Key

CHEM 162

Colligative Properties with Ionic Compounds

1) What is the freezing point of a solution prepared by adding 239.0 g of copper(II) sulfate to 4.00 liters of water? The freezing point depression constant (K_f) of water is 1.86 °C/*m* and remember the density of water is 1.00 g/mL.

Chemical formula for copper(II) sulfate: $CuSO_4$

$239.0\,g\,CuSO_4 \times \frac{1\,mol\,CuSO_4}{159.62\,g\,CuSO_4} = 1.497\,mol$

van't Hoff factor (i): 2

$\Delta T_f = (2)(1.86\,°C/m)\left(\frac{1.497\,mol}{4.00\,kg\,H_2O}\right) = 1.39°C$

$T_f = -1.39°C$

2) What is the new boiling point of a solution prepared by adding 96.0 g of sodium acetate to 383 mL of water? The boiling point constant (K_b) for water is 0.512 °C/*m*.

Chemical formula for sodium acetate: $NaC_2H_3O_2$

$96.0\,g\,NaC_2H_3O_2 \times \frac{1\,mol}{82.034\,g} =$

$1.17\,mol\,NaC_2H_3O_2$

van't Hoff factor (i): 2

$\Delta T_b = (2)(0.512\,°C/m)\left(\frac{1.17\,mol\,NaC_2H_3O_2}{0.383\,kg\,H_2O}\right)$

$= 3.13°C$

$T_b = 103.13°C$

3) Assuming 100% dissociation, calculate the freezing point (T_f) and boiling point (T_b) of 1.34*m* $Mg(NO_3)_2$(aq). Useful info: For water, K_f = 1.86°C/*m* and K_b = 0.512°C/*m*

$Mg(NO_3)_2$

i=3

$\Delta T_f = (3)(1.86\,°C/\underline{m})(1.34\,\underline{m}) = 7.48°C$

$T_f = -7.48°C$

$\Delta T_b = (3)(0.512\,°C/\underline{m})(1.34\,\underline{m}) = 2.06°C$

$T_b = 102.06°C$