

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.

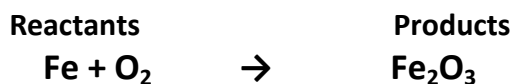
Step 2: Find suitable coefficients, which are the numbers placed before chemical formulas to indicate how many units of each substance are required to balance the equation.

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

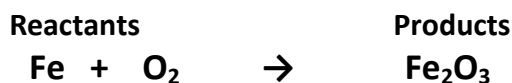
Step 1: Write the unbalanced equation using the correct chemical formula for each reactant and product. Make a table with the total number of elements involved in the reactants and products of a reaction.



Number of units of each substance

| Reactants side | | Products side | |
|----------------|---|---------------|---|
| Fe | 1 | Fe | 2 |
| O | 2 | O | 3 |

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_2 , it means that there are 2 present.
- ✓ Remember: if there is a coefficient in front of a formula such as 3O_2 , 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_2O_3 instead of Fe because it is easier to change the Fe at the end.

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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.

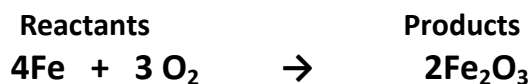
- From the table, you know that there needs to be at least 3 O's on the Products side to make it equal to the O's on the Reactants side. But there is no way to put a coefficient in front of the Reactants to make it exactly equal to 3.
- Therefore, you have to find a common factor. A common factor of 3 O and 2 O is 6. To do this put a 2 coefficient in front of Fe_2O_3 on the products side to give us 2×3 O which is 6 and 2×2 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 | 2 4 |
| O | 2 | O | 3 6 |

- Next, balance for O on the reactants side by putting a 3 in front of the O_2 ; the new number of oxygen is 3×2 , 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 | 1 4 | Fe | 2 4 |
| O | 2 6 | O | 3 6 |

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