

# Chemistry 221

## The Basics of Balancing Chemical Equations

**Step 1:** Write the unbalanced equation using the correct chemical formula for each reactant and product. Keep organized and make a table underneath the reactants and products with the number of elements involved in the reaction.

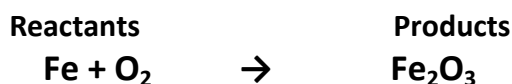
**Step 2:** Find suitable coefficients, which are the numbers placed before chemical formulas to indicate how many units of each substance are required to balance the equation.

**Step 3:** Reduce coefficients to their smallest whole-number values, if necessary, by dividing them by a common divisor

**Step 4:** Check your answer to make sure that the numbers and kinds of atoms are the same on both sides of the equation.

### Example: BALANCING EQUATIONS

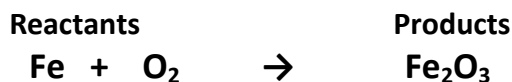
**Step 1:** Write the unbalanced equation using the correct chemical formula for each reactant and product. Make a table with the total number of elements involved in the reactants and products of a reaction.



#### Number of units of each substance

Reactants side		Products side	
<b>Fe</b>	<b>1</b>	<b>Fe</b>	<b>2</b>
<b>O</b>	<b>2</b>	<b>O</b>	<b>3</b>

**Step 2:** Find suitable coefficients, which are the numbers placed before formulas to indicate how many formula units of each substance are required to balance the equation.



- ✓ Remember: if there is no number in front of the formula, it means there is 1 present.
- ✓ Remember: you can only add coefficients, not subscripts.
- ✓ Remember if there is a Subscript such as **O<sub>2</sub>**, it means that there are 2 present.
- ✓ Remember: if there is a coefficient in front of a formula such as **3O<sub>2</sub>**, that means that you multiply the 3 times 2, which equals 6.
- ✓ Make sure you keep track of the coefficients and change them in your table.
- ✓ Hint: Work with H's last.
- ✓ Hint: Start changing the coefficients in front of the most complex formula and end with the simplest formula. For example, change the coefficient in front of **Fe<sub>2</sub>O<sub>3</sub>** instead of **Fe** because it is easier to change the **Fe** at the end.

*Continued on back*



# Chemistry 221

## The Basics of Balancing Chemical Equations

**Step 3:** By looking at this table it is obvious that there are unequal numbers of Fe and O in the products and reactants. Start with trial and error by changing the coefficients to the smallest whole-number values possible to attempt to make the amount of Fe and O the same on both sides.

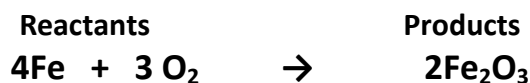
- From the table, you know that there needs to be at least 3 O's on the Products side to make it equal to the O's on the Reactants side. But there is no way to put a coefficient in front of the Reactants to make it exactly equal to 3.
- Therefore, you have to find a common factor. A common factor of 3 O and 2 O is 6. To do this put a 2 coefficient in front of  $\text{Fe}_2\text{O}_3$  on the products side to give us  $2 \times 3$  O which is 6 and  $2 \times 2$  Fe which is 4 Fe. Don't forget to change your table to keep track of reactants and products.



Reactants side			Products side		
Fe	1		Fe	<del>2</del>	4
O	2		O	<del>3</del>	6

- Next, balance for O on the reactants side by putting a 3 in front of the  $\text{O}_2$ , the new number of oxygen is  $3 \times 2$ , which equals 6.
- You are almost done. Now balance for Fe on the reactants side by placing a 4 coefficient to get 4 Fe.

### Final balanced equation



#### Number of units of each substance

Reactants side			Products side		
Fe	<del>1</del>	4	Fe	<del>2</del>	4
O	<del>2</del>	6	O	<del>3</del>	6

**Step 4:** Lastly, check to make sure there are equal numbers of substance on each side.