Name _____

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 :**

   $4Fe\ (s) + 3O_2\ (g) \longrightarrow 2Fe_2O_3\ (s)$

   $4\ \text{mol Fe} \times \frac{55.85\ \text{g Fe}}{1\ \text{mol Fe}} = 223.4\ \text{g Fe}$

   $+$

   $3\ \text{mol } O_2 \times \frac{32.00\ \text{g } O_2}{1\ \text{mol } O_2} = 96.00\ \text{g } O_2$

   $= 319.4\ \text{g}$

   $2\ \text{mol } Fe_2O_3 \times \frac{159.7\ \text{g } Fe_2O_3}{1\ \text{mol } Fe_2O_3}$

   $= 319.4\ \text{g}$

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.**

   $2K\ (s) + Br_2\ (l) \longrightarrow 2KBr\ (s)$

   Relate to potassium (K)

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

   Relate to bromine (Br_2)

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

   Relate to potassium bromide (KBr)

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

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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

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

$$C_3H_8\,(g) + 5O_2\,(g) \longrightarrow 3CO_2\,(g) + 4H_2O\,(g)$$

10.0 mol ? mol

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))

$$2Na\,(s) + Cl_2\,(g) \longrightarrow 2NaCl\,(s)$$

1.25 mol ? g

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

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

(2.) $2.50 \text{ mol } NaCl \times \frac{58.44 \text{ g } NaCl}{1 \text{ mol } NaCl} = 146 \text{ g } NaCl$

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

$$NH_4NO_3\,(s) \longrightarrow N_2O\,(g) + 2H_2O\,(g)$$

25.0 g ? g

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

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

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

(3.) $0.624 \text{ mol } H_2O \times \frac{18.02 \text{ g } H_2O}{1 \text{ mol } H_2O} = 11.2 \text{ g } H_2O$