

Answer on Question #51214 – Chemistry – Physical Chemistry

Question:

An aqueous solution containing 10.00×10^{-4} kg of a solute in 8.00×10^{-2} kg of water was found to freeze at 272.72 K. Calculate the molar mass of the solute. Molar enthalpy of fusion of ice at its melting point 273.15 K is 6021 J mol^{-1} .

Solution:

According to the equation of cryoscopy:

$\Delta T = K \times C$, where $\Delta T = T(\text{the freeze of pure solvent}) - T(\text{the freeze of solution})$,

C- molality is defined $N(\text{the number of moles of compound})/m(\text{the mass of solvent})$

K – cryoscopic constant, $K(\text{water}) = 1.853 \text{ K kg/mol}$.

Thus, $\Delta T = 273.15 \text{ K} - 272.72 \text{ K} = 0.43 \text{ K}$

$C = \Delta T/K = 0.232056 \text{ mol/kg}$,

$N = C \times m(\text{water}) = 0.23056 \text{ mol/kg} \times 0.008 \text{ kg} = 0.0185645 \text{ mol}$

Molar weight of the solute is: $M_w = m(\text{solute})/N = 1 \text{ g} / 0.0185645 \text{ mol} = 53.87 \text{ g/mol}$

Answer: 53.87 g/mol