Extra Credit Extension

EFFECT OF A SOLUTE ON FREEZING AND BOILING POINTS

Name _____

We use the following formulas to calculate changes in freezing and boiling point due to the presence of a nonvolatile solute. Freezing point is always lowered, boiling point is always raised.

$\Delta T_F = m \times d.f. \times k_F$

$\Delta T_B = m \times d.f. \times k_B$

$k_B H_2O = 0.52° C/m$

$k_F H_2O = 1.86° C/m$

m = molality of solution

k_F and k_B = constants for particular solvent

d.f. = dissociation factor (how many particles solute breaks up into: for a nonelectrolyte, d.f. = 1)

(Theoretical Dissociation Factor is always greater than observed effect.)

Solve the problems below.

1. What is the new boiling point if 25 g of NaCl is dissolved in 1.0 Kg of water?

_____

2. What is the freezing point of the solution in Problem 1?

_____

3. What are the new freezing and boiling points of water if 50. g of ethylene glycol (molecular mass = 62 g/mol) is added to 50. g of water?

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4. When 5.0 g of a nonelectrolyte is added to 25 g of water, the new freezing point is -2.5° C. What is the molecular mass of the unknown compound?

_____

MOLARITY BY DILUTION

Name _____

Acids are usually acquired from chemical supply houses in concentrated form. These acids are diluted to the desired concentration by adding water. Since moles of acid before dilution = moles of acid after dilution, and moles of acid = M x V then, $M_1 \times V_1 = M_2 \times V_2$. Solve the following problems.

1. How much concentrated 18 M sulfuric acid is needed to prepare 250 mL of a 6.0 M solution?

   83 mL

2. How much concentrated 12 M hydrochloric acid is needed to prepare 100 mL of a 2.0 M solution?

   17 mL

3. To what volume should 25 mL of 15 M nitric acid be diluted to prepare a 3.0 M solution?

   125 mL

4. To how much water should 50. mL of 12 M hydrochloric acid be added to produce a 4.0 M solution?

   100mL (150mL total soln)

5. To how much water should 100. mL of 18 M sulfuric acid be added to prepare a 1.5 M solution?

   1.1 liters (1.2 liters total soln)