Freezing pt. depression/boiling pt. elevation problems:

1. List the following aqueous solutions in order of their expected freezing points: 0.050 m $CaCl_2$; 0.15 m NaCl; 0.10 m HCl; 0.050 m $HC_2H_3O_2$; 0.10 m $C_{12}H_{22}O_{11}$.

$(0.050\ m\ CaCl_2)(3) = 0.15$

$(0.15\ m\ NaCl)(2) = 0.30$

$(0.10\ m\ HCl)(2) = 0.20$

$0.05\ m\ HC_2H_3O_2 = 0.05$

$0.10\ m\ C_{12}H_{22}O_{11} = 0.10$

2. Which of the following solutes will produce the largest increase in boiling point upon addition of 1 kg of water: 1 mol $Co(NO_3)_2$; 2 mol KCl; 3 mol ethylene glycol ($C_2H_6O_2$)?

moles x # ions

3. Camphor ($C_{10}H_{16}O$) melts at 179.8°C, and its has a particularly large freezing point depression constant, K_f = 40.0°C/m. When 0.186 g of an organic substance of unknown molar mass is dissolved in 22.01 g of liquid camphor, the freezing point of the mixture is found to be 176.7°C. What is the molar mass of the solute?

$\Delta T_f = K_f m i$

$3.1°C = (40.0°C/m)x$

$x = \frac{3.1°C}{40.0°C/m}$

$x = 0.078\ m$

179.8°C
−176.7°C
3.1°C

$molality = \frac{moles\ of\ solute}{kg\ of\ solvent}$

$0.078\ m = \frac{x}{0.02201\ kg}$

$x = 0.002\ moles$

$\frac{0.186\ g}{0.002\ moles} = 93.00\ \frac{g}{moles}$