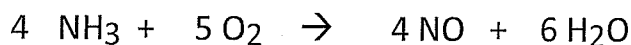


## Stoichiometry Worksheet

Note: rough answers are provided in ( ) but may not match yours in terms of sig figs

Name: \_\_\_\_\_ Section: \_\_\_\_\_ Due Date: \_\_\_\_\_

1. Ammonia gas reacts with oxygen gas according to the following equation:



- a. How many moles of oxygen gas are needed to react with 23 moles of ammonia? (29 mole)

$$\frac{23 \text{ mol NH}_3}{(2 \text{ SF})} \times \frac{5 \text{ O}_2}{4 \text{ NH}_3} = 29 \text{ mol O}_2$$

- b. How many grams of NO are produced when 25 moles of oxygen gas react with an excess of ammonia? (600 g)

$$\frac{25 \text{ mol O}_2}{(2 \text{ SF})} \times \frac{4 \text{ NO}}{5 \text{ O}_2} \times \frac{(14.01 + 16.00) \text{ g}}{1 \text{ NO}} = 6.0 \times 10^2 \text{ g NO}$$

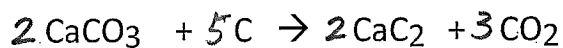
- c. If 24 grams of <sup>H<sub>2</sub>O</sup> water are produced, how many moles of <sup>NO</sup> nitrogen monoxide are formed? (0.89 mole)

$$\frac{24 \text{ g}}{(2 \text{ SF})} \times \frac{1 \text{ mol H}_2\text{O}}{(2 \times 1.01 + 16.00) \text{ g}} \times \frac{4 \text{ mol NO}}{6 \text{ mol H}_2\text{O}} = 0.89 \text{ mol NO}$$

- d. How many grams of oxygen are needed to react with 6.78 grams of ammonia? (16.0 g)

$$\frac{6.78 \text{ g NH}_3}{(3 \text{ SF})} \times \frac{1 \text{ mol NH}_3}{(14.01 + 3 \times 1.01) \text{ g}} \times \frac{5 \text{ mol O}_2}{4 \text{ mol NH}_3} \times \frac{(4 \text{ SF})}{2 \times 16.00 \text{ g}} = 15.9 \text{ g}$$

2. The compound calcium carbide,  $\text{CaC}_2$ , is made by reacting calcium carbonate with carbon at high temperatures. The UNBALANCED EQUATION for the reaction is:



- a. Balance the equation.  
 b. How many moles of carbon are required to produce 5.0 moles  $\text{CO}_2$ ? (8.3 mole)

$$\underset{(2SF)}{5.0 \text{ mol } \text{CO}_2} \times \frac{\overset{\text{C}}{5 \text{ mol C}}}{3 \text{ mol } \text{CO}_2} = 8.3 \text{ mol C}$$

- c. How many grams of calcium carbide are produced when 4.0 moles of carbon reacts with an excess of calcium carbonate? (102 g) (4SF)

$$\underset{(2SF)}{4.0 \text{ mol C}} \times \frac{\overset{\text{CaC}_2}{2 \text{ mol CaC}_2}}{5 \text{ mol C}} \times \frac{(40.08 + 2 \times 12.01) \text{ g}}{1 \text{ mol CaC}_2} = 1.0 \times 10^2 \text{ g CaC}_2$$

- d. How many moles of carbon dioxide are produced when 55 grams of calcium carbonate react with an excess of carbon? (0.83 mole)

$$\underset{(2SF)}{55 \text{ g}} \times \frac{\overset{\text{CO}_2}{1 \text{ mol CaCO}_3}}{(40.08 + 12.01 + 3 \times 16.00) \text{ g}} \times \frac{3 \text{ mol } \text{CO}_2}{2 \text{ mol CaCO}_3} = 0.82 \text{ mol } \text{CO}_2$$

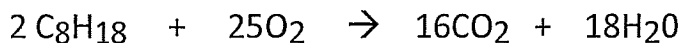
- e. How many grams of carbon are needed to react with 453 grams of calcium carbonate? (136 g)

$$\underset{(3SF)}{453 \text{ g}} \times \frac{\overset{\text{C}}{1 \text{ mol CaCO}_3}}{(40.08 + 12.01 + 3 \times 16.00) \text{ g}} \times \frac{5 \text{ C}}{2 \text{ CaCO}_3} \times \frac{12.01 \text{ g}}{1 \text{ C}} = 136. \text{ g}$$

- f. How many grams of calcium carbonate are needed to form 598 grams of calcium carbide? (934 g)

$$\underset{(3SF)}{598 \text{ g}} \times \frac{\overset{\text{CaCO}_3}{1 \text{ mol CaC}_2}}{(40.08 + 2 \times 12.01) \text{ g}} \times \frac{2 \text{ mol CaCO}_3}{2 \text{ mol CaC}_2} \times \frac{(40.08 + 12.01 + 3 \times 16.00) \text{ g}}{1 \text{ mol CaCO}_3} = 934 \text{ g}$$

For the given combustion of **octane,  $C_8H_{18}$** , answer the following questions:



- a. How many moles of  $CO_2$  would be produced by reacting 0.67 moles of  $C_8H_{18}$  with excess of oxygen? (Amount of oxygen is not involved in the calculation) (5.4 mol  $CO_2$ )

$$\underset{(2SF)}{0.67 \text{ mol } C_8H_{18}} \times \frac{16 \text{ mol } CO_2}{2 \text{ mol } C_8H_{18}} = 5.4 \text{ mol } CO_2$$

- b. How many moles of  $H_2O$  would be produced by reacting 0.67 moles of octane with excess of oxygen? (6.0 mol  $H_2O$ )

$$\underset{(2SF)}{0.67 \text{ mol } C_8H_{18}} \times \frac{18 \text{ mol } H_2O}{2 \text{ mol } C_8H_{18}} = 6.0 \text{ mol } H_2O$$

- c. If we react 225g of octane  $C_8H_{18}$  with oxygen, how many moles of  $O_2$  are required? (24.7 mol  $O_2$ )

$$\underset{(3SF)}{225 \text{ g}} \times \frac{1 \text{ mol } C_8H_{18}}{\underset{(5SF)}{(8 \times 12.01 + 18 \times 1.01) \text{ g}}} \times \frac{25 \text{ mol } O_2}{2 \text{ mol } C_8H_{18}} = 24.6 \text{ mol } O_2$$

- d. If we react 225g of  $C_8H_{18}$  with excess oxygen, how many moles of  $CO_2$  are produced? (15.8 mol  $CO_2$ )

$$225 \text{ g} \times \frac{1 \text{ mol } C_8H_{18}}{(8 \times 12.01 + 18 \times 1.01) \text{ g}} \times \frac{16 \text{ mol } CO_2}{2 \text{ mol } C_8H_{18}} = 15.8 \text{ mol } CO_2$$

- e. If we react 225g of octane  $C_8H_{18}$  with excess oxygen, how many moles of  $H_2O$  are produced? (17.8 mol  $H_2O$ )

$$\underset{(3SF)}{225 \text{ g}} \times \frac{1 \text{ mol } C_8H_{18}}{(8 \times 12.01 + 18 \times 1.01) \text{ g}} \times \frac{18 \text{ mol } H_2O}{2 \text{ mol } C_8H_{18}} = 17.7 \text{ mol } H_2O$$

- f. If we wish to make 7.5 mol  $CO_2$ , how many grams of  $C_8H_{18}$  will be used? (110g  $C_8H_{18}$ )

$$\underset{(2SF)}{7.5 \text{ mol } CO_2} \times \frac{2 \text{ mol } C_8H_{18}}{16 \text{ mol } CO_2} \times \frac{(8 \times 12.01 + 18 \times 1.01) \text{ g}}{1 \text{ mol } C_8H_{18}} = 110 \text{ g } C_8H_{18}$$

- g. If we wish to make 7.5 mol CO<sub>2</sub>, how many grams of O<sub>2</sub> do we need? (380g O<sub>2</sub>)

$$\begin{array}{l} 7.5 \text{ mol CO}_2 \times \frac{25 \text{ mol O}_2}{16 \text{ mol CO}_2} \times \frac{(16.00 \times 2) \text{ g}}{1 \text{ mol O}_2} = 380 \text{ g O}_2 \\ (2\text{SF}) \end{array}$$

- h. If we wish to make 7.5 mol CO<sub>2</sub>, how many grams of H<sub>2</sub>O will be produced? (150g H<sub>2</sub>O)

$$\begin{array}{l} 7.5 \text{ mol CO}_2 \times \frac{18 \text{ mol H}_2\text{O}}{16 \text{ mol CO}_2} \times \frac{(2 \times 1.01 + 16.00) \text{ g}}{1 \text{ mol H}_2\text{O}} = 150 \text{ g H}_2\text{O} \\ (2\text{SF}) \end{array}$$

- i. If we have 3.56g C<sub>8</sub>H<sub>18</sub>, how many grams of O<sub>2</sub> do we need to react with it? (12.5g O<sub>2</sub>)

$$\begin{array}{l} 3.56 \text{ g C}_8\text{H}_{18} \times \frac{1 \text{ mol C}_8\text{H}_{18}}{(8 \times 12.01 + 18 \times 1.01) \text{ g}} \times \frac{25 \text{ mol O}_2}{2 \text{ mol C}_8\text{H}_{18}} \times \frac{(2 \times 16.00) \text{ g}}{1 \text{ mol O}_2} \\ (3\text{SF}) \\ = 12.5 \text{ g O}_2 \end{array}$$

- j. If we have 3.56g C<sub>8</sub>H<sub>18</sub>, how many grams of CO<sub>2</sub> will be produced? (11.0g CO<sub>2</sub>)

$$\begin{array}{l} 3.56 \text{ g C}_8\text{H}_{18} \times \frac{1 \text{ mol C}_8\text{H}_{18}}{(8 \times 12.01 + 18 \times 1.01) \text{ g}} \times \frac{16 \text{ mol CO}_2}{2 \text{ mol C}_8\text{H}_{18}} \times \frac{(12.01 + 2 \times 16.00) \text{ g}}{1 \text{ mol CO}_2} \\ (3\text{SF}) \\ = 11.0 \text{ g CO}_2 \end{array}$$

- k. If we have 3.56g C<sub>8</sub>H<sub>18</sub>, how many grams of H<sub>2</sub>O will be produced? (5.06g H<sub>2</sub>O)

$$\begin{array}{l} 3.56 \text{ g C}_8\text{H}_{18} \times \frac{1 \text{ mol C}_8\text{H}_{18}}{(8 \times 12.01 + 18 \times 1.01) \text{ g}} \times \frac{18 \text{ mol H}_2\text{O}}{2 \text{ mol C}_8\text{H}_{18}} \times \frac{(2 \times 1.01 + 16.00) \text{ g}}{1 \text{ mol H}_2\text{O}} \\ (3\text{SF}) \\ = 5.05 \text{ g H}_2\text{O} \end{array}$$

- l. Using the answers from i, j, and k for burning of 3.56g of octane, check if the law of conversion of mass is obeyed or not.

$$\begin{array}{rcl} 3.56 \text{ g C}_8\text{H}_{18} + 12.5 \text{ g O}_2 & \stackrel{?}{=} & 11.0 \text{ g CO}_2 + 5.05 \text{ g H}_2\text{O} \\ 16.1 \text{ g} & = & 16.1 \text{ g} \\ \checkmark & & \checkmark \end{array}$$

Yes, it is obeyed.