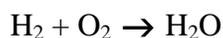


## Balancing Equations Using Matrices

*NOTE: this application requires that you have a calculator capable of doing MATRICES. Most if not all graphical calculators have this capability.*

Eventually in your chemistry studies, you will have ample opportunity to balance equations! Balancing equations means writing chemical equations such that the amount of stuff you start with in the reaction equals the amount of stuff you end up with as a product. In other words, if I start baking bread with 10 pounds of flour, I should end up with 10 pounds of bread, unless some is lost onto the floor or if some of it goes up in smoke! Remember this is the law of conservation of mass!!!

A simple example goes a long way. We can form water by combining hydrogen gas (H<sub>2</sub>) and oxygen (O<sub>2</sub>) in the presence of electricity. The reaction looks like this:

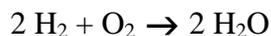


If you do some of the mass calculations you will find this:

$$2 \text{ grams of hydrogen} + 32 \text{ grams of oxygen} = 18 \text{ grams of water}$$

What this says is that you start with 34 grams of stuff and end up with 18 grams of stuff. You've lost 16 grams of stuff, and the law of conservation of mass says that just doesn't happen! Where did the 16 grams go?

They're not lost, we just haven't balanced the equation! You might have also noticed that there are two oxygens on the left and only one on the right! We need to get things in the correct proportions for this reaction to be balanced. The balanced reaction looks like this:



This says that we need two hydrogen molecules to combine with one oxygen molecule to form two new water molecules. If we do the math:

$$(2 \times 2 \text{ grams of hydrogen}) + 32 \text{ grams of oxygen} = (2 \times 18 \text{ grams of water})$$

We now have 36 grams of stuff on the left and 36 grams on the right. We also now have 4 hydrogens on the left, four hydrogens on the right, two oxygens on the left, and two on the right.