WKS
Molarity & Dilutions

Name Answer Key
Period _____ Date _____

Perform the following calculations involving percent by mass, percent by volume, and molarity.

1. What is the molarity of an aqueous solution containing 0.3 mol Na_2SO_4 in a 0.5 L solution?

$$\text{Molarity} = \frac{0.3 \text{ mol } Na_2SO_4}{0.5 \text{ L solution}} = \boxed{0.6 \text{ M } Na_2SO_4}$$

2. What is the molarity of an aqueous solution containing 1.2 mol $FeCl_3$ in a 400 mL solution? [Hint: what unit must volume be in?]

$$V = 400 \text{ mL} \times \frac{1 \times 10^{-3} \text{ L}}{1 \text{ mL}} = 0.4 \text{L}$$

$$\text{Molarity} = \frac{1.2 \text{ mol } FeCl_3}{0.4 \text{ L solution}} = \boxed{3.0 \text{ M } FeCl_3}$$

3. What is the molarity of an aqueous solution containing 25.5 g of KBr in a 0.25 L solution? [Hint: what unit must mass be converted to?]

$$\text{MM KBr} = 39.10 \text{ g} + 79.90 \text{ g} = 119.0 \text{ g/mol; mol KBr} = 25.5 \text{ g} \times \frac{1 \text{ mol}}{119.0 \text{ g}} = 0.214 \text{ mol}$$

$$\text{Molarity} = \frac{0.214 \text{ mol KBr}}{0.25 \text{ L solution}} = \boxed{0.857 \text{ M KBr}}$$

4. How many moles of LiF are in 0.15 L of a 1.5 M aqueous solution? [Hint: rearrange the formula for molarity and solve for moles of solute.]

$$\text{moles LiF} = M \times V = \frac{1.5 \text{ mol LiF}}{1 \text{ L solution}} \times 0.15 \text{ L} = \boxed{0.225 \text{ mol LiF}}$$

5. What mass of $CaCl_2$ is present in 50 mL [convert!] of a 0.20 M aqueous solution? [Hint: find moles first!]

$$\text{MM } CaCl_2 = 40.08 \text{ g} + 2(35.45 \text{ g}) = 110.98 \text{ g/mol}$$

$$\text{mol } CaCl_2 = \underbrace{\frac{0.20 \text{ mol } CaCl_2}{1 \text{ L solution}} \times 0.050 \text{ L}}_{0.010 \text{ mol } CaCl_2} \times \frac{110.98 \text{ g } CaCl_2}{1 \text{ mol } CaCl_2} = 1.11 \text{ g } CaCl_2$$

6. What is the volume of a 0.35 M aqueous solution containing 0.07 moles of KNO_3? [Hint: set up the formula for molarity and rearrange to solve for volume.]

$$M = \frac{\text{mol}}{V} \text{ so } V = \frac{\text{mol}}{M} \text{ and } V = \frac{0.07 \text{ moles}}{0.35 \text{ M}} = 0.20 \text{ L}$$

$$\text{or } V = 0.07 \text{ moles} \times \frac{1 \text{ L}}{0.35 \text{ moles}} = \boxed{0.20 \text{ L}}$$

7. If you dilute 100 mL (V_1) of a 0.15 M NaOH (M_1) solution to a final volume of 150 mL (V_2), what will the molarity (M_2) of the diluted solution be? [Remember, for dilutions you do not need to convert to L.]

$$M_1V_1 = M_2V_2; \; M_2 = \frac{M_1V_1}{V_2} = \frac{(0.15 \text{ M NaOH})(100 \text{ mL})}{150 \text{ mL}} = \boxed{0.10 \text{ M NaOH}}$$

8. What volume (V_1) of a 0.15 M NaOH (M_1) stock solution will you need to make 250 mL (V_2) of a 0.030 M (M_2) solution?

$$M_1V_1 = M_2V_2; \; V_1 = \frac{M_2V_2}{M_1} = \frac{(0.030 \text{ M NaOH})(250 \text{ mL})}{0.15 \text{ M NaOH}} = \boxed{50.0 \text{ mL}}$$

9. You have 345 mL (V_1) of a 1.5 M (M_1) NaCl solution. If you boil the water until the volume of the solution is reduced to 250 mL (V_2), what will the molarity (M_2) of the solution be?

$$M_2 = \frac{M_1V_1}{V_2} = \frac{(1.5 \text{ M NaCl})(345 \text{ mL})}{250 \text{ mL}} = \boxed{2.07 \text{ M NaCl}}$$

10. What volume (V_2) of 0.050 M (M_2) HCl solution can be made by diluting 250. mL (V_1) of 10. M (M_1) HCl stock solution?

$$V_2 = \frac{M_1V_1}{M_2} = \frac{(10. \text{ M HCl})(250. \text{ mL})}{0.050 \text{ M HCl}} = \boxed{50{,}000 \text{ mL} = 50. \text{ L}}$$