Worksheet: Molarity Name *KEY*

Molarity:

- a *quantitative* description of solution concentration.
- Abbreviated *M*

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{liters of solution}}$$

Problems: Show all work and circle your final answer.

1. To make a 4.00 M solution, how many moles of solute will be needed if 12.0 liters of solution are required?

$$4.00\ M = \frac{\text{moles of solute}}{12.0\ L} \qquad \text{moles of solute} = \boxed{48.0\ mol}$$

2. How many moles of sucrose are dissolved in 250 mL of solution if the solution concentration is 0.150 M?

$$?\ L = 250\ \cancel{mL} \times \frac{1\ L}{1000\ \cancel{mL}} = 0.25\ L$$

$$0.150\ M = \frac{\text{moles of solute}}{0.25\ L} \qquad \text{moles of solute} = \boxed{0.038\ mol}$$

3. What is the molarity of a solution of HNO_3 that contains 12.6 grams HNO_3 in 1.0 L of solution?

$$?\ mol\ HNO_3 = 12.6\ \cancel{g\ HNO_3} \times \frac{1\ mol\ HNO_3}{63.0\ \cancel{g\ HNO_3}} = 0.200\ mol\ HNO_3$$

$$M = \frac{0.200\ mol\ HNO_3}{1.0\ L} = \boxed{0.200\ M}$$

4. How many grams of potassium nitrate are required to prepare 0.250 L of a 0.700 M solution?

$$0.700\ M = \frac{\text{moles of solute}}{0.250\ L} \qquad \text{moles of solute} = 0.175\ mol$$

$$?\ g\ KNO_3 = 0.175\ \cancel{mol\ KNO_3} \times \frac{101.1\ g\ KNO_3}{1\ \cancel{mol\ KNO_3}} = \boxed{17.7\ g\ KNO_3}$$

5. 125 cm^3 of solution contains 3.5 moles of solute. What is the molarity of the solution?

$$? \text{ g } KNO_3 = 0.175 \cancel{\text{ mol } KNO_3} \times \frac{101.1 \text{ g } KNO_3}{1 \cancel{\text{ mol } KNO_3}} = \boxed{17.7 \text{ g } KNO_3}$$

$$M = \frac{3.5 \text{ mol}}{0.125 \text{ L}} = \boxed{28 \text{ M}}$$

6. Which solution is more concentrated? Solution "A" contains 50.0 g of $CaCO_3$ in 500.0 mL of solution. Solution "B" contains 6.0 moles of H_2SO_4 in 4.0 L of solution. *SHOW WORK!*

"A":

$$? \text{ mol } CaCO_3 = 50.0 \cancel{\text{ g } CaCO_3} \times \frac{1 \text{ mol } CaCO_3}{100.0 \cancel{\text{ g } CaCO_3}} = 0.500 \text{ mol } CaCO_3$$

$$? \text{ L} = 500.0 \cancel{\text{ mL}} \times \frac{1 \text{ L}}{1000 \cancel{\text{ mL}}} = 0.500 \text{ L} \qquad M = \frac{0.500 \text{ mol}}{0.500 \text{ L}} = 1.00 \text{ M}$$

"B":

$$M = \frac{6.0 \text{ mol}}{4.0 \text{ L}} = 1.5 \text{ M}$$

"B" is more concentrated: 1.5 M

7. How many liters of solution can be produced from 2.5 moles of solute if a 2.0 M solution is needed?

$$2.0 \text{ M} = \frac{2.5 \text{ moles}}{\text{liters of solution}} \qquad \text{liters of solution} = 1.25 \text{ L} = \boxed{1.3 \text{ L}}$$

8. What would be the concentration of a solution formed when 1.00 g of NaCl are dissolved in water to make 100.0 mL of solution?

$$? \text{ mol} = 1.00 \cancel{\text{ g NaCl}} \times \frac{1 \text{ mol NaCl}}{58.5 \cancel{\text{ g NaCl}}} = 0.0171 \text{ mol NaCl}$$

$$? \text{ L} = 100.0 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 0.1000 \text{ L} \qquad M = \frac{0.0171 \text{ mol}}{0.1000 \text{ L}} = \boxed{0.171 \text{ M}}$$