Answer on Question #59955, Chemistry / General Chemistry

1. if i add 45 grams of sodium chloride to 500 grams of water, what will the melting and boiling points be of the resulting solutions

Solution:

Freezing point depression:

$\Delta T_F = K_F \cdot C_m \cdot i$

K_F - cryoscopic constant (1.86 for water solution)

C_m – molality of solution

i – van 't Hoff factor (NaCl – electrolyte,). If α→100%, i of NaCl = 2.

boiling point elevation:

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

K_b - ebullioscopic constant (0.51 for water solution)

$C_m = \frac{n}{m}$

$n = \frac{m}{M} = \frac{45g}{58.5\ g/mol} = 0.77$ mol

m – mass of solvent = 0.5 kg

$C_m = \frac{n}{m} = \frac{0.77\ mol}{0.5\ kg} = 0.54$ mol/kg

$\Delta T_F = 1.86 \cdot 0.54 \cdot 2 = 2.01$

$\Delta T_F = T_{F\ (water)} - T_{F\ (solution)}$

$T_{F\ (solution)} = T_{F\ (water)} - \Delta T_F$

$T_{F\ (solution)} = 0° - 2.01 = -2.01°$

Freezing point (T_F) = melting point = -2.01°C

$\Delta T_b = 0.51 \cdot 0.77 \cdot 2 = 0.76$

$\Delta T_b = T_{b\ (solution)} - T_{b\ (water)}$

$T_{b\ (solution)} = 100° + 0.76 = 100.76°C$

Answer: melting point = -2.01°C , boiling point = 100.76°C.