Balancing Chemical Reactions

Introduction

The Law of Conservation of Mass:

- **The mass of a closed system will remain constant,**
  - **regardless of the processes acting inside the system.**
- **(Mass cannot be created/destroyed)**
- **In a chem. rxn:**
  reactants mass = products mass

Introduction

$H_2 + O_2 \rightarrow H_2O$

Determine the formula mass for the compounds in the reactants and the products:

2.02 amu + 32.00 amu → 18.02 amu

What is wrong here?

(Violates the Law of Conservation of Mass)

Introduction

$H_2 + O_2 \rightarrow H_2O$

~~**2.02 amu + 32.00 amu → 18.02 amu**~~

How do we remedy this problem?

Use <u>coefficients</u> in front of the compounds to balance the mass of the products and the mass of the reactants.

Introduction

Determine the formula mass for the products and reactants:

$2\ H_2 + O_2 \rightarrow 2\ H_2O$

2.02 amu $+ 32.02$ amu $\rightarrow 36.04$ amu

reactants mass = product mass

Steps to Balance a Chemical Reaction:

1. **Draw a vertical line through the arrow in the equation and down an inch or two.**
2. **Write down the elements below the reactants side of the equation and determine the number of atoms for each element. Do the same on the products side (in the same order).**
3. **Find the highest number atoms for an element (that is not repeated) on one side of the equation. (Wait till the end to balance the elements that are repeated on the same side.)**

Steps to Balance a Chemical Reaction:

4. On the other side of the equation, find the same element and place a coefficient in front of the compound to balance the number of atoms of that element with the other side (Finding the least common multiple and use that as the desired number of atoms for that element).

5. Write the number of atoms that the element has next to the symbol to double check that they are balanced.

Steps to Balance a Chemical Reaction:

6. Find the next highest subscript and continue adding coefficients to get the same number of atoms of each element on each side.

7. When you encounter coefficients that would have a decimal (e.g. 2.5, 3.5, etc.) try multiplying all coefficients by two.

Example 1:

$\underline{2}\ H_2 + \underline{1}\ O_2 \rightarrow \underline{2}\ H_2O$

H = ~~2~~ 4	H = ~~2~~ 4
O = 2	O = ~~1~~ 2

Reaction Type:

Addition

Example 2:

$\underline{2}\ NaHCO_3 \rightarrow \underline{2}\ NaCO_3 + \underline{1}\ H_2$

Na = ~~1~~ 2	Na = ~~1~~ 2
H = ~~1~~ 2	H = 2
C = ~~1~~ 2	C = ~~1~~ 2
O = ~~3~~ 6	O = ~~3~~ 6

Reaction Type:

Decomposition