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

Stoichiometry Worksheet I

Name____________________________Section_________Due Date______

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

$$4\,NH_3 + 5\,O_2 \longrightarrow 4\,NO + 6\,H_2O$$

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

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

c. If 24 grams of water are produced, how many moles of nitrogen monoxide are formed? (0.89 mole)

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

2. The compound calcium carbide, CaC_2, is made by reacting calcium carbonate with carbon at high temperatures. The UNBALANCED EQUATION for the reaction is:

$$CaCO_3 + C \longrightarrow CaC_2 + CO_2$$

a. Balance the equation.

b. How many moles of carbon are required to produce 5.0 moles CO_2? (8.3 mole)

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

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

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

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

Stoichiometry Worksheet II

Name________________

For the given combustion reaction of **octane, C_8H_{18}**, answer the following questions: (Answers to the questions are given in parenthesis.)

$2C_8H_{18} + 25O_2$ -----------> $16CO_2 + 18H_2O$

a. Write all possible molar ratios from this equation.

b. How many moles of CO_2 would be produced by reacting 0.67 moles of octane with excess of oxygen? (Amount of oxygen is not involved in the calculation) (5.4 mol CO_2)

c. 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)

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

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

$2C_8H_{18} + 25O_2$ -----------> $16CO_2 + 18H_2O$

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

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

h. If we wish to make 7.5 mol CO_2, how many grams of O_2 do we need ? (380 g O_2)

i. If we wish to make 7.5 mol CO_2, how many grams of H_2O will be produced? (150 g H_2O)

j. If we have 3.56 g C_8H_{18}, how many grams of O_2 do we need to react with it ? (12.5 g O_2)

k. If we have 3.56 g C_8H_{18}, how many grams of CO_2 will be produced? (11.0 g CO_2)

l. If we have 3.56 g C_8H_{18}, how many grams of H_2O will be produced? (5.06 g H_2O)

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

* It's okay if you're off by a few decimal places (0.1, 0.01)

Stoichiometry Worksheet I

Name__Key________________Section________Due Date______

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

$$4\,NH_3 + 5\,O_2 \longrightarrow 4\,NO + 6\,H_2O$$

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

$$23 \text{ moles } NH_3 \times \left(\frac{5 \text{ moles } O_2}{4 \text{ moles } NH_3}\right) = 28.75 = \boxed{29 \text{ mol } O_2}$$

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

This means don't worry about how much ammonia you're starting with — assume it's enough to react w/ all the O

$$25 \text{ moles } O_2 \times \left(\frac{4 \text{ mole } NO}{5 \text{ mole } O_2}\right) \times \left(\frac{30.01 \text{ g } NO}{1 \text{ mol } NO}\right) = \boxed{600 \text{ g } NO}$$

c. If 24 grams of water are produced, how many moles of nitrogen monoxide are formed? (0.89 mole)

$$24 \text{ g } H_2O \times \left(\frac{1 \text{ mol } H_2O}{18.02 \text{ g } H_2O}\right) \times \left(\frac{4 \text{ mol } NO}{6 \text{ mol } H_2O}\right) = \boxed{0.89 \text{ mol } NO}$$

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

$$6.78 \text{ g } NH_3 \times \left(\frac{1 \text{ mol } NH_3}{17.04 \text{ g } NH_3}\right) \times \left(\frac{5 \text{ mol } O_2}{4 \text{ mol } NH_3}\right) \times \left(\frac{32.00 \text{ g } O_2}{1 \text{ mol } O_2}\right)$$

$$= \boxed{15.9 \text{ g } O_2}$$

2. The compound calcium carbide, CaC_2, is made by reacting calcium carbonate with carbon at high temperatures. The UNBALANCED EQUATION for the reaction is:

$$2\ CaCO_3 + 5C \longrightarrow 2\ CaC_2 + 3CO_2$$

a. Balance the equation.

b. How many moles of carbon are required to produce 5.0 moles CO_2? (8.3 mole)

$$5.0\ mol\ CO_2 \times \left(\frac{5\ mol\ C}{3\ mol\ CO_2}\right) = \boxed{8.3\ mol\ C}$$

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

$$4.0\ mol\ C \times \left(\frac{2\ mol\ CaC_2}{5\ mol\ C}\right) \times \left(\frac{64.10\ g\ CaC_2}{1\ mol\ CaC_2}\right) = 102.56 = \boxed{100\ g\ (2\ SF)}$$

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

$$55\ g\ CaCO_3 \times \left(\frac{1\ mol\ CaCO_3}{100.09\ g\ CaCO_3}\right) \times \left(\frac{3\ mol\ CO_2}{2\ mol\ CaCO_3}\right) = \boxed{0.82\ mol\ CO_2}$$

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

$$453\ g\ CaCO_3 \times \left(\frac{1\ mol\ CaCO_3}{100.09\ g\ CaCO_3}\right) \times \left(\frac{5\ mol\ C}{2\ mol\ CaCO_3}\right) \times \left(\frac{12.01\ g\ C}{1\ mol\ C}\right) = \boxed{136\ g\ C}$$

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

$$598\ g\ CaC_2 \times \left(\frac{1\ mol\ CaC_2}{64.10\ g\ CaC_2}\right) \times \left(\frac{2\ mol\ CaCO_3}{2\ mol\ CaC_2}\right) \times \left(\frac{100.09\ g\ CaCO_3}{1\ mol\ CaCO_3}\right) = \boxed{934\ g\ CaCO_3}$$

Stoichiometry Worksheet II

Name Key

For the given combustion reaction of **octane, C_8H_{18}**, answer the following questions:
(Answers to the questions are given in parenthesis.)

$2C_8H_{18}$ + $25O_2$ ------------> $16CO_2$ + $18H_2O$

a. Write all possible molar ratios from this equation.

$\frac{2 \text{ mol } C_8H_{18}}{25 \text{ mol } O_2}$ $\frac{2 \text{ mol } C_8H_{18}}{18 \text{ mol } H_2O}$ $\frac{25 \text{ mol } O_2}{18 \text{ mol } H_2O}$

$\frac{2 \text{ mol } C_8H_{18}}{16 \text{ mol } CO_2}$ $\frac{25 \text{ mol } O_2}{16 \text{ mol } CO_2}$ $\frac{16 \text{ mol } CO_2}{18 \text{ mol } H_2O}$

Some of these ratios can be simplified by their greatest common factor.

b. How many moles of CO_2 would be produced by reacting 0.67 moles of octane with excess of oxygen? (Amount of oxygen is not involved in the calculation) (5.4 mol CO_2)

$$0.67 \text{ mol } C_8H_{18} \times \left(\frac{16 \text{ mol } CO_2}{2 \text{ mol } C_8H_{18}}\right) = 5.36 = \boxed{5.4 \text{ mol } CO_2}$$

c. 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)

$$0.67 \text{ moles } C_8H_{18} \times \left(\frac{18 \text{ mol } H_2O}{2 \text{ mol } C_8H_{18}}\right) = 6.03 = \boxed{6.0 \text{ mol } H_2O}$$

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

$$225 g \; C_8H_{18} \times \left(\frac{1 \text{ mol } C_8H_{18}}{114.26 g \; C_8H_{18}}\right) \times \left(\frac{25 \text{ mol } O_2}{2 \text{ mol } C_8H_{18}}\right) = \boxed{24.6 \text{ mol } C}$$

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

$$225 g \; C_8H_{18} \times \left(\frac{1 \text{ mol } C_8H_{18}}{114.26 g \; C_8H_{18}}\right) \times \left(\frac{16 \text{ mol } CO_2}{2 \text{ mol } C_8H_{18}}\right) = \boxed{15.8 \text{ m} \; CO_2}$$

$2C_8H_{18}$ + $25O_2$ ------------> $16CO_2$ + $18H_2O$

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

$$225\,g\,C_8H_{18} \times \left(\frac{1\,mol\,C_8H_{18}}{114.26\,g\,C_8H_{18}}\right) \times \left(\frac{18\,mol\,H_2O}{2\,mol\,C_8H_{18}}\right) = \boxed{17.7\,mol\,H_2O}$$

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

$$7.5\,mol\,CO_2 \times \left(\frac{2\,mol\,C_8H_{18}}{16\,mol\,CO_2}\right) \times \left(\frac{114.26\,g\,C_8H_{18}}{1\,mol\,C_8H_{18}}\right) = 107 \neq \boxed{110\,g\ (2SF)}$$

h. If we wish to make 7.5 mol CO_2, how many grams of O_2 do we need? (380 g O_2)

$$7.5\,mol\,CO_2 \times \left(\frac{25\,mol\,O_2}{16\,mol\,CO_2}\right) \times \left(\frac{32.00\,g\,O_2}{1\,mol\,O_2}\right) = 375 = \boxed{380\,g\,O_2}$$

i. If we wish to make 7.5 mol CO_2, how many grams of H_2O will be produced? (150 g H_2O)

$$7.5\,mol\,CO_2 \times \left(\frac{18\,mol\,H_2O}{16\,mol\,CO_2}\right) \times \left(\frac{18.02\,g\,H_2O}{1\,mol\,H_2O}\right) = 152 \neq \boxed{150\,g\ 2SF}$$

j. If we have 3.56 g C_8H_{18}, how many grams of O_2 do we need to react with it ? (12.5 g O_2)

$$3.56\,g\,C_8H_{18} \times \left(\frac{1\,mol\,C_8H_{18}}{114.26\,g\,C_8H_{18}}\right) \times \left(\frac{25\,mol\,O_2}{2\,mol\,C_8H_{18}}\right) \times \left(\frac{32.00\,g}{1\,mol\,O_2}\right) = \boxed{12.5\,g\,O_2}$$

k. If we have 3.56 g C_8H_{18}, how many grams of CO_2 will be produced? (11.0 g CO_2)

$$3.56\,g\,C_8H_{18} \times \left(\frac{1\,mol\,C_8H_{18}}{114.26\,g\,C_8H_{18}}\right) \times \left(\frac{16\,mol\,CO_2}{2\,mol\,C_8H_{18}}\right) \times \left(\frac{44.01\,g\,CO_2}{1\,mol\,CO_2}\right) = \boxed{11.0\,g\,CO_2}$$

l. If we have 3.56 g C_8H_{18}, how many grams of H_2O will be produced? (5.06 g H_2O)

$$3.56\,g\,C_8H_{18} \times \left(\frac{1\,mol\,C_8H_{18}}{114.26\,g\,C_8H_{18}}\right) \times \left(\frac{18\,mol\,H_2O}{2\,mol\,C_8H_{18}}\right) \times \left(\frac{18.02\,g}{1\,mol\,H_2O}\right) = \boxed{5.05\,g\,H_2O}$$

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

octane + oxygen → carbon dioxide + H_2O

yes! (very close— off by 0.01)

$$\boxed{3.56\,g + 12.5\,g = 11.0\,g + 5.05\,g}$$

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