



Chemistry and the Periodic Table

Reference Guide

Equipment Setup

| | |
|----------------------------|---|
| Periodic Table Tiles | 1 |
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Investigation Guides

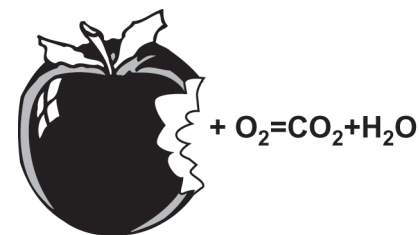
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B-3 Chemical Equations

Key Question: How do you balance chemical equations?

In this Investigation, students learn to identify reactants and products and to write chemical equations. They practice balancing chemical equations using the Periodic Table Tiles. The equations in this Investigation are more challenging than those found in Level A.



Preparation

In order to complete this Investigation, students need to understand how to read the periodic table and how to use oxidation numbers to predict chemical formulas.

Students can learn these skills by completing Investigations B-1 Chemical Formulas.

Setup and Materials

Students work in groups of four at tables.

Each group should have:

- One set of Periodic Table Tiles.

Each student should have:

- One photocopy of the periodic table that came with the Periodic Table Tiles.

Each classroom should have:

- One classroom-sized chart of the periodic table. (Optional, but a useful tool for you and your students).

The Investigation

Time  One class period

- Leading Questions**
- How are chemical equations written and represented?
 - How are atoms conserved in a chemical reaction?

- Learning Goals**
- In this Investigation, students will:
- Write word and chemical-formula forms of chemical equations.
 - Balance chemical equations.

Key Vocabulary reactant, product, chemical equation, coefficient

1

Student responses are not required in part I.

2

2a. I am missing two hydrogen tiles and one oxygen tile so I can't make the products.

B-3

Chemical Equations



B-3

Question: How do you balance chemical equations?

In this Investigation, you will:

1. Investigate how atoms are conserved in a chemical reaction.
2. Use the Periodic Table Tiles to learn how to balance equations.

A chemical reaction involves changes in substances that react to form new products. This process involves the breaking of chemical bonds and the formation of new ones. A chemical equation shows the chemical formulas of the substances that react, called **reactants**, and the chemical formulas of the substances that are produced, called **products**. The number and type of atoms in the reactants must be exactly equal to the number and type of atoms in the products. How do you write a chemical equation so that the number and type of atoms on the reactant and product sides are balanced?

1

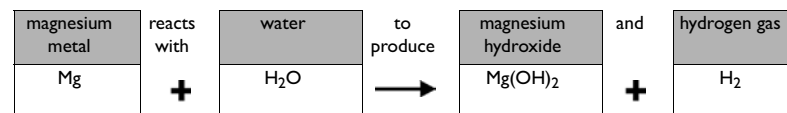
Writing chemical equations

Magnesium metal reacts with water to produce magnesium hydroxide and hydrogen gas.

The statement above is the word form of a chemical reaction. It tells you the names of the reactants and the products. To write it as a chemical equation, you need to determine the chemical formulas of each of the substances in the reaction:

1. Magnesium metal is an element and exists as an atom. Its chemical formula is Mg.
2. The chemical formula for water is H₂O.
3. Magnesium hydroxide is an ionic compound. To write its chemical formula, you need to find out the charges of each of its ions. The magnesium ion is Mg²⁺. The hydroxide ion is OH⁻. You need 1 Mg²⁺ and 2 OH⁻ to make a neutral compound, so the formula is Mg(OH)₂.
4. Pure hydrogen gas always exists as a diatomic molecule, so its chemical formula is H₂.

The chemical equation is written as:

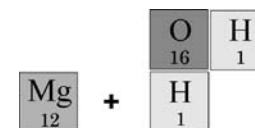


2

Trying out the reaction with Periodic Table Tiles

Use the Periodic Table Tiles to make the reactants above.

Rearrange the reactants to make the products. Is there any problem? What are you missing?



I

3 Balancing the reaction

Chemical equations must always balance. This means that you must use all of the atoms you start with and you cannot have any leftover atoms when you are finished. If you need more atoms to make the products, you can only add them in the form of the actual reactants.

You cannot simply add the extra atoms that you need, unless the chemical formula is a single atom—like Mg. Which atoms did you need more of for the reaction you tried? Since you needed more oxygen and hydrogen atoms, you can only add them in the form of another water molecule.

Try adding another water molecule to the reactants and rearrange them to form the products again. Did the reaction work this time?

4 Writing balanced chemical equations

To balance the equation for this reaction, you needed to add another water molecule to the reactants side. You ended up with the correct amount of products. Since one magnesium atom reacted with two water molecules to form one magnesium hydroxide molecule and one hydrogen gas molecule, the proper way to write the balanced chemical equation is:

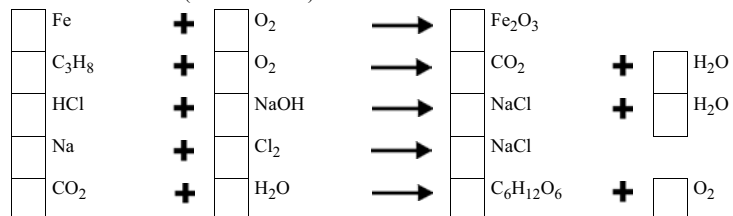


The 2 in front of water is called a **coefficient**. This number tells you how many water molecules are needed in the reaction. The rest of the reactants and products show no coefficients. This is because when the coefficient is 1, there is no need to write it.

5 Try balancing these chemical equations

The following chemical equations have the proper reactants and products. Try to balance each using the following steps:

- Assemble the reactants out of the appropriate tiles.
- Rearrange the reactants to form the products.
- Figure out the number of each reactant and product required to make the equation balance and write the numbers (the coefficients) in the boxes.



2

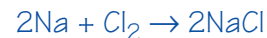
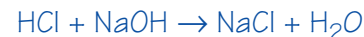
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3a. Yes, this time I had exactly the right number of tiles to make the reaction balance.

4

Student responses are not required in part 4.

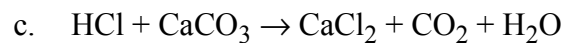
5



1. Answers are:

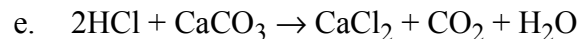
a. The reactants are hydrochloric acid and calcium carbonate. The products are calcium chloride, carbon dioxide, and water.

b. Hydrochloric acid reacts with calcium carbonate to produce calcium chloride, carbon dioxide, and water.

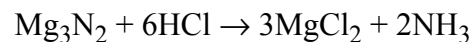
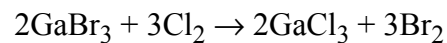
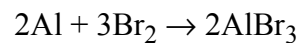
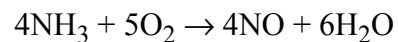
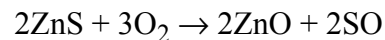
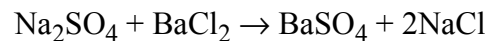


d.

| atom | reactants | products |
|-----------|-----------|----------|
| H | 1 | 2 |
| Cl | 1 | 2 |
| Ca | 1 | 1 |
| C | 1 | 1 |
| O | 3 | 3 |



2. Answers are:



Curriculum Resource Guide: Periodic Table Tiles

Credits

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