

1) You add 24.3 g of KI to 500. mL of pure water. The final volume comes out to be 505. mL.

Which substance is the solute? KI The solvent? H₂O

a) What is the total mass of the solution?

$$24.3\text{g} + 500.\text{g} = \boxed{524\text{g}}$$

b) What is the mass percent of KI in the solution?

$$\% \text{KI} = \frac{24.3\text{g KI}}{524\text{g total}} \times 100 = \boxed{4.63\% \text{ KI by mass}}$$

d) What is the mole fraction of KI in the solution?

$$MF = \frac{\text{mol KI}}{\text{mol KI} + \text{mol H}_2\text{O}} \quad 500.\text{g H}_2\text{O} \left(\frac{1\text{mol}}{18.02\text{g}} \right) = 27.7\text{mol H}_2\text{O}$$

$$24.3\text{g KI} \left(\frac{1\text{mol}}{166.00\text{g}} \right) = 0.146\text{mol KI} \quad MF = \frac{0.146}{27.8} = \boxed{0.00525}$$

e) What is the molarity of the solution?

$$= \frac{\frac{\text{mol KI}}{\text{total L}}}{0.505\text{L}} = \frac{0.146\text{mol KI}}{0.505\text{L}} = \boxed{0.289\text{M KI}}$$

2) a) You mix together 100. grams of H₂O and 78.9 grams of ethanol CH₃CH₂OH (MM = 46.07 g/mol). Find the mole fraction of ethanol in this solution.

$$100.\text{g H}_2\text{O} \left(\frac{1\text{mol}}{18.02\text{g}} \right) = 5.55\text{mol H}_2\text{O} \quad 78.9\text{g Eth} \left(\frac{1\text{mol}}{46.07\text{g}} \right) = 1.71\text{mol Eth} \quad MF = \frac{1.71\text{mol}}{5.55 + 1.71} = \boxed{0.236}$$

b) If the final volume comes out to be 195. mL, find the molarity of the ethanol in this solution.

$$M = \frac{\text{mol Eth}}{\text{total L}} = \frac{1.71\text{mol}}{0.195\text{L}} = \boxed{8.77\text{M EthOH}}$$

c) Find the density of the final solution.

$$D = \frac{\text{total mass}}{\text{total volume (mL)}} = \frac{179\text{g}}{195\text{mL}} = \boxed{0.918\text{ g/mL}}$$

d) Find the MOLALITY of the solution, assuming ethanol is the solute.

$$m = \frac{\text{mol solute}}{\text{kg solvent only}} = \frac{1.71\text{mol Eth}}{0.100\text{kg H}_2\text{O}} = \boxed{17.1\text{m Eth}}$$

3) How is the unit MOLALITY different than MOLARITY?

$$m = \frac{\text{mol solute}}{\text{kg solvent}} \quad M = \frac{\text{mol solute}}{\text{L solution}}$$

different denominator