H_2O

$K_f = 1.86°C/m$

$K_b = 0.512°C/m$

Honors Chemistry
Dr. Wilhelm
Worksheet: Colligative Properties

1. Indicate how many particles are formed when the following solutes dissolve:

Sucrose: $C_{12}H_{22}O_{11}$ $i=1$ Magnesium chloride: $MgCl_2$ $i=3$

Sodium sulfate: Na_2SO_4 $i=3$ Methanol CH_3OH $i=1$

2. When 5.0 g of $CaCl_2$ dissolved in 50.0g of water, what is the boiling point of the solution?

$CaCl_2$	H_2O	Soln
5.0	50.0	
.045		

$m = \frac{.045 mol}{.050 kg} = .90 m$

$\Delta T_B = (.512)(.90m)(3) = 1.38°C$

$T_B = 100°C + 1.38 = \boxed{101.38°C}$

3. What is the freezing point of an aqueous sucrose solution that has 25.0 g $C_{12}H_{22}O_{11}$ per 100g H_2O?

$C_{12}H_{22}O_{11}$	H_2O	Soln
25g	100g	
.073mole		

$m = \frac{.073 mol}{.100 kg} = 0.73m$, $i=1$

$\Delta T_f = (1.86°C/m)(.73m) = 1.36°C$

$T_f = 0° - 1.36° = \boxed{-1.36°}$

4. Determine the freezing point depression of a 0.25M solution of NaCl, given the assumption that the density of this solution is 1.1 g/ml.

NaCl	H_2O	Soln
14.6	1085	1100
.25		
		1000

$m = \frac{0.25 mol}{1.085 kg} = 0.23m$, $i=2$

$\Delta T_f = (1.86°C/m)(.23m)(2) = 0.85°C$

$T_f = 0°C - .85°C = \boxed{-.85°C}$

5. What mass of sucrose should be added to a 75.0g of H_2O to raise the boiling point to 100.3°C?

$\Delta T_B = K_b \cdot m$

$0.3°C = (.512)m$

$m = \frac{0.586 moles}{kg\ H_2O}$

.0750 kg H_2O	.586 mole	342.3g $C_{12}H_{22}O_{11}$ = 15.04g $C_{12}H_{22}O_{11}$
kg	mole	

6. Arrange the following according to decreasing freezing point:

a) 0.15m CH_3COOH b) 0.1m H_2SO_4 c) 0.1m $Mg(NO_3)_2$ d) 0.1m NaBR

$i=1$	$i=3$	$i=3$	$i=2$
.15m	.3m	.3m	.2m

$CH_3COOH \leftrightarrows NaBr > H_2SO_4, Mg(NO_3)_2$ (lowest)