

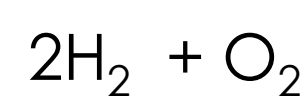
A **chemical reaction** is a process in which atoms are reorganized₂ into different combinations of substances.

▶ **Reactants** are the starting substances.

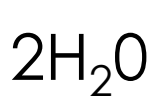
▶ **Products** are the resulting₃ substances.

The **Law of Conservation of Matter** states that in a chemical reaction the number of atoms is conserved₄ no matter how they are arranged.

Reactants



Products



4 hydrogen
2 oxygen

=

4 hydrogen
2 oxygen

CFU

Which of the following are the **reactant(s)** in the chemical reaction below? Explain.

A H_2

B Cl_2

C 2HCl

___ are the **reactants** because...

Which of the following are the **product(s)** in the chemical reaction below? Explain.

A H_2

B 2HCl

C Cl_2

___ are the **products** because...

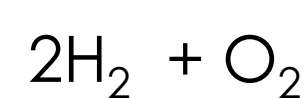
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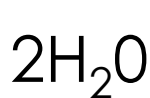
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Reactants



Products



4 hydrogen
2 oxygen

=

4 hydrogen
2 oxygen

CFU

How many atoms of hydrogen are in the **reactants** below? Explain.

A 2

B 4

C 1

There are ___ of hydrogen in the **reactants** because...

How many atoms of hydrogen are in the **products** below?

A 4

B 2

C 1

There are ___ of hydrogen in the **products** because...

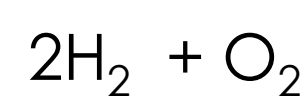
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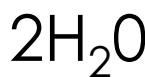
Reactants



4 hydrogen
2 oxygen



Products



4 hydrogen
2 oxygen

=

CFU

Why is the number of atoms in the **reactants** the same as the number of atoms in the **products**?

The number of atoms in the **reactants** is the same as the **products** because...

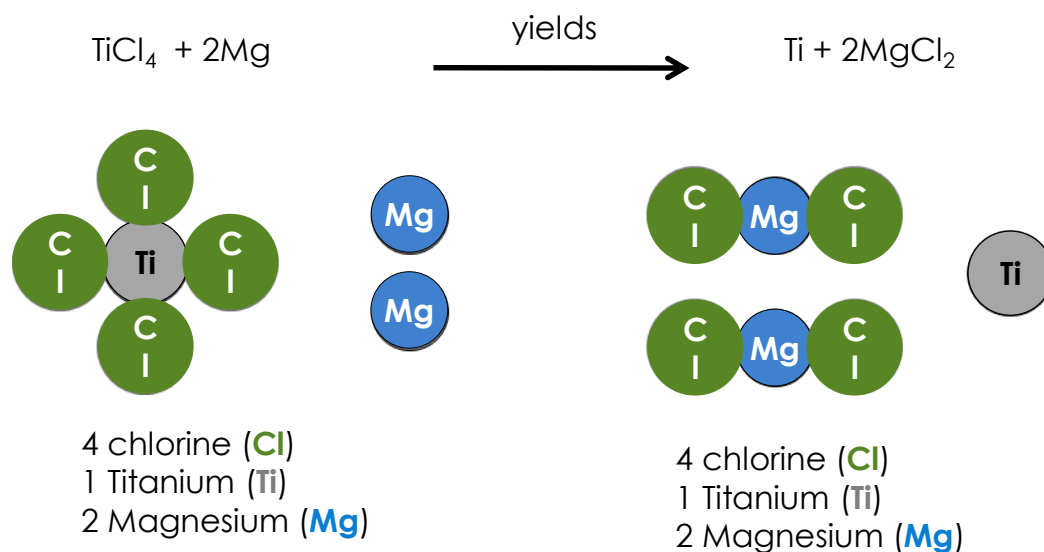
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▶ **Products** are the resulting₃ substances.

The **Law of Conservation of Matter** states that in a chemical reaction the number of atoms is conserved₄ no matter how they are arranged.

In order to make titanium metal, manufacturers combine titanium tetrachloride (TiCl_4) with Magnesium (Mg). This makes magnesium chloride (MgCl_2) and pure titanium (Ti).



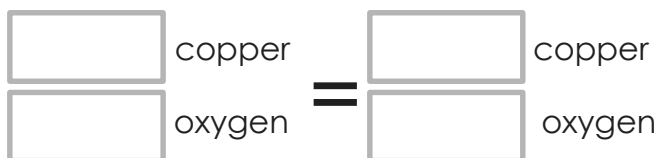
CFU

Explain how matter is conserved in this chemical reaction.

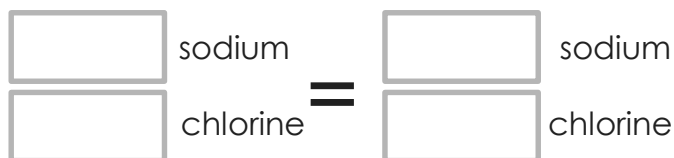
Matter is conserved because...

- 1 Read the balanced chemical reaction.
- 2 Draw a model for the reactants and the products.
- 3 Count and write the number of atoms for the reactants and the products.

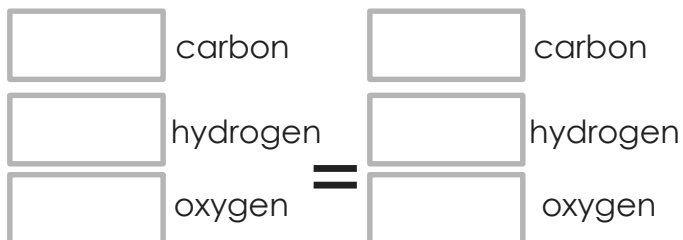
1 Copper (Cu) reacts with oxygen (O₂) to yield copper oxide (CuO).



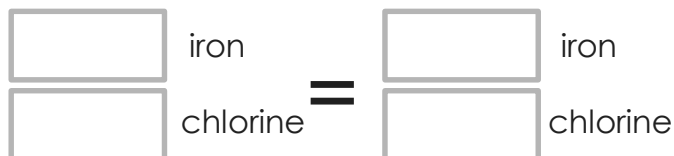
2 Sodium (Na) reacts with chlorine (Cl₂) to form sodium chloride (NaCl).



3 Methane (CH₄) reacts with oxygen (O₂) to form carbon dioxide (CO₂) and water (H₂O).



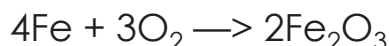
4 Iron (Fe) reacts with chlorine (Cl₂) to form iron trichloride (FeCl₃).



- 1 Read Research #1.
- 2 Identify example(s) of the Law of Conservation of Matter. (underline)

Research #1: The Law of Conservation of Matter

Chemistry is cool, but it is not magic. According to the law of conservation of matter, matter can neither be created nor destroyed. Essentially, this means that atoms themselves cannot be created or destroyed. In a chemical reaction, whatever atoms are present at the beginning of a reaction, must also be present in the products of the reaction. The only difference between the reactants and products, then, is the arrangement of the chemical bonds between atoms, not the atoms themselves. Below is the chemical equation for the reaction that forms rust.

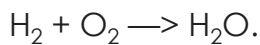


In the reaction, there are four iron (Fe) atoms on the reactant side and four on the product side. There are six oxygen (O) atoms on the reactant side and six on the product side.

- 1 Read Research #2.
- 2 Identify example(s) of the Law of Conservation of Matter. (underline)

Research #2: The Law of Conservation of Matter

The Law of Conservation of Matter states that matter can neither be created or destroyed, but can be changed in form. To understand this law, you can think in terms of the atoms themselves. Take the reaction between hydrogen and oxygen. The product of this reaction is water. The unbalanced chemical equation for this reaction is



If you count up the number of hydrogen atoms on each side, then you find that each side has two hydrogen atoms each. Now count up the oxygen atoms on each side of the chemical equation. The left side of the equation has two oxygen atoms and the right side has only one. This unbalanced chemical equation does not obey the Law of Conservation of Matter.

Now let's look at the balanced equation. $2\text{H}_2 + \text{O}_2 \longrightarrow 2\text{H}_2\text{O}$. If you recount the number of atoms on each side for each substance, then you have four atoms of hydrogen (H) and four atoms of oxygen. Here both sides are equal. This balanced equation obeys the Law of Conservation of Matter.

- 1 Read Research #1 and Research #2.
- 2 Complete the graphic organizer and answer the questions.

Description	Research #1	Research #2	Both
1 Gives examples of balanced chemical equations.			
2 Gives an example of an unbalanced chemical equation.			

- 3 Why do the balanced chemical equations prove the Law of Conservation of Matter?

- 4 Why does the unbalanced chemical equation not obey the Law of Conservation of Matter?

- 5 Write a definition for the Law of Conservation of Matter. Use your own words.

- 1 Read the chemical reaction.
- 2 Count the number of atoms for the reactants and products.
- 3 Explain if the chemical reaction obeys the Law of Conservation of Matter.



	silver	=		silver
	sulfur			sulfur



	iron	=		iron
	oxygen			oxygen

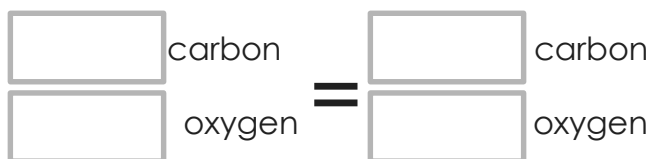


	calcium	=		calcium
	oxygen			oxygen
	hydrogen			hydrogen
	chlorine			chlorine



	carbon	=		carbon
	hydrogen			hydrogen
	oxygen			oxygen

- 1 Read the balanced chemical reaction.
- 2 Draw a model for the reactants and the products.
- 3 Count and write the number of atoms for the reactants and the products.



Anthony says that the following chemical reaction obeys the Law of Conservation of Matter. His teacher disagrees with him. Explain why Anthony is incorrect.

What did you learn today about describing the Law of Conservation of Matter?

Laboratory – **What happens when baking soda is mixed with vinegar?**

<http://www.andybrain.com/sciencelab/2007/11/22/a-classic-easy-chemical-reaction-with-baking-soda-and-vinegar/>

Watch the video. Read the passage.

Baking Soda + Vinegar = ???

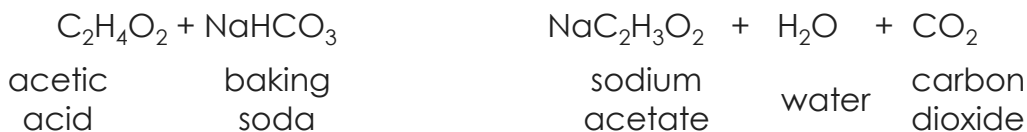
Baking soda is a fabulous ingredient to clean with. Pots and pans scrub clean in an instant. Bathtubs shine. Vinegar is also a stellar cleaning tool. Countertops are clean and disinfected, and glasses are rinsed sparkly clean.

You'd think that putting these two hard-hitting ingredients together would leave you with something no man-made cleaner could touch, right?

What childhood would be complete without the baking soda and vinegar volcano science project? Remember how it exploded up into a creamy, bubbly, overflowing blob? Well, what happened is that a chemical reaction took place.

The vinegar or acetic acid reacts with sodium bicarbonate (baking soda). The bubbles you see from the reaction come from the carbon dioxide. What's left is a dilute solution of sodium acetate in water. In fact, **it's almost all water**. That's not going to get your counters very clean.

How does the balanced equation between baking soda and vinegar explain the Law of Conservation of Matter?



C (carbon) H (hydrogen) Na (sodium) O (oxygen)

When a match is lit, sulfur (S) reacts with oxygen (O₂) in the air to release energy and form sulfur dioxide (SO₂). Which is a true statement about this chemical reaction?



Description	True or False	Justification
1 two molecules of oxygen react with one molecule of sulfur		
2 two molecules of sulfur oxide are produced		
3 the reactants and the products contain the same number of atoms of sulfur and oxygen		
4 the reactants and the products contain different numbers of atoms of sulfur and oxygen		

Determine which chemical reactions obey the Law of Conservation of Matter. Justify your answer.

Description	Yes/No	Justification
<p>1 Sodium (Na) reacts with oxygen (O₂) to produce sodium oxide (Na₂O).</p> $4\text{Na} + \text{O}_2 \rightarrow 2 \text{Na}_2\text{O}$		<hr/> <hr/> <hr/>
<p>2 Carbon (C) is added to one hydrogen (H₂) to produce methane (CH₄) and chlorine (Cl₂).</p> $\text{C} + \text{H}_2 \rightarrow \text{CH}_4 + \text{Cl}_2$		<hr/> <hr/> <hr/>
<p>3 Nitrogen (N₂) reacts with hydrogen (H₂) to produce ammonia (NH₃).</p> $\text{N}_2 + 3\text{H}_2 \rightarrow \text{NH}_3$		<hr/> <hr/> <hr/>
<p>4 Aluminum oxide (Al₂O₃) produces aluminum (Al) and (O₂).</p> $2 \text{Al}_2\text{O}_3 \rightarrow 4\text{Al} + 3\text{O}_2$		<hr/> <hr/> <hr/>

Have you ever prepared meat on a propane grill? The meat placed over the burner is cooked with the help of heat energy released after the burning of propane gas (C₃H₈). When propane is burned with the help of oxygen (O₂), it gives off heat energy, water (H₂O), and carbon dioxide (CO₂).



Description	True or False	Justification
1 The oxygen in the reactants rearranges to produce only water.		<hr/> <hr/> <hr/> <hr/>
2 All the reactants and the products contain oxygen.		<hr/> <hr/> <hr/> <hr/>
3 The atoms in propane and oxygen rearrange to produce carbon dioxide and water.		<hr/> <hr/> <hr/> <hr/>
4 The reaction produces five molecules of oxygen and four molecules of water.		<hr/> <hr/> <hr/> <hr/>