Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_

Introduction to Balancing Equations

1. Go to <https://phet.colorado.edu/en/simulation/balancing-chemical-equations> then click the “play” button in the center of the picture.
2. Click “Introduction”.

The **Law of Conservation of Mass** tells that matter can never be created or destroyed. This means that in chemical reactions, the number of atoms we start with and end with must be the same. Today you will begin to look at how we show the law of conservation of mass through balanced chemical equations.

1. Use the arrows to adjust the number of molecules. This number is called a **coefficient**—it is the number in *front* of the compound that tells you how many of each compound you have.
2. How do the pictures represent the molecules? Draw an example molecule of each of the following below:
 N2 H2 NH3
3. Compare: The two diagrams below show two different things. One shows **H2** and one shows **2 H**. Label which is which and explain how you know.

This diagram shows: \_\_\_\_\_\_\_\_\_\_\_\_ This diagram shows: \_\_\_\_\_\_\_\_\_\_\_\_
I know because… I know because…
4. At the top right, click the “tools” drop down menu. Pick either the scales or the bar chart.
5. Adjust the coefficients until you get a smiley face—this means the reaction is balance. The coefficients that give a balanced equation are:

 \_\_\_\_\_\_\_\_ N2 + \_\_\_\_\_\_\_\_ H2 🡪 \_\_\_\_\_\_\_\_\_ NH3
6. Count the number of each atom (individual circles) on each side when the reaction is balanced. Fill them in to the table below:

|  |  |  |
| --- | --- | --- |
|  | **Reactants (left side)** | **Products (right side)** |
| **Nitrogen atoms (blue circles)** |  |  |
| **Hydrogen atoms (white circles)** |  |  |

1. The number of nitrogen atoms in reactants and products should be the same. The number of hydrogen atoms in the reactants and products should also be the same (but not the same amount as the nitrogen atoms). If they are not the same, double check your counting and fix your table.
2. Explain how your data from question #6 demonstrates the law of conservation of mass:
3. Click “separate water” at the bottom of the screen. Again, adjust the coefficients until the equation is balanced (a smiley face comes up). You might also want to try both tools (the balance and the bar chart).
The coefficients for the balanced equation are:

 \_\_\_\_\_\_\_\_\_ H2O 🡪 \_\_\_\_\_\_\_\_\_ H2 + \_\_\_\_\_\_\_\_\_ O2
4. Count the number of each atom (individual circles) on each side when the reaction is balanced. Fill them in to the table below:

|  |  |  |
| --- | --- | --- |
|  | **Reactants (left side)** | **Products (right side)** |
| **Oxygen atoms (red circles)** |  |  |
| **Hydrogen atoms (white circles)** |  |  |

*\*\*Remember to double check that there is the same amount on each side!*

1. What strategies did you use to balance this equation?
2. Click “combust methane” at the bottom of the screen. Adjust the coefficients until the reaction is balanced.
The coefficients for the balanced equation are:

 \_\_\_\_\_\_\_\_\_ CH4 + \_\_\_\_\_\_\_\_\_ O2 🡪 \_\_\_\_\_\_\_\_\_ CO2 + \_\_\_\_\_\_\_\_\_ H2O

|  |  |  |
| --- | --- | --- |
|  | **Reactants (left side)** | **Products (right side)** |
| **Carbon atoms (grey circles)**  |  |  |
| **Oxygen atoms (red circles)** |  |  |
| **Hydrogen atoms (white circles)** |  |  |

*\*\*Remember to double check that they add up—oxygen is in two places on the products side!*

1. How was your strategy for balancing this equation different than previous problems?
2. Explain what it means to “balance” an equation.
3. How does this relate to the law of conservation of mass?
4. Click the “game” button at the bottom of the screen. Click “Level 1” and try balancing some equations. If you master level 1, try again *without the pictures* (click the red “-“ button at the top right corner of the white box). After you master that, move on to the next level. You must complete at least level 1.

|  |  |  |
| --- | --- | --- |
|  | **With pictures** | **Without pictures** |
| **Level 1 score:** |  |  |
| **Level 2 score:** |  |  |
| **Level 3 score:** |  |  |