Balancing Equations Worksheet – CHEM 110

Balance the following chemical reactions:

$$\_\_\_\_Fe_2O_3 + \_\_\_\_CO \rightarrow \_\_\_\_Fe + \_\_\_\_CO_2$$

Solving a problem such as this one is about as hard as it will get. Sometimes, when you have odd numbers of atoms, multiplying through by 2 can help – at least it can allow you to work with even numbers – which most people's brains like more than odd numbers. This would have worked for the carbon problem we did in class. It might help make things even, but isn't going to solve our real math problem here.

Other times, you will have to create a little equation in your head. The good news is, we really won't see coefficients larger than 5 or 7 (unless you have subscripts larger than that!) But notice in this problem our subscripts are 1, 2, and 3. So anticipate some smaller numbers to create a balanced equation.

So let's start with the easy stuff – the iron. Hopefully everyone is able to get to this point in the equation:

$$\_\_\_\_Fe_2O_3 + \_\_\_\_CO \rightarrow \_\_2\_\_Fe + \_\_\_\_CO_2$$

Then we get into the O and C. And unfortunately, the two are tied together – but good news is, whatever we put in front of the compounds, it has to be the same number- because they both have 1 C in them. So ultimately, we are balancing the C's if we balance the O's. Does that make sense? For example, if we leave the lines blank, we have 1 C on the left and 1 C on the right. If we put a 2 on the left in front of CO, we have to put a 2 on the right in front of CO_2 to balance the C. So – whatever we do to CO, we must also do to CO_2. This means that ultimately we must balance the O's in order to balance the C's.

And you can do this two ways, "trial and error" – self, if I multiply by x what would I get, if I multiply by y what would I get, or – set up an equation.

Let's look at "trial and error" – or – what would I multiply by since this is how we approached things in class.

We know that we have 3 O's in the Fe_2O_3 and 1 O in the CO, and 2 O's in the CO_2

So $3 + (1x) = ??$ on the left and $2x = ??$

And – when we do the math – those question marks have to equal the same number – because that's what balancing the O's is all about!

So, if I say x = 1, then 3 + 1(1) = 3 + 1 = 4. And 2(1) = 2. And 4 and 2 are not the same number.

So, if I say, self, I'll multiply by 2 instead

3 + 1(2) = 3 + 2 = 5 and 2(2) = 4. And again, 5 and 4 are not the same number!

So, if I say, self, I'll multiply by 3:

3 + 1(3) = 3 + 3 = 6 and 2(3) = 6 HEY 6 and 6 are the same number!! And I have multiplied the CO by 3 and the CO_2 by 3 so I have 3 C's on both sides!

____Fe_2O_3 + __3__CO → __2__Fe + __3__CO_2

So asking yourself – self, what do I multiply by can get you there quickly (hopefully you knew that multiplying by 1 wasn't going to get you the right answer so you would have skipped that step ☺)

Now, if you are mathematically savvy, you might have realized that since both equations have to equal the same number, that they equal each other.

3 + 1(x) = ???? ???? = 2(x)

Therefore 3 + 1x = 2x

Solve the equation 3 +1x – 1x = 2x - 1x

3 = 1x therefore x = 3! This tells me that I would need to multiply by 3 – which my "trial and error" had already shown me!