

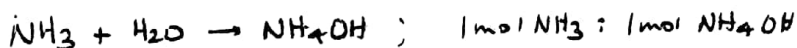
Be sure to include all your work. This includes any and all equations used, conversions and units.

1. A 32.0% by weight solution of propanol, C_3H_7OH , in water has a density at $20^\circ C$ of 0.945 g/mL . What are the molarity and molality of the solution?

$$\frac{\text{mol}}{\text{L}} \parallel \frac{32.0 \text{ g } C_3H_7OH}{100 \text{ g } C_3H_7OH(aq)} \times \frac{1 \text{ mol } C_3H_7OH}{60.11 \text{ g } C_3H_7OH} \times \frac{0.945 \text{ g } C_3H_7OH(aq)}{1 \text{ mL } C_3H_7OH(aq)} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 5.03 \text{ M } C_3H_7OH$$

$$\frac{\text{mol}}{\text{kg}} \parallel \frac{32.0 \text{ g } C_3H_7OH}{68.0 \text{ g } H_2O} \times \frac{1 \text{ mol } C_3H_7OH}{60.11 \text{ g } C_3H_7OH} \times \frac{1000 \text{ g}}{1 \text{ kg}} = 7.83 \text{ m } C_3H_7OH$$

2. How many liters of ammonia at $25.0^\circ C$ and 1.46 atm are required to prepare 3.00 L of a 2.50 M solution of NH_3 ?



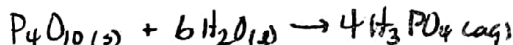
$$\parallel \frac{3.00 \text{ L } NH_3(aq)}{1 \text{ L } NH_3(aq)} \times \frac{2.50 \text{ mol } NH_3}{1 \text{ L } NH_3(aq)} \times \frac{0.0821 \text{ L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} \times \frac{(25.0 + 273.15) \text{ K}}{1.46 \text{ atm}} = 126 \text{ L } NH_3$$

3. Calculate the percent by mass and the molality in terms of $CuSO_4$ for a solution prepared by dissolving 11.5 g of $CuSO_4 \cdot 5H_2O$ in $1.00 \times 10^2 \text{ mL}$ of water.

$$\parallel \frac{11.5 \text{ g } CuSO_4 \cdot 5H_2O}{249.72 \text{ g } CuSO_4 \cdot 5H_2O} \times \frac{1 \text{ mol } CuSO_4 \cdot 5H_2O}{249.72 \text{ g } CuSO_4 \cdot 5H_2O} \times \frac{5 \text{ mol } H_2O}{1 \text{ mol } CuSO_4 \cdot 5H_2O} \times \frac{18.02 \text{ g } H_2O}{1 \text{ mol } H_2O} = 4.15 \text{ g } H_2O$$

$$\% \text{ mass} = \frac{(11.5 - 4.15) \text{ g } CuSO_4}{(11.5 + 100) \text{ g } CuSO_4(aq)} = 6.60\%$$

4. What is the molarity of H_3PO_4 in a solution that is prepared by dissolving 10.0 g of P_4O_{10} in sufficient water to make 0.500 L of solution?



$$\parallel \frac{10.0 \text{ g } P_4O_{10}}{283.88 \text{ g } P_4O_{10}} \times \frac{1 \text{ mol } P_4O_{10}}{283.88 \text{ g } P_4O_{10}} \times \frac{4 \text{ mol } H_3PO_4}{1 \text{ mol } P_4O_{10}} \times \frac{1000 \text{ g}}{159.62 \text{ g } CuSO_4} \times \frac{1 \text{ mol } CuSO_4}{159.62 \text{ g } CuSO_4} = 0.282 \text{ M } H_3PO_4$$

5. A sample of $HgCl_2$ weighing 9.41 g is dissolved in 32.75 g of ethanol, C_2H_5OH ($K_b = 1.20^\circ C/m$). The boiling point elevation of the solution is $1.27^\circ C$. Is $HgCl_2$ an electrolyte in ethanol? Show your calculations.

$$\Delta T_b = i K_b m \parallel \frac{1.27^\circ C}{1.20^\circ C \cdot \text{kg Ethanol}} \times \frac{\text{mol } HgCl_2}{9.41 \text{ g } HgCl_2} \times \frac{271.49 \text{ g } HgCl_2}{1 \text{ mol } HgCl_2} \times \frac{32.75 \text{ g Ethanol}}{1000 \text{ g}} = 1$$

$$i = \frac{\Delta T_b}{K_b m}$$

if $i = 1$ then there is 1 particle in solution = nonelectrolyte

6. The sugar fructose contains $40.0\% \text{ C}$, $6.7\% \text{ H}$, and $53.3\% \text{ O}$ by mass. A solution of 11.7 g of fructose in 325 g of ethanol has a boiling point of $78.59^\circ C$. The boiling point of ethanol is $78.35^\circ C$ and the K_b is $1.20^\circ C/m$. What is the molecular formula of fructose?

$$EF = \frac{40.0 \text{ g C}}{12.01 \text{ g}} = \frac{3.33 \text{ mol C}}{3.33} = 1 \text{ CH}_2O$$

$$\frac{6.7 \text{ g H}}{1.01 \text{ g}} = \frac{6.63 \text{ mol H}}{3.33} = 2$$

$$\frac{53.3 \text{ g O}}{16.00 \text{ g}} = \frac{3.33 \text{ mol O}}{3.33} = 1$$

$$\Delta T_b = i K_b \frac{\text{mol}}{\text{kg}} \parallel \frac{(78.59 - 78.35)^\circ C}{1.20^\circ C \cdot \text{kg}} \times \frac{\text{mol}}{11.7 \text{ g Fructose}} \times \frac{325 \text{ g Ethanol}}{1000 \text{ g}} = 0.065 \text{ mol}$$

$$M.M. = \frac{11.7 \text{ g Fructose}}{0.065 \text{ mol Fructose}} = 180 \text{ g/mol} = 6$$

$$(CH_2O)_6 = C_6H_{12}O_6$$