\,m}{39.7}$$

$$m = 0.07733 = \frac{\text{moles caffeine}}{\text{kg camphor}}$$

$$10g \text{ camphor} \times \frac{1\,kg}{1000\,g} = 0.01\,kg$$

$$0.07733 = \frac{\text{moles}}{0.01\,kg}$$

$$0.0007733 \text{ moles } C_8H_{10}N_4O_2 = \frac{1\,mol}{195\,g} =$$

$$0.151g\ C_8H_{10}N_4O_2$$

$$0.151g \times \frac{1000\,mg}{1g} = 151mg \text{ of caffeine}$$

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Name: Emily Huynh

Potentially useful information:	$\Delta T_b = K_b m \quad \Delta T_f = K_f m \quad \text{molality } (m) = \frac{n_{solute}}{\text{kg solvent}}$

A 151 mg sample of caffeine is dissolved in 10.0 g of camphor $\left(K_f = 39.7 \frac{°C}{m}\right)$, and it decreases the freezing point of camphor by 3.07 °C.

Using the freezing point depression data, show that the molar mass of caffeine ($C_8H_{10}N_4O_2$) is approximately 195 g/mol.

151 mg solute

$K_f = 39.7 \frac{°C}{m}$

$\Delta T_f = 3.07°C$

10 g solvent

$(10 g \text{ camphor})\left(\frac{1 kg}{1000 g}\right) = .01 kg$

$151 mg \left(\frac{1 g}{1000 mg}\right) = .151 g$

$\Delta T_f = K_f m$

$3.07°C = \left(39.7 \frac{°C}{m}\right)\left(\frac{.151g\left(\frac{1 mol}{x}\right)}{.01 kg}\right)$

$3.07°C = (39.7)\left(\frac{.151}{x}\right)\left(\frac{1}{.01}\right)$

$3.07°C = \frac{599.47}{x}$

$\boxed{x = 195 g/mol}$

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Name: Brandi Richardson 11/27/18

Potentially useful information:	$\Delta T_b = K_b m \quad \Delta T_f = K_f m \quad \text{molality } (m) = \frac{n_{solute}}{\text{kg solvent}}$

A 151 mg sample of caffeine is dissolved in 10.0 g of camphor $\left(K_f = 39.7\frac{°C}{m}\right)$, and it decreases the freezing point of camphor by 3.07 °C.

Using the freezing point depression data, show that the molar mass of caffeine ($C_8H_{10}N_4O_2$) is approximately 195 g/mol.

$\Delta T_f = K_f m$

$\frac{3.07°C}{39.7\frac{°C}{m}} = \frac{(39.7\frac{°C}{m})m}{39.7\frac{°C}{m}}$

$m = 0.0773\ m$

$0.0773 = \frac{n_{caffeine}}{\text{kg camphor}}$

$151\text{ mg } C_8H_{10}N_4O_2 \text{ (caffeine)} \times \frac{0.001\text{ g } C_8H_{10}N_4O_2}{1\text{ mg } C_8H_{10}N_4O_2} \times \frac{1\text{ mol } C_8H_{10}N_4O_2}{194.48\text{ g } C_8H_{10}N_4O_2} = 0.000776\text{ mol}$

$10.0\text{ g camphor} \times \frac{0.001\text{ kg camphor}}{1\text{ g camphor}} = 0.01\text{ kg camphor}$

$m = \frac{0.000776\text{ mol caffeine}}{0.01\text{ kg camphor}} \approx 0.0776$ ✓

$0.0776 \approx 0.0773$

Chemistry 161a – Fall 2018

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Chapter 11 Quiz

Name: Maya Sanghvi

Potentially useful information:	$\Delta T_b = K_b m \quad \Delta T_f = K_f m \quad \text{molality } (m) = \frac{n_{solute}}{\text{kg solvent}}$

A 151 mg sample of caffeine is dissolved in 10.0 g of camphor $\left(K_f = 39.7\frac{°C}{m}\right)$, and it decreases the freezing point of camphor by 3.07 °C.

Using the freezing point depression data, show that the molar mass of caffeine ($C_8H_{10}N_4O_2$) is approximately 195 g/mol.

$3.07°C = 39.7 \cdot m$

$m = 0.0773299748 \frac{mol}{kg}$

$0.151g \times \frac{1 mol}{195g} = \frac{7.7 \times 10^{-4} mol}{0.010g \text{ camphor}} = 0.077 = 0.077$ ✓

↑

the molalities achieved by both methods are equal, which shows that the molar masses are equal

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Name: Enrique Vazquez

Potentially useful information:	$\Delta T_b = K_b m$ $\Delta T_f = K_f m$ molality $(m) = \frac{n_{solute}}{\text{kg solvent}}$

A 151 mg sample of caffeine is dissolved in 10.0 g of camphor $\left(K_f = 39.7\frac{°C}{m}\right)$, and it decreases the freezing point of camphor by 3.07 °C.

Using the freezing point depression data, show that the molar mass of caffeine ($C_8H_{10}N_4O_2$) is approximately 195 g/mol.

151 mg $\Delta T_f = 3.07$

$m = \frac{n_{solute}}{\text{Kg Solvent}}$ $3.07 = \frac{n_{caffine}}{.01\text{ Kg}} \cdot 39.7$

$n_{caffine} = 7.7 \cdot 10^{-4}$ mol

$X g \cdot \frac{1\text{ mol}}{195 g} = 7.7 \cdot 10^{-4}$ mol $\cdot 195$

$\cdot 195$

$X = .151 g \rightarrow$ 151 mg