

## Stoichiometry

### I. Particle & Mole Relationships

1. Define the term stoichiometry.

Stoichiometry - study of quantitative relationships between the amounts of reactants + products formed by a chemical reaction

2. Stoichiometry is based on the Law of Conservation of Mass.

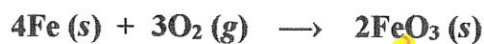
(Circle One) : True False

3. The mass of the reactants equals the mass of the products in chemical reactions.

4. What two things do the coefficients in chemical equations represent?

1. # of individual particles 2. # of moles of particles

5. Determine the total masses of the reactants and products in the following equation :



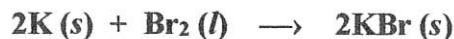
$$\begin{array}{l}
 4 \text{ mol Fe} \times \frac{55.85 \text{ g Fe}}{1 \text{ mol Fe}} = 223.4 \text{ g Fe} \\
 3 \text{ mol O}_2 \times \frac{32.00 \text{ g O}_2}{1 \text{ mol O}_2} = 96.00 \text{ g O}_2 \\
 \hline
 = 319.4 \text{ g}
 \end{array}
 \quad \Bigg| \quad
 \begin{array}{l}
 2 \text{ mol Fe}_2\text{O}_3 \times \frac{159.7 \text{ g Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} \\
 \hline
 = 319.4 \text{ g}
 \end{array}$$

### II. Mole Ratios

1. Define the term mole ratio.

Mole Ratio - ratio between the numbers of moles of any two of the substances in a balanced chemical equation

2. Determine the mole ratios for the following equation.



Relate to potassium (K)

$$\frac{2 \text{ mol K}}{1 \text{ mol Br}_2} \quad \text{and} \quad \frac{2 \text{ mol K}}{2 \text{ mol KBr}}$$

Relate to bromine (Br<sub>2</sub>)

$$\frac{1 \text{ mol Br}_2}{2 \text{ mol K}} \quad \text{and} \quad \frac{1 \text{ mol Br}_2}{2 \text{ mol KBr}}$$

Relate to potassium bromide (KBr)

$$\frac{2 \text{ mol KBr}}{2 \text{ mol K}} \quad \text{and} \quad \frac{2 \text{ mol KBr}}{1 \text{ mol Br}_2}$$

III. Mole & Mass Conversions

1. Write the general equation used to determine the moles of an unknown substance from moles of a known substance.

\* Can be then converted into grams

$$\text{moles of known} \times \frac{\text{moles of unknown}}{\text{moles of known}} = \text{moles of unknown}$$

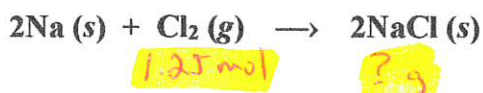
2. Using the following equation, determine how much carbon dioxide (moles) is produced. (10.0 mol of propane ( $C_3H_8$ ) present)



Mole Ratio:  $\frac{3 \text{ mol } CO_2}{1 \text{ mol } C_3H_8}$

$$10.0 \text{ mol } C_3H_8 \times \frac{3 \text{ mol } CO_2}{1 \text{ mol } C_3H_8} = 30.0 \text{ mol } CO_2$$

3. Using the following equation, determine how much table salt (grams) is produced. (1.25 mol of chlorine gas ( $Cl_2$ ) reacts with sodium ( $Na$ ))

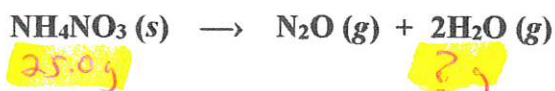


Mole Ratio:  $\frac{2 \text{ mol } NaCl}{1 \text{ mol } Cl_2}$

$$1.25 \text{ mol } Cl_2 \times \frac{2 \text{ mol } NaCl}{1 \text{ mol } Cl_2} = 2.50 \text{ mol } NaCl$$

$$2.50 \text{ mol } NaCl \times \frac{58.44 \text{ g } NaCl}{1 \text{ mol } NaCl} = 146 \text{ g } NaCl$$

4. Using the following equation, determine how much water (grams) is produced. (25.0 g of ammonium nitrate ( $NH_4NO_3$ ) present)



Mole Ratio:  $\frac{2 \text{ mol } H_2O}{1 \text{ mol } NH_4NO_3}$

$$25.0 \text{ g } NH_4NO_3 \times \frac{1 \text{ mol } NH_4NO_3}{80.04 \text{ g } NH_4NO_3} = 0.312 \text{ mol } NH_4NO_3$$

$$0.312 \text{ mol } NH_4NO_3 \times \frac{2 \text{ mol } H_2O}{1 \text{ mol } NH_4NO_3} = 0.624 \text{ mol } H_2O$$

$$0.624 \text{ mol } H_2O \times \frac{18.02 \text{ g } H_2O}{1 \text{ mol } H_2O} = 11.2 \text{ g } H_2O$$