

Physical vs. Chemical Properties

If you are asked to describe a classmate, most of you will list things like height, hair color, eye color, etc. These are all properties that belong to the person you are describing.

Physical Properties

In your description of your classmate, things like hair or eye color, height, and weight are all physical properties. They are physical features of the person you are describing and the things you can see or observe. In science, physical properties can include things you see plus such things as the melting point, boiling point, freezing points, color, shape, and odor. They describe a substance. The size of the sample doesn't change these properties. An ounce of water will freeze at the same temperature as a gallon of water. A small piece of gold is the same color as a large nugget.

Physical Mixtures

Often several things are mixed together. If the substances remain what they were before they were mixed, it is a physical mixture. For example, if you have a cup of green M&Ms and a cup full of blue M&Ms but decide you want to mix them all in one bowl, you can do so. In the bowl, the green M&Ms are still green M&Ms and the blue M&Ms are still blue M&Ms. They have not changed and still have the same physical properties even though they are mixed with other things. If you decide to "unmix" them, you can separate them into a cup of blue and a cup of green M&Ms. This is a physical mixture. It doesn't change what they are, only where they are.

Similarly, if you were to take a teaspoon of salt and mix it with a teaspoon of sugar, both the salt and sugar would continue to be salt and sugar. They would remain the same substance they were before they were mixed. If you wanted to do so (and it would surely take a long time), you could take a microscope, separate the two, and once again have a teaspoon of salt and a teaspoon of sugar. Neither was changed chemically. It was only a physical mixture.

Chemical Properties

Chemical properties are not things you can observe except during a chemical reaction. They are based on the structure of the atoms or molecules that make that substance. Chemical properties include how something reacts to water. For example, iron rusts when exposed to water but gold does not. The key to understanding a chemical property is change. You know it is a chemical property if the substance changes. The rust is a new substance and no longer iron. A chemical property is something that causes a substance to change into another substance. In other words, a chemical property is the way it reacts to another substance.

Name _____

Date _____

Chemical Mixtures and Chemical Reaction

Unlike physical mixtures, where the individual things that combine remain what they were before joining the mixture, in a chemical mixture, the two or more substances combine chemically to form a new substance. Chemical mixtures are not easily reversed and some cannot be reversed. Iron and water create a chemical mixture and form the new substance we know as rust. This reaction cannot be reversed back to water and iron because parts of both the water molecule and the iron have combined into a new molecule.

Here are some simple illustrations to help you understand:

$G + B \rightarrow GB$ This is a physical mixture because you can see the same substance on both sides of the equation. This represents our green and blue M&Ms. You can see the green ones on the left side (when they were in the cup) and you can see them on the right side (when they are mixed in the bowl).

$A + B \rightarrow C$ In this example, we see two different substances on the left that combine to form a new and completely different substance **C** on the right.

Name _____

Date _____

Practice

Identify if the following are physical (P) or chemical (C) characteristics. Circle your answer.

1. P C The color of the house is red.
2. P C Oxygen is a gas.
3. P C A flagpole is 25 feet tall.
4. P C A ruby is red.
5. P C Copper conducts electricity.
6. P C Water freezes at 32 degrees F.
7. P C Iron reacts with water to form rust.
8. P C Silver reacts with moisture in the air to form tarnish.
9. P C Steel is attracted to a magnet.
10. P C Sand and dirt are mixed in a flower pot.

Decide whether the following are chemical or physical mixtures and explain why.

Milk + Chocolate syrup → Chocolate milk chemical or physical – Why?

Corn + oil + heat → popcorn + steam chemical or physical – Why?

Bread + peanut butter → sandwich chemical or physical – Why?

Name _____

Date _____

Answers

1. physical
2. physical
3. physical
4. physical
5. physical
6. physical
7. chemical
8. chemical
9. physical
10. physical

Chocolate milk is actually a mixture. On the atomic and molecular level, milk is still milk and chocolate syrup is still chocolate syrup. The syrup doesn't look the same because its molecules are no longer concentrated together but instead disbursed among a large number of milk molecules. When you look at the chocolate milk you are seeing a few syrup molecules with a large number of milk molecules.

Popped corn is a chemical reaction. The first clue is that you can't reverse the process. Secondly, there is a byproduct to the process, water, that is given off in the form of steam as the kernel burst.

A peanut butter sandwich is a physical mixture. You can reverse the process by removing the peanut butter from the bread (although getting all of it would definitely be difficult). The peanut butter is on the surface of the bread and has not changed the bread.