

# OMOGENEUS VS. ETEROGENEOUS MATTER

Name \_\_\_\_\_

Classify the following substances and mixtures as either homogeneous or heterogeneous. Write a ✓ in the correct column.

**HOMOGENEOUS**      **HETEROGENEOUS**

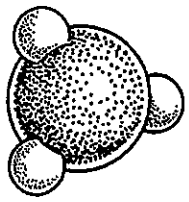
- flat soda pop \_\_\_\_\_
- cherry vanilla ice cream \_\_\_\_\_
- salad dressing \_\_\_\_\_
- sugar \_\_\_\_\_
- soil \_\_\_\_\_
- aluminum foil \_\_\_\_\_
- black coffee \_\_\_\_\_
- sugar water \_\_\_\_\_
- city air \_\_\_\_\_
- paint \_\_\_\_\_
- alcohol \_\_\_\_\_
- iron \_\_\_\_\_
- beach sand \_\_\_\_\_
- pure air \_\_\_\_\_
- spaghetti sauce \_\_\_\_\_

# SUBSTANCES VS. MIXTURES

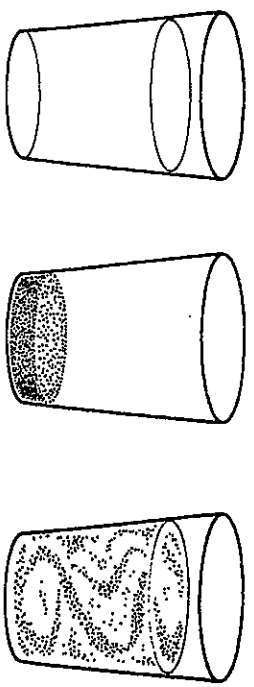
Name \_\_\_\_\_

A substance is matter for which a chemical formula can be written. Elements and compounds are substances. Mixtures can be in any proportion, and the parts are not chemically bonded.

Classify the following as to whether it is a substance or a mixture by writing S or M in the space provided.



- |                   |       |                 |       |
|-------------------|-------|-----------------|-------|
| 1. sodium         | _____ | 11. iron        | _____ |
| 2. water          | _____ | 12. salt water  | _____ |
| 3. soil           | _____ | 13. ice cream   | _____ |
| 4. coffee         | _____ | 14. nitrogen    | _____ |
| 5. oxygen         | _____ | 15. eggs        | _____ |
| 6. alcohol        | _____ | 16. blood       | _____ |
| 7. carbon dioxide | _____ | 17. table salt  | _____ |
| 8. cake batter    | _____ | 18. nail polish | _____ |
| 9. air            | _____ | 19. milk        | _____ |
| 10. soup          | _____ | 20. cola        | _____ |



## PHYSICAL VS. CHEMICAL CHANGES

Name \_\_\_\_\_

In a physical change, the original substance still exists; it has only changed in form. In a chemical change, a new substance is produced. Energy changes always accompany chemical changes.

Classify the following as being a physical or chemical change.

1. Sodium hydroxide dissolves in water. \_\_\_\_\_
2. Hydrochloric acid reacts with potassium hydroxide to produce a salt, water and heat. \_\_\_\_\_
3. A pellet of sodium is sliced in two. \_\_\_\_\_
4. Water is heated and changed to steam. \_\_\_\_\_
5. Potassium chlorate decomposes to potassium chloride and oxygen gas. \_\_\_\_\_
6. Iron rusts. \_\_\_\_\_
7. When placed in  $H_2O$ , a sodium pellet catches on fire as hydrogen gas is liberated and sodium hydroxide forms. \_\_\_\_\_
8. Evaporation \_\_\_\_\_
9. Ice melting \_\_\_\_\_
10. Milk sours. \_\_\_\_\_
1. Sugar dissolves in water. \_\_\_\_\_
2. Wood rotting \_\_\_\_\_
3. Pancakes cooking on a griddle \_\_\_\_\_
4. Grass growing in a lawn \_\_\_\_\_
5. A tire is inflated with air. \_\_\_\_\_
6. Food is digested in the stomach. \_\_\_\_\_
7. Water is absorbed by a paper towel. \_\_\_\_\_

Name \_\_\_\_\_

Pure Substances and Mixtures

## 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:

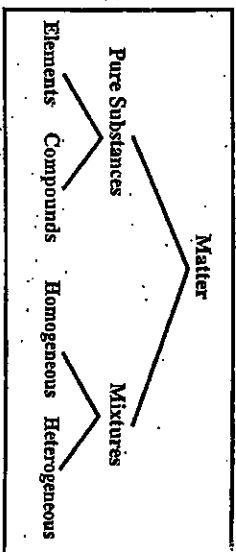
- Homogeneous Mixture—The parts of the mixture are evenly distributed.
- Heterogeneous Mixture—The parts of the mixture are not evenly distributed.

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

1. \_\_\_\_\_ table salt
2. \_\_\_\_\_ mixed nuts
3. \_\_\_\_\_ sugar
4. \_\_\_\_\_ fruit salad
5. \_\_\_\_\_ aspirin
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
8. \_\_\_\_\_ soil
9. \_\_\_\_\_ seawater
10. \_\_\_\_\_ mayonnaise
11. \_\_\_\_\_ bronze
12. \_\_\_\_\_ soda pop



## Properties

Recall that physical properties can be observed without producing new substances. Chemical properties describe how a substance interacts (or fails to interact) with other substances to produce new substances. Extensive properties depend upon the amount of matter in the sample; intensive properties do not. Classify each of the properties listed below as extensive physical, intensive physical, or chemical.

- |                                           |           |
|-------------------------------------------|-----------|
| 1. Color                                  | 1. _____  |
| 2. Combustibility                         | 2. _____  |
| 3. Hardness                               | 3. _____  |
| 4. Density                                | 4. _____  |
| 5. Mass                                   | 5. _____  |
| 6. Melting point                          | 6. _____  |
| 7. Ductility                              | 7. _____  |
| 8. Volume                                 | 8. _____  |
| 9. Failure to react with other substances | 9. _____  |
| 10. Odor                                  | 10. _____ |
| 11. Weight                                | 11. _____ |
| 12. Malleability                          | 12. _____ |
| 13. Tendency to corrode                   | 13. _____ |

Some of the measured properties of a given substance are listed below. Write the general name describing each property. Select the names from the properties listed for Exercises 1-13 above.

- |                                                           |           |
|-----------------------------------------------------------|-----------|
| 14. 15 mL                                                 | 14. _____ |
| 15. Can easily be hammered into sheets.                   | 15. _____ |
| 16. 2.8 g/mL                                              | 16. _____ |
| 17. Burns when heated in the presence of O <sub>2</sub> . | 17. _____ |
| 18. Stinks when heated.                                   | 18. _____ |
| 19. Can be scratched by a diamond.                        | 19. _____ |
| 20. 500°C                                                 | 20. _____ |
| 21. Can easily be drawn into a wire.                      | 21. _____ |

Review Activity

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## Classification of Matter

Choose words from the list to fill in the blanks in the paragraphs.

- |                    |                      |                   |
|--------------------|----------------------|-------------------|
| chemical property  | heterogeneous matter | physical property |
| compound           | homogeneous matter   | property          |
| element            | intensive property   | substance         |
| extensive property | mixture              |                   |

### Word List

- Matter that has uniform characteristics throughout is called (1) \_\_\_\_\_.
- Matter that has parts with different characteristics is called (2) \_\_\_\_\_. A characteristic by which a variety of matter is recognized is called a(n) (3) \_\_\_\_\_. A characteristic that depends upon the amount of matter in the sample is called a(n) (4) \_\_\_\_\_. A characteristic that does not depend upon the amount of matter is called a(n) (5) \_\_\_\_\_. A characteristic that can be observed without producing new kinds of matter is called a(n) (6) \_\_\_\_\_. A characteristic that depends on how a kind of matter changes its composition (or fails to change its composition) during interactions with other kinds of matter is called a(n) (7) \_\_\_\_\_.

- Matter can also be classified according to the basic types of matter it contains. A simple substance that cannot be broken down into other substances by chemical means is called a(n) (8) \_\_\_\_\_. A chemical combination of simple substances is called a(n) (9) \_\_\_\_\_. A physical combination of different substances that retain their individual properties is called a(n) (10) \_\_\_\_\_. Either an element or a compound may be referred to as a(n) (11) \_\_\_\_\_. Classify each of the following as an element, compound, heterogeneous mixture, or homogeneous mixture.

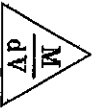
- |                              |           |
|------------------------------|-----------|
| 12. Water                    | 12. _____ |
| 13. Carbon                   | 13. _____ |
| 14. Air                      | 14. _____ |
| 15. Table salt               | 15. _____ |
| 16. Sugar dissolved in water | 16. _____ |
| 17. Homogenized milk         | 17. _____ |
| 18. Granite                  | 18. _____ |
| 19. Oxygen                   | 19. _____ |
| 20. Sand in water            | 20. _____ |

Review Activity

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3. What is the weight of the ethanol that exactly fills a 200.0 mL container? The density of ethanol is 0.789 g/mL.



4. A rectangular block of copper metal weighs 1896 g. The dimensions of the block are 8.4 cm by 5.5 cm by 4.6 cm. From this data, what is the density of copper? (hint: find the volume of a block first)

5. What volume of silver metal will weigh exactly 2500.0 g. The density of silver is 10.5 g/cm<sup>3</sup>.

6. Find the mass of 250.0 mL of benzene. The density of benzene is 0.8765 g/mL.

7. A block of lead has dimensions of 4.50 cm by 5.20 cm by 6.00 cm. The block weighs 1587 g. From this information, calculate the density of lead.

8. 28.5 g of iron shot is added to a graduated cylinder containing 45.50 mL of water. The water level rises to the 49.10 mL mark. From this information, calculate the density of iron.

## SEPARATION OF MIXTURES

Name \_\_\_\_\_

1. Making advantage of various physical and chemical properties, how would you separate the following mixtures into their components?

1. Sand and water \_\_\_\_\_

2. Sugar and water \_\_\_\_\_

3. Oil and water \_\_\_\_\_

4. Sand and gravel \_\_\_\_\_

5. A mixture of heptane (boiling point 98°C) and heptanol (boiling point 176°C)

6. A mixture of iodine solid and sodium chloride (hint: iodine is not soluble in water.)

7. A mixture of lead and aluminum pellets

8. A mixture of soil and iron filings