

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.

$$\Delta T_f = m \times \text{d.f.} \times k_f$$

$$\Delta T_b = m \times \text{d.f.} \times k_b$$

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.)

$$k_b \text{H}_2\text{O} = 0.52^\circ \text{C/m}$$

$$k_f \text{H}_2\text{O} = 1.86^\circ \text{C/m}$$

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?

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?
