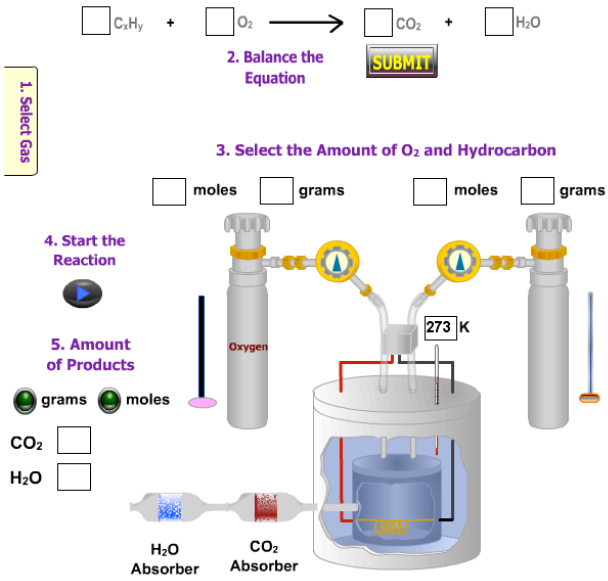
Burning a Hydrocarbon II

Name_____ Lab Section_____

Problem Statement: How are the masses of products limited by the amounts of reactants?

I. Data Collection:

A. Go to http://cheminfo.chem.ou.edu/~mra/home.html and open the Burning a Hydrocarbon II Simulation. Your screen should look like the figure.



The apparatus represents a reaction container that can be filled with different amounts of hydrocarbon gases from a gas cylinder and different amounts of oxygen from a second gas cylinder. A hydrocarbon is a chemical substance containing only hydrogen and carbon. When hydrocarbons combine with oxygen, (i.e. burn), they produce carbon dioxide and water as products. To use the simulation you must (1) select a gas by clicking on the select tab, (2) balance the chemical equation and submit it, (3) specify the amount of hydrocarbon gas and oxygen gas with slide bars, (4) start the reaction, and (5) examine the amount of products. These steps are numbered in the simulation.

B. Click on the Select Gas tab and pick CH_4, methane. Balance the equation using the lowest ratio of whole numbers and submit the equation. Add 100g of CH_4 and 100 of O_2 to the reaction container and start the reaction. The simulation will burn the gas and pass the products through filters that will absorb the product molecules so that they can be weighed. Click on the product buttons. Record the data you collected in the following tables.

____CH_4 + ____O_2 → ____CO_2 + ____H_2O

Masses in Grams			
Reactants		Products	
O_2	CH_4	CO_2	H_20
100	100		
100	90		
100	80		
100	70		
100	60		
100	50		
100	40		
100	30		
100	20		
100	10		

Moles			
Reactants		Products	
O_2	CH_4	CO_2	H_20

C. Repeat the experiment reducing the amount of CH_4 while keeping the amount of O_2 the same. Use the amounts shown in the table. Record the data you collected in the above tables.

II. Data Analysis and Interpretation

A. Plot the mass of CH_4 vs. the masses of CO_2 and H_2O. Explain the shape of the plot in terms of the chemical reaction.

B. Connect the points on the graph by drawing two straight lines. What is the significance of the point where the two lines intersect? Include the graph in your report.

C. Plot the moles of CH_4 vs. the moles of CO_2 and H_2O. Connect the points on the graph by drawing two straight lines. What is the significance of the point where the two lines intersect? How is this point related to the balanced chemical equation for this reaction? Include the graph in your report.

D. A limiting reagent is the reactant in a chemical reaction that controls the amount of products that can be produced. It "limits" the amount of product. Other reagents are said to be "in excess." What is the limiting reagent and what reagent is in excess: (a) when 100g of O_2 and 100g of CH_4 are reacted, (b) when 100g of O_2 and 50g of CH_4 are reacted, and (c) when 100g of O_2 and 10g of CH_4 are reacted? How much excess in each case?

III. Data Collection

A. Click on the Select Gas tab and pick C_2H_6, ethane. Balance the equation using the lowest ratio of whole numbers and submit the equation. Balance the equation using the lowest ratio of whole numbers and submit the equation. Add 100 of O_2 and 10.0g of C_2H_6 to the reaction container and start the reaction. The simulation will burn the gas and pass the products through filters that will absorb the product molecules so that they can be weighed. Click on the product buttons. Record the data you collected in the following tables.

____ C_2H_6 + ____O_2 → ____CO_2 + ____H_2O

Masses in Grams			
Reactants		Products	
O_2	C_2H_6	CO_2	H_20
100	10		
90	20		
80	30		
70	40		
60	50		
50	60		
40	70		
30	80		
20	90		
10	100		

Moles			
Reactants		Products	
O_2	C_2H_6	CO_2	H_20

C. Repeat the experiment reducing the amount of O_2 while increasing the amount of CH_4. Use the amounts shown in the table. Record the data you collected in the above tables.

III. Data Analysis and Interpretation

A. Plot the masses of O_2 and C_2H_6 vs. the masses of CO_2 and H_2O on the same graph. Explain the shape of the plots in terms of the chemical reaction? Connect the points on the graph by drawing two straight lines. What is the significance of the points where two lines intersect? Include the graph in your report.

B. Plot the moles of O_2 and C_2H_6 vs. the moles of CO_2 and H_2O on the same graph. Connect the points on the graph by drawing two straight lines. What is the significance of the point where the two lines intersect? How is this point related to the balanced chemical equation for this reaction? Include the graph in your report.

C. Identify the limiting reagent when you have an equal number of grams of the reactants.

IV. Conclusions

A. If you burned 100g of C_2H_6 with 100g of O_2, how many grams of CO_2 and H_2O would be formed? How many grams of C_3H_8 and O_2 would be in excess?

B. Check your predictions with the simulation.