

1. What is the molarity of a solution made from 28.5 grams of HgCl₂ in 250.0 mL of solution?

$$28.5 \text{ g} \times \frac{1 \text{ mol}}{271.49 \text{ g}} \times \frac{1}{0.2500 \text{ L}} = \underline{0.420 \text{ M}}$$

2. 40.0 mL of water is added to 4.00 mL of 6.0M NH₄OH. What is the molarity of the diluted solution?

$$M_1 V_1 = M_2 V_2 \quad (4.00)(6.0) = (44.0)(?)$$

$$? = \underline{0.55 \text{ M}}$$

3. How many mL of a 0.200 M solution of BaSO₄ would be required to deliver 65mg of Ba²⁺ to a test tube? (The barium should have a mass of 65mg not including the sulfate.)

$$.065 \text{ g} \times \frac{1 \text{ mol}}{137.33 \text{ g}} = 0.0004733 \text{ mol Ba}^{2+} \times \frac{1 \text{ L}}{0.2 \text{ moles}} = 0.0024 \text{ L} = \underline{2.4 \text{ mL}}$$

4. The freezing point of a glucose solution (C₆H₁₂O₆; molar mass=180.0 g/mol) is -9.7°C. The density of the solution is 1.50 g/mL. Find the molarity of the glucose solution. K_f for water is 1.86°C/m.

$$5.215 \text{ moles} \times \frac{180.0 \text{ g}}{\text{mol}} = 938.71 \text{ g solute}$$

$$+ 9.7 = 1.86 \text{ m} \quad m = 5.215 \text{ assume 1 kg}$$

$$1000.00 \text{ g solvent} \quad 938.71 \text{ g soln} \times \frac{1 \text{ mL}}{1.50 \text{ g}} = 1292 \text{ mL}$$

5. Calculate the mole fraction of acetic acid in a mixture consisting of 9.0 g water, 120 g acetic acid (C₂H₄O₂) and 115 g of ethyl alcohol (C₂H₅OH).

$$\text{H}_2\text{O} = 18.02 \text{ g/mol} \quad \text{EtOH} = 46.08 \text{ g/mol} \quad 9.0 \times \frac{1 \text{ mol}}{18.02} = 0.4994 \quad 115 \times \frac{1 \text{ mol}}{46.08 \text{ g}} = 2.499$$

$$\text{HOAc} = 60.06 \text{ g/mol} \quad X_{\text{HOAc}} = \frac{1.998}{4.9964} = 0.40 \quad 120 \times \frac{1 \text{ mol}}{60.06 \text{ g}} = 1.998 \quad \text{Total moles} = 4.9964$$

6. You are instructed to administer 30.0 mg of a drug which is supplied in a concentration of 10.0 mg per 0.500 mL. How many mL should you administer?

$$\underline{1.500 \text{ mL}} \quad (3 \times 0.500)$$

7. What is the molality of NaCl in an aqueous solution which is 4.20 M? The density of the solution is 1.05 g/mL.

$$\text{assume 1 L} \quad 4.20 \text{ moles} \quad \text{mass soln} = 1050 \text{ g} \quad \frac{4.20}{.804552} = 5.22 \text{ m}$$

$$4.20 \text{ mol} \times 58.44 \text{ g/mol} = 245.448 \text{ g} \quad \text{mass solute} = 245.448 \text{ g}$$

$$\text{mass solvent} = 804.552 \text{ g}$$

8. Concentrated sulfuric acid is 98% sulfuric acid by mass and has a density of 1.84 g/mL. Find the molarity of this solution.

$$98 \text{ g H}_2\text{SO}_4, 2 \text{ g H}_2\text{O}, 100 \text{ g solution}$$

$$100 \text{ g} \times \frac{1 \text{ mL}}{1.84 \text{ g}} = 54.35 \text{ mL} \quad \frac{98 \text{ g}}{98.09 \text{ g/mol}} = 0.999 \text{ mol} = 18 \text{ M}$$

$$\frac{64.00}{32.07} / 98.09 \text{ g/mol} \quad \frac{0.999 \text{ mol}}{.05435 \text{ L}} = 18 \text{ M}$$

9. How many grams of bromine, Br₂, are needed to prepare 0.500 L of a 0.0100 M solution in water?

$$0.500 \text{ L} \times 0.0100 \text{ moles} = 0.005 \text{ mol} \times 159.8 \text{ g/mol} = 0.799 \text{ grams}$$

10. What is the molality of a solution made by dissolving 81.3 g of ethylene glycol (anti-freeze) in 166 g of water? (ethylene glycol formula = C₂H₆O₂)

$$81.3 \text{ g} \times \frac{1 \text{ mol}}{62.08 \text{ g}} = 1.31 \text{ mol} \quad \frac{1.31 \text{ mol}}{.166 \text{ kg}} = \underline{7.89 \text{ m}}$$

$$\begin{array}{r} 200.59 \\ 35.45 \\ 35.45 \\ \hline 271.49 \end{array}$$

$$\begin{array}{r} 5.215 \text{ moles} \\ \hline 1.292 \text{ L} \end{array}$$

$$\underline{4.04 \text{ M}}$$

$$\begin{array}{r} 22.99 \\ 35.45 \\ \hline 58.44 \text{ g/mol} \end{array}$$

$$\begin{array}{r} 79.9 \\ 79.9 \\ \hline 159.8 \end{array}$$

$$\begin{array}{r} 24.02 \\ 6.06 \\ 32.00 \\ \hline 62.08 \text{ g/mol} \end{array}$$