



Name: _____ Pd: _____

Basic Stoichiometry PhET Lab rvsd 2/2011

Let's make some sandwiches!

Introduction:

When we bake/cook something, we use a specific amount of each ingredient. Imagine if you made a batch of cookies and used way too many eggs, or not enough sugar. YUCK! In chemistry, reactions proceed with very specific recipes. The study of these recipes is *stoichiometry*. When the reactants are present in the correct amounts, the reaction will produce products. What happens if there are more or less of some of the reactants present?

Procedure: Go to: <http://phet.colorado.edu/en/simulation/reactants-products-and-leftovers>

Click the play button

Part 1: Making Sandwiches:

Cheese Sandwiches

1. The Cheese Sandwich is a simulation of a two-reactant *synthesis* reaction. In this case, one reactant will be *limiting*, while the other will be in excess.
2. Take some time and familiarize yourself with the simulation.
3. Set the reaction to a simple mole ratio of 2:1
4. Complete the table below while making tasty cheese sandwiches (Enter values into reactants and products section at bottom for simulation)

Bread Used	Cheese Used	Sandwiches Made	Excess Bread	Excess Cheese
5 slices	5 slices			
4 slices	3 slices			
		2 sandwiches	1 slice	0 slices
6 slices		3 sandwiches		4 slices

Meat and Cheese Sandwiches

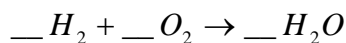
1. The Meat and Cheese Sandwich is a simulation of a three-reactant *synthesis* reaction. In this case, one reactant will be *limiting*, while the other two will be in excess.
2. Take some time and familiarize yourself with the simulation.
3. Set the reaction to a simple mole ratio of 2:1:1
4. Complete the table below while making tasty cheese sandwiches (Enter values into reactants and products section at bottom for simulation)

Bread Used	Meat Used	Cheese Used	Sandwiches Made	Excess Bread	Excess Meat	Excess Cheese
5 slices	5 slices	5 slices				
4 slices	3 slices	2 slices				
			2 sandwiches	1 slice	0 slices	2 slices
6 slices			3 sandwiches		4 slices	1 slice

Part 2: Molecules:

Make Water

- Now let's work with real chemical reaction, one that creates a very entertaining BOOM!
- What is the mole ratio for the reaction of hydrogen and oxygen to produce water?



- Complete the table below while making water H_2O from hydrogen H_2 and oxygen O_2 :

Hydrogen Molecules H_2	Oxygen Molecules O_2	Water Molecules H_2O	Excess H_2	Excess O_2
4 molecules	4 molecules			
7 molecules	6 molecules			
		4 molecules	0 molecules	0 molecules
9 moles	8 moles			
		4 moles	1 moles	0 moles
4.0 moles	2.5 moles			
1.5 moles		1.5 moles	0 moles	0 moles

- Notice that the labels changed from **molecules** to **moles**. This does not change the mole ratio, as a mole is simply a large number of molecules. How many molecules is a mole? _____



- Now try producing **ammonia**, a very important chemical in industry and farming.
- What is the mole ratio for the production of ammonia? $\underline{\quad} N_2 + \underline{\quad} H_2 \rightarrow \underline{\quad} NH_3$
- Complete the table below:

Moles N_2	Moles H_2	Moles NH_3	Excess N_2	Excess H_2
3 moles	6 moles			
6 moles	3 moles			
		4 moles	2 moles	0 moles
1.5 moles	4.0 moles			

- Combustion of **hydrocarbons** like methane CH_4 produce two products, water and carbon dioxide CO_2 .
- What is the mole ratio for the combustion of methane? $\underline{\quad} CH_4 + \underline{\quad} O_2 \rightarrow \underline{\quad} CO_2 + \underline{\quad} H_2O$


- Complete the table below: **WATCH FOR FRACTIONS**

mol CH_4	mol O_2	mol CO_2	mol H_2O	Excess mol CH_4	Excess mol O_2
4 mol	4 mol				
3 mol	6 mol				
		2 mol	4 mol		
		3 mol		0 mol	
				2 mol	0 mol
				3 mol	1 mol

Part 3: Game:


Game: Level 1

Fill in the chart and include the correct formulas, no leftovers. Play for time after first time.

	Reactants	→	Products	Best time
#1				
#2				
#3				
#4				
#5				


Game: Level 2

Fill in the chart and include the correct formulas, no leftovers. Play for time after first time.

	Reactants	→	Products	Best time
#1				
#2				
#3				
#4				
#5				

Game: Level 3

Fill in the chart and include the correct formulas, no leftovers. Play for time after first time.

	Reactants	→	Products	Best time
#1				
#2				
#3				
#4				
#5				