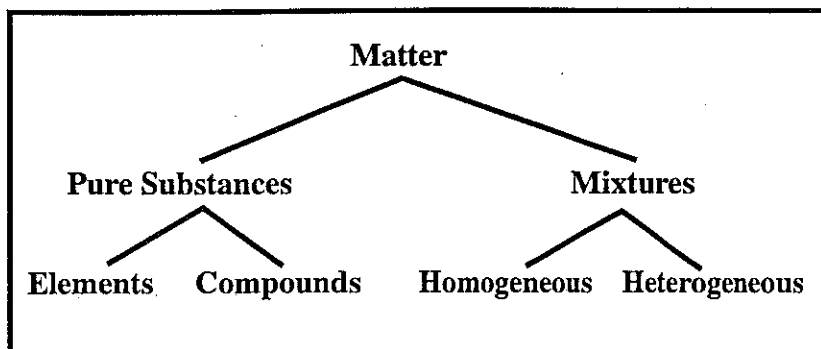


Classification of Matter

Matter is defined as something that

- has mass or weight.
- takes up space (has volume).
- exhibits the property of inertia. (If something is at rest, it stays at rest unless a force acts on it.)
- cannot occupy the same space as other matter at the same time.



All matter can be categorized as either a pure substance or a mixture.

Pure Substances

A pure substance has the same composition throughout, and pure substances often occur naturally. Two examples of pure substances are elements and compounds.

- **Elements** cannot be broken down.
- **Compounds** are formed from the chemical combination of two or more elements. These elements cannot be separated by physical means. The properties of a compound are entirely different from the properties of each of the elements that make up the compound.

Mixtures

Mixtures are formed when two or more substances (solids, liquids, or gases) are physically combined. The parts of a mixture can be physically separated from one another. All of the substances in a mixture retain their original properties.

There are two kinds of mixtures:

- **Homogeneous Mixture**—The parts of the mixture are evenly distributed.
- **Heterogeneous Mixture**—The parts of the mixture are *not* evenly distributed.

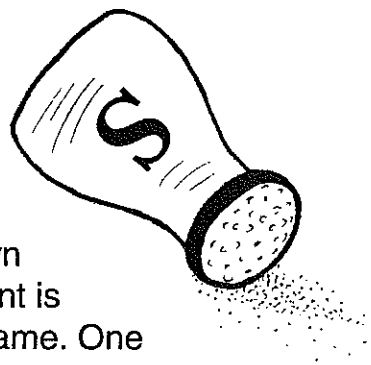
Write *P* or *M* before each of the following to indicate whether it is a pure substance or a mixture.

- | | | |
|--------------------|---------------------|---------------------------------|
| 1. ____ table salt | 3. ____ sugar | 5. ____ aspirin |
| 2. ____ mixed nuts | 4. ____ fruit salad | 6. ____ prepared instant coffee |

Write *HO* or *HE* before each of the following to indicate whether it is a homogeneous mixture or a heterogeneous mixture.

- | | |
|--------------------------------------|---------------------|
| 7. ____ oil & vinegar salad dressing | 10. ____ mayonnaise |
| 8. ____ soil | 11. ____ bronze |
| 9. ____ seawater | 12. ____ soda pop |

Pure Substances



Two types of pure substances are elements and compounds.

Elements

Elements cannot be chemically changed or broken down into simpler substances. The smallest particle of an element is called an atom. All atoms of a particular element are the same. One hundred and nine different kinds of elements have been discovered on Earth. Ninety-two of those are naturally occurring, and the other seventeen were created in a laboratory.

Compounds

Compounds are pure substances that are formed when two or more elements are chemically combined. The elements in a specific compound are combined in definite proportions. If the proportions are changed, different compounds are formed. Compounds have their own properties, and they do not retain the properties of the elements that form them. Scientists have identified approximately four million compounds that form from combinations of two or more elements. The elements in a compound can be separated only by chemical means.

Common substances such as water, sugar, salt, and vinegar are compounds. The scientific name for a compound comes from the elements it contains.

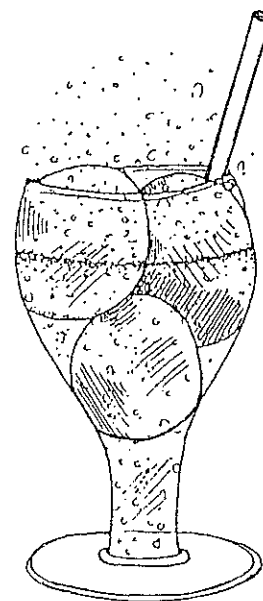
Sodium is a metal. When pure sodium is placed in water, an explosion occurs. Chlorine is a poisonous gas. When one atom of sodium chemically combines with one atom of chlorine, a compound called sodium chloride is formed. This compound is also known as table salt.

1. What characteristics does sodium chloride have? _____

2. Sodium chloride is made up of sodium and chlorine, but it isn't a poisonous gas and it doesn't explode in water. Explain why.

3. Hydrogen peroxide (H_2O_2) is a compound made from two elements: hydrogen and oxygen. Water (H_2O) is also a compound made from hydrogen and oxygen. What makes these two compounds different? _____

More About Mixtures



Mixtures contain more than one kind of substance. The properties of a mixture are a blend of the properties of the materials that are combined in the mixture. A mixture's properties vary depending on the amount of each substance present in the sample.

Mixtures can be made by combining liquids, solids, or gases together in various ways. The substances in a mixture can be separated by physical means.

There are two kinds of mixtures: heterogeneous mixtures and homogeneous mixtures. In a **heterogeneous mixture**, the parts of the mixture are not evenly distributed. Oil and vinegar salad dressing is an example of a heterogeneous mixture. The oil and the vinegar do not mix together evenly. The parts of a **homogeneous mixture** are evenly distributed. The mixture is the same throughout. Sugar and water combine to form a homogeneous mixture.

Solutions are homogeneous mixtures that form when one substance is dissolved in another substance.

Six ways to physically separate mixtures are listed below. Correctly match them to the mixture that they would best separate.

- | | |
|---|--------------------------------|
| 1. ____ letting something settle | a. blood |
| 2. ____ distillation | b. alcohol and water |
| 3. ____ evaporation | c. sugar and water |
| 4. ____ using a magnet | d. wood chips and iron filings |
| 5. ____ physically separating with your hands | e. peas and beans |
| 6. ____ using a centrifuge | f. sand and water |

The four ways to make a mixture are listed at the top of this page. An ice cream float is an example of a mixture made from a solid, a liquid, and a gas. The ice cream is solid, the soda pop is liquid, and the carbonation is a gas. Write the letter of the combination that describes each mixture below.

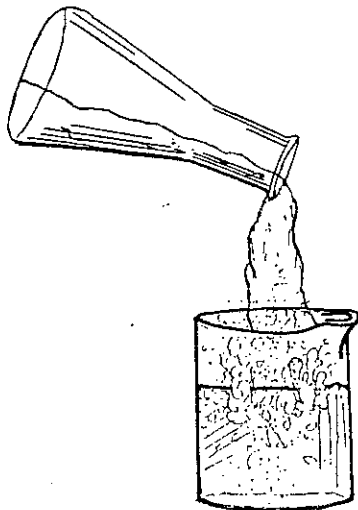
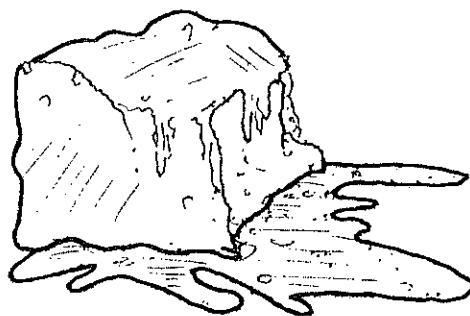
- | | |
|--|---------------------------|
| 7. ____ nuts and bolts | A. liquid and liquid |
| 8. ____ salt and water | B. solid and solid |
| 9. ____ polluted air | C. gas and gas |
| 10. ____ oil and water | D. liquid and solid |
| 11. ____ air in a scuba tank | E. solid, liquid, and gas |
| 12. ____ wet, sudsy clothes in a washing machine | F. solid and gas |

Properties of Matter

A property is a characteristic that describes matter. Matter has both physical properties and chemical properties.

Physical Properties

The physical properties of a substance can be observed or measured without chemically changing the substance. Some examples of physical properties are color, luster (shine), malleability (ability to change shape), brittleness, odor, taste, density, texture, hardness, electrical conductivity, heat conductivity, boiling point, melting point, and freezing point.



Chemical Properties

The chemical properties of a substance determine whether or not it will react chemically. The chemical activity of a substance is defined as how easily the substance reacts with another substance. The chemical activity of elements depends on how easy it is for them to gain or lose electrons and how many electrons they have in their outer shell. The elements are grouped together in the periodic table based on their chemical properties.

Write *C* or *P* to indicate whether each of the following is a chemical or physical property.

1. ____ Antioxidants are used as food preservatives in margarine.
2. ____ White phosphorous glows in the dark.
3. ____ White phosphorous ignites easily.
4. ____ Graphite is a good lubricant.
5. ____ Gold does not react with water.
6. ____ Strontium reacts with water.
7. ____ Gallium has a melting point of about 86° Fahrenheit.
8. ____ Iron rusts when it is exposed to air.
9. ____ Diamonds are the hardest substance known to humankind.
10. ____ Silver is a good conductor of electricity.