Basic Stoichiometry PhET Lab   **Name**_____

Let's make 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 makes products. We are going to look at what happens when there are more or less of some of the reactants present.

Procedure: *PhET Simulations → Play with the Sims → Chemistry → Reactants, Products, and Leftovers* **OPEN IN HTML 5**
(http://phet.colorado.edu/sims/html/reactants-products-and-leftovers/latest/reactants-products-and-leftovers_en.html)

Part 1: Making Sandwiches:

1. A cheese sandwich requires 2 slices of bread to 1 slice of cheese. If there is exactly twice as many slices of bread as cheese, then there will be no leftovers. What happens if you have two slices of bread and two slices of cheese? You have a slice of cheese left over!
2. Use the simulation to play around with this *two-reactant synthesis* reaction. Take some time and familiarize yourself with the simulation buttons
3. At the bottom of the screen, change the coefficients of the reactants to 2:1.

4. Notice that there is now one sandwich with no leftovers!
5. Complete situations B through D. A has been done for you as an example.

Situation	Bread Used	Cheese Used	Sandwiches Made	Excess Bread	Excess Cheese
A	4 slices	5 slices	2 sandwiches	0 bread	3 cheese
B	2 slices	3 slices			
C			2 sandwiches	1 slice	0 slices
D	6 slices		3 sandwiches		4 slices

6. Look at situation A. The cheese in this case is said to be in *excess*. The other reactant (bread) has no leftovers. The bread in this case is the *limiting reactant*.
7. In situations B, C, and D, determine the limiting reactant: B: _____ C: _____ D: _____

Part 2: Real Chemical Reactions:
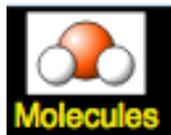
8. Select "Molecules" towards the bottom of your screen. We can now work with real chemical reaction, one that creates a very entertaining BOOM!
9. What is the lowest molecule ratio for the reaction of hydrogen and oxygen to produce water? That is, balance the following equation:

$$\_\_ H_2 + \_\_ O_2 \rightarrow \_\_ H_2O$$

10. 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
6 molecules	8 molecules			
		4 molecules	1 molecules	0 molecules

Stop for check point: Teacher signature for this page: _____

11. Towards the top, select ⚪ **Make Ammonia** . **Ammonia** is a very important chemical in industry and farming.
12. Complete the table below:

Molecules N_2	Molecules H_2	Molecules NH_3	Excess N_2	Excess H_2
3 molecules	6 molecules			
6 molecules	3 molecules			
		4 molecules	2 molecules	0 molecules
6 molecules	4 molecules			

13. Towards the top, select ⚪ **Combust Methane** which will produce two products, water and carbon dioxide CO_2.

14. Balance the equation for the combustion of methane: $\_\_CH_4 + \_\_O_2 \rightarrow \_\_CO_2 + \_\_H_2O$

15. Complete the table below:

molecules CH_4	molecules O_2	molecules CO_2	molecules H_2O	Excess molecules CH_4	Excess molecules O_2
4 molecules	4 molecules				
3 molecules	6 molecules				
		2 molecules	4 molecules		
		3 molecules			

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Part 3: The BEST PART:

16. Go to the game section. To do this click on a button called "Game" that has a smiley face, which is at the bottom of the screen.

17. There are three levels. Each level has 5 challenges. When you think you have the number of molecules necessary, click the "Check" button. You will be awarded points if you get the equation correct. **You only get two attempts.**

Keep Trying
Level: 1
Score: 2 out of 10
Continue

18. **Complete all 5 attempts. When you get to the final screen (see image to the right),** write down your score and show your teacher your score before moving on… else you get to do it again!

19. Once you have completed Level 1, you will continue to Level 2. Then you will try Level 3.

Level 1 Score:

_____ / 10

Teacher Signature:

_____

Level 2 Score:

_____ / 10

Teacher Signature:

_____

Level 3 Score:

_____ / 10

Teacher Signature:

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