Name: Key Date: _____ Block: _____

Volume Stoichiometry

Mole – Volume Conversions

1. Determine the volume, in liters, occupied by 0.030 moles of a gas at STP.

$$.03 \text{ mol} \times \frac{22.4 \text{ L}}{1 \text{ mol}} = \boxed{.672 \text{ L}}$$

2. How many moles of argon atoms are present in 11.2 L of argon gas at STP?

$$11.2 \text{ L Ar} \times \frac{1 \text{ mol}}{22.4 \text{ L}} = \boxed{.5 \text{ mol Ar}}$$

3. What is the volume of 0.05 mol of neon gas at STP?

$$.05 \text{ mol} \times \frac{22.4 \text{ L}}{1 \text{ mol}} = \boxed{1.12 \text{ L}}$$

4. What is the volume of 1.2 moles of water vapor at STP?

$$1.2 \text{ mol} \times \frac{22.4 \text{ L}}{1 \text{ mol}} = \boxed{26.88 \text{ L}}$$

5. A sample of neon has a volume of 75.8L at STP. How many moles are present?

$$75.8 \text{ L} \times \frac{1 \text{ mol}}{22.4 \text{ L}} = \boxed{3.38 \text{ mol}}$$

6. Convert 0.45 moles of sodium hydroxide to liters.

$$.45 \text{ mol} \times \frac{22.4 \text{ L}}{1 \text{ mol}} = \boxed{10.08 \text{ L}}$$

Mass-Volume Practice I (remember that 1000ml = 1 L)

1. Given the balanced equation, how many milliliters of carbon dioxide gas at STP are produced from the decomposition of 1.59 g of ferric carbonate?

$Fe_2(CO_3)_3 \rightarrow Fe_2O_3 + 3CO_2$

366.27 mL CO_2

$$1.59\,g\ Fe_2(CO_3)_3 \times \frac{1\ mol\ Fe_2(CO_3)_3}{291.72\,g} \times \frac{3\ mol\ CO_2}{1\ mol\ Fe_2(CO_3)_3} \times \frac{22.4\,L}{1\ mol\ CO_2} \times \frac{1000\,mL}{1\,L}$$

2. Given the balanced equation, how many milliliters of oxygen gas at STP are released from the decomposition of 2.57 g of calcium chlorate ($Ca(ClO_3)_2$)?

$Ca(ClO_3)_2 \rightarrow CaCl_2 + 3O_2$

$$2.57\,g\ Ca(ClO_3)_2 \times \frac{1\ mol}{206.98\,g} \times \frac{3\ mol\ O_2}{1\ mol\ Ca(ClO_3)_2} \times \frac{22.4\,L}{1\ mol} \times \frac{1000\,mL}{1\,L} = 834.39\,mL$$

3. Given the balanced equation, how many milliliters of carbon dioxide gas at STP are released from the decomposition of 1.59 g of lithium hydrogen carbonate?

$2\ LiHCO_3 \rightarrow Li_2CO_3 + H_2O + CO_2$

$$1.59\,g\ LiHCO_3 \times \frac{1\ mol}{67.96\,g} \times \frac{1\ mol\ CO_2}{2\ mol\ LiHCO_3} \times \frac{22.4\,L}{1\ mol} \times \frac{1000\,mL}{1\,L} = 262.04\,mL$$

4. Given the balanced equation, how many milliliters of oxygen gas at STP are released from the decomposition of 2.50 g mercuric oxide?

$2\ HgO \rightarrow 2\ Hg + O_2$

$$2.5\,g\ HgO \times \frac{1\ mol\ HgO}{216.59\,g\ HgO} \times \frac{1\ mol\ O_2}{2\ mol\ HgO} \times \frac{22.4\,L}{1\ mol\ O_2} \times \frac{1000\,mL}{1\,L} = 129.28\,mL$$

5. Given the balanced equation, what mass of magnesium metal reacts with sulfuric acid to yield 225 mL of hydrogen gas at STP?

$Mg + H_2SO_4 \rightarrow MgSO_4 \quad H_2$

$$225\,mL\ H_2 \times \frac{1\,L}{1000\,L} \times \frac{1\ mol\ H_2}{22.4\,L} \times \frac{1\ mol\ Mg}{1\ mol\ H_2} \times \frac{24.31\,g\ Mg}{1\ mol} = .244\,g\ Mg$$

Mass-Volume Practice II
(Assume liters unless otherwise noted)

1. Hydrogen peroxide is always decomposing. How many grams of hydrogen peroxide must decompose to give 55.0 mL of oxygen gas at STP? First, convert 55.0 mL to liters.

$$2\ H_2O_2 \rightarrow 2\ H_2O + O_2$$

$$55.0\ mL \times \frac{1\ L}{1000\ L} \times \frac{1\ mol}{22.4\ L} \times \frac{2\ mol\ H_2O_2}{1\ mol\ O_2} \times \frac{34.01\ g}{1\ mol} = \boxed{.167\ g\ H_2O_2}$$

2. Candles are made of paraffin wax ($C_{25}H_{52}$). When paraffin burns in oxygen, carbon dioxide and water are produced. If 5.5 g of paraffin wax burn, what volume of carbon dioxide is produced at STP?

$$C_{25}H_{52} + 38\ O_2 \rightarrow 25\ CO_2 + 26\ H_2O$$

$$5.5\ g\ C_{25}H_{52} \times \frac{1\ mol}{352.68\ g} \times \frac{25\ mol\ CO_2}{1\ mol\ C_{25}H_{52}} \times \frac{22.4\ L}{1\ mol} = \boxed{8.73\ L\ CO_2}$$

3. The body metabolizes sucrose, $C_{12}H_{22}O_{11}$, by burning it with oxygen to produce carbon dioxide, water, and energy (ATP). If 3 moles of sucrose are burned according to the following equation, what volume of carbon dioxide is produced at STP?

$$C_{12}H_{22}O_{11} + 12\ O_2 \rightarrow 12\ CO_2 + 11\ H_2O$$

$$3\ mol\ C_{12}H_{22}O_{11} \times \frac{12\ mol\ CO_2}{1\ mol\ C_{12}H_{22}O_{11}} \times \frac{22.4\ L}{1\ mol} = \boxed{806.4\ L\ CO_2}$$

4. Solid lithium hydroxide (LiOH) is used in spacecraft to remove exhaled carbon dioxide from the air. The lithium hydroxide reacts with carbon dioxide to form lithium carbonate (Li_2CO_3) and water. How many grams of carbon dioxide can be absorbed by 74 g of LiOH?

$$2\ LiOH + CO_2 \rightarrow Li_2CO_3 + H_2O$$

$$74\ g\ LiOH \times \frac{1\ mol\ LiOH}{23.95\ g\ LiOH} \times \frac{1\ mol\ CO_2}{2\ mol\ LiOH} \times \frac{44.01\ g}{1\ mol\ CO_2} = \boxed{67.99\ g\ CO_2}$$

Volume-Volume Practice

1. Assuming all gas volumes are measured at STP, how many liters of oxygen gas react with 2.00 L of carbon monoxide? Balance the equation before proceeding.

$2CO + O_2 \rightarrow 2CO_2$

$$2.0\ L\ CO \times \frac{1\ mol\ CO}{22.4\ L} \times \frac{1\ mol\ O_2}{2\ mol\ CO} \times \frac{22.4\ L}{1\ mol\ O_2} = \boxed{1\ L\ O_2}$$

2. How many liters of carbon dioxide are produced from 2.00 L of CO? (use the equation in #1)

$$2.0\ L\ CO \times \frac{1\ mol\ CO}{22.4\ L} \times \frac{2\ mol\ CO_2}{2\ mol\ CO} \times \frac{22.4}{1\ mol} = \boxed{2\ L\ CO_2}$$

3. Assuming all gas volumes are measured at STP, how many milliliters of iodine vapor react with 125 mL of hydrogen gas? Balance the equation.

$H_2 + I_2 \rightarrow 2HI$

$$125\ mL\ H_2 \times \frac{1\ L}{1000\ mL} \times \frac{1\ mol\ H_2}{22.4\ L} \times \frac{1\ mol\ I_2}{1\ mol\ H_2} \times \frac{22.4\ L}{1\ mol\ I_2} \times \frac{1000\ mL}{1\ L} = \boxed{125\ mL\ I_2}$$

4. How many milliliters of hydrogen iodide are produced from 125 mL of H_2? (use the equation in #3)

$$125\ mL \times \frac{1\ L}{1000\ mL} \times \frac{1\ mol\ H_2}{22.4\ L} \times \frac{2\ mol\ HI}{1\ mol\ H_2} \times \frac{22.4\ L}{1\ mol\ HI} \times \frac{1000\ mL}{1\ L} = \boxed{250\ mL\ HI}$$

5. Assuming all gas volumes are measured at STP, how many milliliters of nitrogen gas react to give 45.0 mL of ammonia gas? Balance the equation.

$3H_2 + N_2 \rightarrow 2NH_3$

$$45.0\ mL\ NH_3 \times \frac{1\ L}{1000\ mL} \times \frac{1\ mol\ NH_3}{22.4\ L} \times \frac{1\ mol\ N_2}{2\ mol\ NH_3} \times \frac{22.4\ L}{1\ mol\ N_2} \times \frac{1000\ mL}{1\ L} = \boxed{22.5\ mL}$$

6. How many milliliters of hydrogen gas must react to give 45.0 mL of NH_3? (use the equation in #5)

$$45.0\ mL\ NH_3 \times \frac{1\ L}{1000\ mL} \times \frac{1\ mol\ NH_3}{22.4\ L} \times \frac{3\ mol\ H_2}{2\ mol\ NH_3} \times \frac{22.4\ L}{1\ mol\ H_2} \times \frac{1000\ mL}{1\ L} = \boxed{67.5\ mL}$$