Answer on Question #44101, Chemistry, Other

Question:

An aqueous solution of ethanol has density 1.025 g/ml and it is 2 M. What is the molality of this solution ?

Solution:

Molarity and molality are both measures of concentration of solutions. Molarity, symbolized M, is defined as the number of moles of solute per liter of solution:

M= (moles of solute)/(liters of solution).

Molality, symbolized m, is the number of moles of a solute per kilogram of solvent:

m= (moles of solute)/(kilogram of solvent).

Step 1. Make an assumption
Assume you have 1 L of 2.0 M ethanol solution. 2.0 M ethanol solution means that there is 2 moles of ethanol per 1 liter of solution.

Step 2. Find the total mass of the solution

1.025 g/ml= 1.025 kg/L

mass of solution= volume×density= 1 L×1.025 kg/L= 1.025 kg = 1025 g

Step 3. Calculate the mass of the solute
2.0 M ethanol solution means that there is 2 moles of ethanol per 1 liter of solution.
Convert 2 moles to grams:

mass= moles×molar mass

The molar mass of ethanol is 46 g/mol (from the periodic table: C_2H_6O, 12×2+1×6+16×1= 46)

2 moles× 46 g/mol = 92 grams of ethanol

Step 4. Calculate the mass of the solvent

1025 grams of solution – 92 grams of solute= 933 grams of solvent= 0.933 kg of solvent

Step 5. Calculate the molality

2 moles of solute/0.933 kg of solvent= 2.1 mol/kg= 2.1 m

Answer: Molality of the solution is 2.1.