Answer on the question #67033, Chemistry / General Chemistry

Question:

What is the boiling point of a 0.195m aqueous solution of K2S?
(Report amount to three decimal points.)

Solution:

The boiling point of the solution is increased by the addition of non-volatile substance K_2S. The change of the boiling temperature can be calculated as:

$$\Delta T = iK_b m,$$

where i is the van't Hoff factor, K_b is the ebulioscopic constant of the solvent (0.512 °C·kg/mol for water) and m is the molality of the solution.

Van't Hoff factor for K_2S is:

$$i = \alpha n + (1 - \alpha),$$

where α is the degree of dissociation and n is the number of the ions produced. According to the equation of dissociation of K_2S (K_2S ® $2K^+ + S^{2-}$), number of the ions produced is 3. Assuming complete dissociation ($\alpha = 1$):

$$i = 1 \cdot 3 + (1 - 1) = 3$$

Change of the boiling point is:

$$\Delta T = 3 \cdot 0.512(℃ \cdot kg \cdot mol^{-1}) \cdot 0.195(mol \cdot kg^{-1}) = 0.300\ ℃$$

Normal boiling point of water is (373.17 – 273.15) = 100.02°C. Then, the boiling point of the solution is 100.02 + 0.300 = 100.320°C.

Answer: 100.320°C

The boiling point was taken from NIST chemistry webbook
http://webbook.nist.gov/cgi/cbook.cgi?ID=C7732185&Units=SI&Mask=4#Thermo-Phase