Worksheet #1 Stoichiometry

1. Calculate the number of grams water produced by the complete reaction of 100. g of hydrogen with excess oxygen (theoretical yield). $2H_2 + O_2 \rightarrow 2H_2O$

100. g H_2 × $\frac{1 \text{ mole}}{2.02 \text{ g}}$ × $\frac{2 \text{ moles } H_2O}{2 \text{ moles } H_2}$ × $\frac{18.02 \text{ g}}{1 \text{ mole}}$ = 892 g H_2O

2. Calculate the mass of carbon required to consume 5.67 g of iron (III) oxide.

$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$

5.67 g Fe_2O_3 × $\frac{1 \text{ mole}}{159.6 \text{ g}}$ × $\frac{3 \text{ moles C}}{2 \text{ moles } Fe_2O_3}$ × $\frac{12.0 \text{ g}}{1 \text{ mole}}$ = 0.639 g C

3. Calculate the amount of oxygen in grams produced by the reaction of 89.0 g of water.

$2H_2O \rightarrow 2H_2 + O_2$

89.0 g H_2O × $\frac{1 \text{ mole}}{18.02 \text{ g}}$ × $\frac{1 \text{ mole } O_2}{2 \text{ moles } H_2O}$ × $\frac{32.0 \text{ g}}{1 \text{ mole}}$ = 79.4 g O_2

4. Calculate the theoretical yield in grams of Fe produced by the reaction of 5.67 g of iron (III) oxide.

$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$

5.67 g Fe_2O_3 × $\frac{1 \text{ mole}}{159.6 \text{ g}}$ × $\frac{4 \text{ moles Fe}}{2 \text{ moles } Fe_2O_3}$ × $\frac{55.8 \text{ g}}{1 \text{ mole}}$ = 3.96 g Fe

5. Calculate the number of moles CO_2 produced by the reaction of 0.45 g of C.

$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$

0.45 g C × $\frac{1 \text{ mole}}{12.0 \text{ g}}$ × $\frac{3 \text{ moles } CO_2}{3 \text{ moles C}}$ = 0.794 moles CO_2

6. Calculate the number of Fe atoms consumed in the reaction if 100. g of Fe_2O_3 react.

$2Fe_2O_3 + 3C \rightarrow (550 \text{ K}) \rightarrow 4Fe + 3CO_2$

100. g Fe_2O_3 × $\frac{1 \text{ mole}}{159.6 \text{ g}}$ × $\frac{4 \text{ moles Fe}}{2 \text{ moles } Fe_2O_3}$ × $\frac{6.02 \times 10^{23} \text{ at}}{1 \text{ mole}}$ = 7.54 × 10^{23} at Fe

7. Calculate the number of grams water produced by the complete reaction of 14.5 g of oxygen (theoretical yield).

$2H_2 + O_2 \rightarrow 2H_2O$

14.5 g O_2 × $\frac{1 \text{ mole}}{32.0 \text{ g}}$ × $\frac{2 \text{ moles } H_2O}{1 \text{ mole } O_2}$ × $\frac{18.02 \text{ g}}{1 \text{ mole}}$ = 16.3 g H_2O

8. Calculate the mass of carbon required to produce 5.67 g of iron.

$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$

5.67 g Fe × $\frac{1 \text{ mole}}{55.8 \text{ g}}$ × $\frac{3 \text{ moles C}}{4 \text{ moles Fe}}$ × $\frac{12.0 \text{ g}}{1 \text{ mole}}$ = 0.610 g C

9. Calculate the amount of oxygen in grams produced by the reaction of 125 g of water.

$2H_2O \rightarrow 2H_2 + O_2$

125 g H_2O × $\frac{1 \text{ mole}}{18.02 \text{ g}}$ × $\frac{1 \text{ mole } O_2}{2 \text{ moles } H_2O}$ × $\frac{32.0 \text{ g}}{1 \text{ mole}}$ = 111 g O_2