Name: ______________________

Balancing Legos

Background
According to the Law of Conservation of Matter, matter can neither be created nor destroyed. But it can be rearranged. That is what is happening when a chemical reaction occurs. We are taking atoms that are already there, sometimes combined with other atoms to form molecules, and we are rearranging them to make new molecules. The new molecules of the products are made from the atoms that are already there in the reactants.

Objective
In this activity we are going to become familiar with balancing chemical equations by making the product “molecules” from the available reactant “molecules”, both of which are in the form of Legos.

Procedure
1. Each group should obtain a bag of Legos. The first equation you are going to balance is the equation for making water:

   \[ \text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O} \]

   There are a few gases that are not going to be found by themselves in nature. These are called diatomic gases. When you hear them referred to, you always assume they are in diatomic form unless you are told otherwise. These gases are: hydrogen, oxygen, nitrogen, fluorine, chlorine, bromine and iodine.

2. Take two yellow Legos of the same size and put them together. This is 1 hydrogen molecule.
3. Now take two red Legos of the same size and put them together. This is 1 oxygen molecule.
4. Now take two yellow Legos of the same size and put that with 1 red Lego. This is 1 water molecule.
5. Put the hydrogen molecule and the oxygen molecule on your left side and the water molecule on your right side. Are there the same numbers of each color of Legos on each side? In order to get the sides equal you can ONLY add another one of the existing molecules. This means only either a complete hydrogen molecule or oxygen molecule to the left side or a complete water molecule to the right side.
6. Keep adding and taking away molecules to the sides until both sides are equal.
7. In the end you should have two hydrogen molecules and an oxygen molecule on the left side and two water molecules on the right side.

Draw/color your Lego equation below:

<table>
<thead>
<tr>
<th>Reactants</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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8. Notice how the types of atoms balance out? If we were to write this as a balanced chemical equation we would write:

\[2H_2 + O_2 \rightarrow 2H_2O\]

9. Take apart your molecules and try this reaction (note that oxygen is a diatomic gas, but sodium can be found by itself in nature)

\[Na + O_2 \rightarrow Na_2O\]

*Note: you will need to correctly balance it!

Draw/color your Lego equation below:

<table>
<thead>
<tr>
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<th>Products</th>
</tr>
</thead>
</table>

10. Have your teacher check that you constructed the equation correctly.

11. Try this one more time with this reaction

\[Al_2O_3 \rightarrow Al + O_2\]

*Note: you will need to correctly balance it!

Draw/color your Lego equation below:

<table>
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</tr>
</thead>
</table>

12. Have your teacher check that you constructed the equation correctly.

13. Now we are going to simulate what actually happens in a reaction. We will use the reaction for ammonia-NH\(_3\) (note the two diatomic gases)

\[N_2 + H_2 \rightarrow NH_3\]

14. Make several of the nitrogen molecules and make several of the hydrogen molecules. (We are only making reactant molecules at this point).

15. Now using 1 nitrogen molecule and 1 hydrogen molecule, take the molecules apart and see if you can make an ammonia molecule. What are you lacking? What do you have too much of?

16. Pick up another reactant molecule that you think will enable you to use all the included atoms to make complete ammonia molecules.
17. By the end of this you should have completely used up 1 nitrogen molecule and three hydrogen molecules in order to make 2 complete ammonia molecules:

\[ N_2 + 3H_2 \rightarrow 2NH_3 \]

18. Take apart all your molecules and try this procedure with the following equation:

\[ H_2 + Cl_2 \rightarrow HCl \]
Write your balanced equation below. Have your teacher check it.

\[ _____H_2 + _____Cl_2 \rightarrow _____HCl \]

**Conclusion**

1. In your own words, explain the Law of Conservation of Matter.

2. How would you apply the Law of Conservation of Matter to a concept like baking a cake?

3. Balance the following:

\[ _____CS_2 + _____O_2 \rightarrow _____CO_2 + _____SO_2 \]

\[ _____Al + _____Fe_2O_3 \rightarrow _____Al_2O_3 + _____Fe \]

\[ _____C_2H_2 + _____O_2 \rightarrow _____CO_2 + _____H_2O \]