① solute $CaCl_2$ solvent H_2O

$\Delta T_f = ?$

$K_f = \frac{1.86°C}{m}$

$m = \frac{\text{mol } CaCl_2}{\text{kg } H_2O} = \frac{\left(2.2\text{ lbs } CaCl_2 \times \frac{454\text{ g } CaCl_2}{1\text{ lb } CaCl_2} \times \frac{1\text{ mol } CaCl_2}{110.98\text{ g } CaCl_2}\right)}{\left(800.\text{ g} \times \frac{1\text{ kg}}{1000\text{ g}}\right)} = 11\ m$

i

$CaCl_{2(s)} \xrightarrow{H_2O} Ca^{2+}_{(aq)} + 2Cl^-_{(aq)}$

$i = 3$

$\Delta T_f = \left(\frac{1.86°C}{m}\right)(11\ m)(3) = 61°C$

$T_{org} - \Delta T_f = T_{new}$

$0°C - 61°C = \boxed{-61°C}$

② solute = NaCl

solvent = H_2O

$\Delta T_b = 106 - 100 = 6°C$

$K_b = .52°C/m$

$m = ?$

$i = 2$

$m = \frac{\Delta T_b}{K_b} = \frac{6°C}{\frac{.52°C}{m}(2)} = 5.8\ m$

$m = \frac{\text{mol}}{\text{kg}}$ $\quad \text{mol} = m \cdot \text{kg}$

$= \left(\frac{5.8\text{ mol}}{1\text{ kg}}\right)(5.0\text{ kg})$

$\text{mol} = 29$ mol NaCl

$29\text{ mol NaCl} \times \frac{58.44\text{ g NaCl}}{1\text{ mol NaCl}} = 1695$ NaCl

2000 g

(3) solute = adrenaline

solvent = CCl_4

$\Delta T_b = .49°C$

$K_b = 5.02°C/m$

$m =$

$\frac{\Delta T_b}{K_b} = \frac{K_b \cdot m}{K_b}$

$m = \frac{.49°C}{5.02°C/m} = .0976\ m$

$kg \cdot m = mol$ $\quad kg = \left(36.0\,g \times \frac{1\,kg}{1000\,g}\right)\left(.0976\,\frac{mol}{kg}\right)$

$mol = .00351\ mol$

molar mass $= \frac{.64\,g}{.00351\,mol} = 182\,g/mol$

3.51×10^{-3} (180)

(4) solute = C_2H_6O Assume 100g sample

solvent = H_2O 25g C_2H_6O

75g H_2O

$m = \frac{\left(25\,g\,C_2H_6O \times \frac{1\,mol}{46.07\,g}\right)}{.075\,kg} = 5.3\ m$

$i = 1$

$\Delta T_b = K_b \cdot m \cdot i$

$= \left(.52°C/m\right)(5.3\ m)(1)$

$= 2.8°C$

$T_{org} + \Delta T_b = T_{new}$

(102.8°C)

$\Delta T_f = K_f \cdot m \cdot i$

$= \left(1.86°C/m\right)(5.3\ m)(1)$

$= 9.9°C$

$T_{org} - \Delta T_f = T_{new}$

$-9.9°C$

No