Chemical properties are any of the properties of matter that may only be observed and measured by performing a chemical change or chemical reaction. Chemical properties cannot be determined by touching or viewing a sample; the structure of the sample must be altered for the chemical properties to become apparent.

**Examples of Chemical Properties**

Here are some examples of chemical properties:

- reactivity with other chemicals
- toxicity
- coordination number
- flammability
- enthalpy of formation
- heat of combustion
- oxidation states
- chemical stability
- types of chemical bonds that will form

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<th>Ice Water</th>
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<td><img src="image" alt="Ice Water Diagram" /></td>
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**Physical Properties:**

Physical properties can be observed or measured without changing the composition of matter. Physical properties are used to observe and describe matter.

Physical properties include: appearance, texture, color, odor, melting point, boiling point, density, solubility, polarity, and many others.

The three states of matter are: solid, liquid, and gas. The melting point and boiling point are related to changes of the state of matter. All matter may exist in any of three physical states of matter.

In the graphic on the left the solid and liquid forms of water - ice are shown.

**Question: What Is the Difference Between a Chemical Property and a Physical Property?**

A chemical property and a physical property are related to chemical and physical changes of matter.

**Answer:** A physical property is an aspect of matter that can be observed or measured without changing it. Examples of physical properties include color, molecular weight and volume.

A chemical property may only be observed by changing the chemical identity of a substance. This property measures the potential for undergoing a chemical change. Examples of chemical properties include reactivity, flammability and oxidation states.
Physical Changes:

A physical change takes place without any changes in molecular composition. The same element or compound is present before and after the change. The same molecule is present throughout the changes. Physical changes are related to physical properties since some measurements require that changes be made.

Melting Point: As solid matter is heated it eventually melts or changes into a liquid state at the melting point. Ice (a solid form of water) melts at 0 °C and changes to the liquid state.

Carbon dioxide melts at -56.6°C

Boiling Point: As the liquid matter is heated further it eventually boils or vaporizes into a gas at the boiling point. Liquid water boils and changes into a gas, usually called steam or water vapor at 100 °C. In all three states the same molecules of water (H₂O) are present.

Carbon dioxide boils at -78.5°C

Chemical Changes

It's the Fourth of July in Providence, Rhode Island. Brilliant fireworks are exploding in the night sky. When you look at the fireworks, you see dazzling sparkles of red, white and blue trickle down in all directions.

The explosion of fireworks is an example of chemical change.

During a chemical change, substances are changed into different substances. Another words, the composition of the substance changes.
**Signs of Chemical Changes**

*How can you tell whether a change is a chemical change?*

If you think you are unfamiliar with chemical changes, *think again.*

**Color Changes**

As in the case of autumn leaves, a change in color is a clue to indicate a chemical change.

Perhaps you have found a half eaten apple that turns brown. The reason is that a chemical change has occurred when food spoils.

**Physical changes** are relatively easy to identify. If only the form of a substance changes, you have observed a physical change.

A common physical change occurs when *matter changes from one phase to another.* When an ice cube melts for example, it becomes liquid water. The solid ice and liquid water have the same composition. The only difference is the form.

*[You have just witnessed a spectacular chemical change if you have seen the leaves change color in the autumn.]*
When you bake a cake, energy is absorbed by the batter as it changes from a runny mix into a cake.

Energy - Absorbed or Released

Another sign of a chemical change is the release or gain of energy by an object. Many substances absorb energy to undergo a chemical change. Energy is absorbed during chemical changes involved in cooking, like baking a cake.

Energy can also be released during a chemical change. The fireworks that were mentioned above release energy in a form of light that you can see.

You can also see that energy is released when in this movie clip when sodium and chlorine are combined with water.

Odor Changes

It only takes one experience with a rotten egg to learn that they smell different from fresh eggs. When eggs and food spoil, they undergo a chemical change. The change in odor is a clue to the chemical change.
Production of Gases or Solids

The formation of a gas is a clue to chemical changes. The bubbles of gas that you observed form when an antacid is dropped into water is an example of change.

Another clue that a chemical change has occurred is the formation of a solid. A solid that separates out of solution during a chemical change is called a precipitate.

Not easily reversed

How do physical and chemical changes differ from each other? Think about ice for a moment. After ice melts into liquid water, you can refreeze it into solid ice if the temperature drops. Freezing and melting are physical changes. The substances produced during chemical changes however cannot easily change back into the original substances.

The most important thing for you to remember is that in a physical change the composition of a substance does not change and in a chemical change the composition of a substance does change.

Chemical vs Physical Change

Chemical Reactions

Chemical Changes are also called Chemical Reactions. Chemical reactions involve combining different substances. The chemical reaction produces a new substance with new and different physical and chemical properties.
Matter is *never* destroyed or created in chemical reactions. The particles of one substance are rearranged to form a new substance. The same number of particles that exist before the reaction exist after the reaction.

To create your own chemical change, click on [Fireworks](#). To find more fun information about firework displays that you see [click here](#).

Consumer fireworks are illegal to possess in Rhode Island, however there are still plenty of opportunities to enjoy a great show. Although it rarely happens, it is possible that a firework component might fall to the ground without exploding. [What do you do?](#)