

# Read About Chemical and Physical Changes

## DEFINITIONS OF PHYSICAL AND CHEMICAL CHANGES

*In a chemical change, a new substance is made, like when you burn a candle. In a physical change, no new substance is made, like when water turns to ice.*

***To better understand the difference between chemical vs. physical changes....***

## LET'S BREAK IT DOWN!

### Chemical changes make new substances

Anytime a new substance is made, a chemical change takes place.

Usually two or more materials are combined and a new substance is formed. A chemical change can produce amazing explosions, like fireworks. Some chemical changes are a little more difficult to spot, like when a nail rusts.



If you notice bubbles being formed, or a change in color or temperature, there is a good chance a chemical change has taken place, but not always. Scientists can determine if a chemical change has occurred by asking this question: Was the substance formed present before? If the answer is no, then it is a chemical change.

Since chemical changes make new substances, most of them cannot easily be undone. For example, when you burn wood, you can't really turn the gases back into a log very easily.

## Physical changes do not make a new substance.

Physical changes come in many forms. It can be a change in the shape or appearance of an object, like crumpling a piece of paper, or cutting, bending, or dissolving something.

Since objects do not become a different substance during a physical change, it is usually easy to reverse the change. For example, if you dissolve sugar in water you can easily reverse the change by evaporating the water from the solution. When all the water evaporates, sugar crystals will be left behind.



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## Physical changes also happen when matter changes states.

There are three common states of matter: solid, liquid, and gas. When a substance changes states (from a liquid to a gas, for example), it is undergoing a physical change.

In the video, when the gallium spoon melted in hot water, the gallium did not become a different metal.

Melting is an example of a phase change, where a solid is changed to a liquid. Freezing and boiling are also physical changes.



## Chemical and physical changes are all around us.

Chemical and physical changes take place around you all the time. When you make cereal for breakfast, combining the milk and cereal is a physical change. When you eat the cereal, a chemical change happens during digestion.

Sometimes, it can be difficult to tell if a chemical or physical change is taking place. In the video, Dr. Jeff and the team explore a few different reactions to determine if they are chemical or physical changes, by figuring out if the material made after the reaction was present before the reaction.



## EXAMPLES OF PHYSICAL AND CHEMICAL CHANGES



**Chopping a banana.** Since cutting a banana only changes its appearance, a new substance is NOT formed. That makes this an example of a physical change.



**Burning a gummy bear.** In the video, when the gummy candy was placed into a test tube with the oxidizer, the gummy candy burned up and created new chemicals. Since new chemicals were formed, it is an example of a chemical change.



**Coke and Mentos.** Mixing Coke and Mentos looks like a chemical change, but since the gas released is carbon dioxide AND it was present before the foaming happened, it is actually a physical change.

## VOCABULARY FOR PHYSICAL AND CHEMICAL CHANGES

### Catalyst

A substance that speeds up a chemical reaction.

### Chemical Change

A type of change in which a new substance is formed. For example: burning something.

### Physical Change

A type of change in which a new substance is NOT formed. For example: water boiling.

### Oxidizer

A chemical that provides a lot of oxygen to help things burn.

### Carbon Dioxide

A gas without any color or smell that is commonly found in soda. It is also called CO<sub>2</sub> and comes out the back of a car or bus that is running.

### Hydrogen

A gas less dense than air that has no color or smell. It is extremely flammable meaning it can burn.

## **DISCUSSION QUESTIONS FOR PHYSICAL VS. CHEMICAL CHANGES**

### **What happens when Zoe stirs the very hot water with the spoon made from Gallium metal? What kind of change happens?**

When Zoe stirs the hot water with the Gallium spoon, the metal melts. This is an example of a physical change because the Gallium changed forms, but it didn't change into a new substance (it is still Gallium).

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### **What kind of change happens when Dr. Jeff puts the gummy candy into a tube containing oxidizer? Why?**

When Dr. Jeff drops the gummy candy into the tube containing oxidizer, the gummy candy bursts into flames producing smoke and carbon (new substances). Therefore, this is a chemical change.

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### **What method did the team use to test what type of gas was produced in the reaction between the Mentos and soda?**

Dr. Jeff, Izzy and Zoe used a balloon to collect some of the gas produced when soda and Mentos were combined. They then tested this gas to determine its properties. They concluded that it was carbon dioxide by observing that it extinguished candles.

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### **When Zoe pours the carbon dioxide gas onto the candles, why do they go out one by one?**

Carbon dioxide gas is heavier than air. This is why it stays inside the pitcher. When Zoe pours it at the top of the steps, it flows down the steps because it is heavier than the air that was there. When the carbon dioxide displaces the air, the candle doesn't have enough oxygen, so it goes out. This process happens to each candle as the carbon dioxide sinks lower and lower.

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### **What evidence did the team find that the reaction between the Mentos and soda was a physical change?**

It was unclear at first whether the reaction that caused the soda to fizz uncontrollably was a chemical or physical change. The team investigated and determined that the gas produced was carbon dioxide, which is the same gas already used to make the soda fizzy. That means it is not a new substance, making this a physical change.

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### **What is a flame test and what can we learn from it?**

A flame test is a way to tell different types of gases apart. Scientists know how different types of gas will react when exposed to a flame. For example, oxygen would make the match glow brighter, carbon dioxide would make it go out, and hydrogen can burn so it makes a POP sound when next to a flame. These are the most common gases tested in a flame test but there are others as well.

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