



Does it Matter?

EQ: What are matter's characteristics?

Physical and Chemical Properties of Matter

All matter has properties. We recognize a person by his face, voice, height, fingerprints, DNA, and other factors.

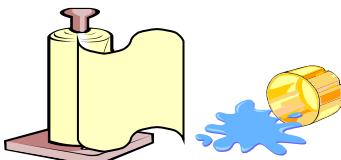
The more properties identified, the better we know the person.

In a similar way, matter has many properties. The two basic types of properties associated with matter are physical and chemical.



Physical Properties

Physical properties do not change the chemical nature of matter. A physical change occurs in shape, form, or appearance but no new substance is created. Examples of physical properties include color, odor, hardness, texture, luster, volume or size, shape, solubility (ability to dissolve), **molecular polarity** (positively or negatively charged), freezing, boiling and melting points, taste, magnetism, density, salinity, absorbency, and many others.

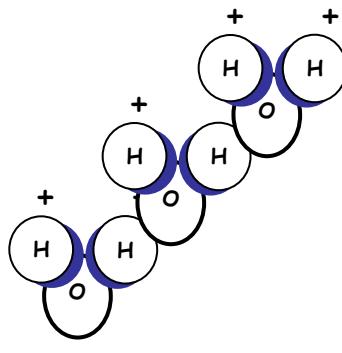


Solubility and polarity are classified as physical properties because no new substances are produced as a result of testing for these properties.

Classification of Matter

A substance is more easily identified when many properties have been recognized. Matter is sorted and classified according to its

properties. For example, the property of a substance being metal or nonmetal determines part of that substance's classification on the periodic table. Copper is a metallic substance with a shiny, reddish-color, and a density of 89.2 grams per cubic centimeter. It is nonmagnetic, and has good electrical conductivity.



Properties of Water

Properties of water you are familiar with are transparency, color, melting and freezing temperatures, solubility, and other factors. There are other properties with which you may not be as familiar. When

electrons are not shared equally in a molecule, it is said to be **polar**. This is the situation with water, H₂O. The water molecule is neutral as a whole, but one end tends to be positive and one end tends to be negative. Each end of one water molecule is attracted to the end of another molecule. This attraction causes water molecules to stick together and create surface tension. This is why it hurts so much to do a "belly buster" off the high diving board.

The water molecules will not separate easily to allow you to enter the water. A lot of the energy from your fall is transferred back to your body. The sticking together of like atoms or molecules in the above example is called **cohesion**.



The sticking together of unlike atoms or molecules is called **adhesion**, such as tape sticking to wrapping paper on a package. The two substances are not alike yet they stick to each other.

Physical Change

Physical change in matter affects one or more of the physical properties of a substance. This change does not alter the nature of the substance. For example, when you tear a piece



of paper into tiny pieces, you still have paper. It is in a different shape or form, but it has not changed its chemical composition. Melting butter to add to popcorn at the movies is a physical change in the state or phase of matter for the butter. Other examples of physical change are chopping wood, bending a paper clip, adding ice to tea. Because a physical change does not involve changing the chemical structure of the material, it can usually be changed back easily. If you mold silly putty into a shape then decide you want to make it something different, you simply remold it into something else. The ability to restore something to its original substance is a characteristic of physical change. Some processes that produce a physical change are cutting, grinding, boiling, freezing, melting, condensing, breaking, separating, chopping, splitting, mixing, tearing, crushing and blending.

Chemical properties

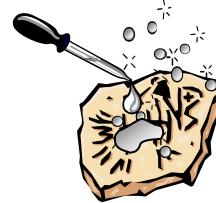
Chemical changes deal with reactions of two or more substances and result in the formation of new material. Chemical properties change the chemical nature of matter. Examples of chemical properties are heat of combustion, reactivity with water or other materials, and pH. For example, copper reacts with nitric acid to produce brown fumes. In the form of a compound, copper chloride in the presence of aluminum, will decompose (break down) into

copper and aluminum chloride. Decomposition of copper with other chemicals is one of its chemical properties.

Chemical Change

A chemical change occurs when the composition of a substance is changed into a new product. Chemical changes usually occur when two or more substances come in contact with each other, or when heat is applied. As matter and energy cycle through the environment, atoms and molecules are transformed and recombined

in different ways creating new substances. The new substances have different properties than the



original material. For instance, iron rusting (iron and oxygen reacting), or acid fizzing when it comes in contact with limestone (acid and calcium carbonate reacting) are examples of chemical changes.

Evidence of Chemical Change

The outcomes, or products, of a chemical reaction cannot easily be turned back into the original substances. Once paper is burned, it cannot be restored to its original state. Indications of a chemical change are change in color, production of gas (bubbles), production of a solid (precipitate), creation of heat (exothermic reaction), or cooling (endothermic reaction), light being given off and production of an odor. Not all chemical reactions show these indications in any easily visible way, and these changes do not necessarily indicate a chemical reaction. These are only visible evidences of activity that allow us to infer that a reaction is occurring on a molecular level.



After reading the passage, answer the following questions.

1. Reread paragraph 2 and use context clues to write your own definition of molecular polarity.
2. Give three physical properties of an orange.
3. In front of each of the following, write a "P" if the characteristic is a physical property and a "C" if the characteristic is a chemical property.

<input type="checkbox"/> Bitterness	<input type="checkbox"/> Flammability
<input type="checkbox"/> Corrosion	<input type="checkbox"/> Soft
<input type="checkbox"/> Solubility	<input type="checkbox"/> Decompose
<input type="checkbox"/> Saltiness	<input type="checkbox"/> Purple
4. Why does it hurt to do a "belly buster"?
5. How are *cohesion* and *adhesion* alike?

How are *cohesion* and *adhesion* different?

6. How can properties of matter be used to classify matter?
Give an example other than copper.
7. When sugar is dissolved in hot tea, physical changes occur. Write two physical properties of sugar that change when dissolved in hot tea.
8. If you were camping in a rainforest for two days, your presence would cause many changes to the surroundings. Describe two physical and two chemical changes that could occur as a result of your experience.