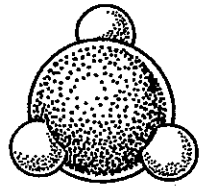
SUBSTANCES VS. MIXTURES

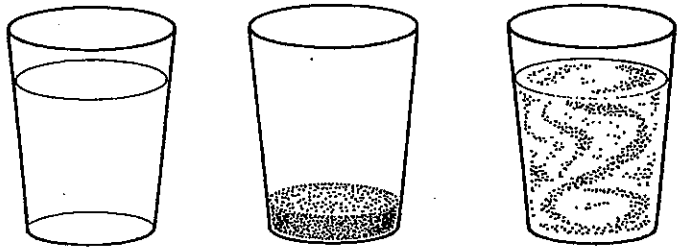
Name Key



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



OMOGENEOUS VS. TEROGENEOUS MATTER

Name Key

ssify the following substances and mixtures as either homogeneous or heterogeneous. ce 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	✓	

PHYSICAL VS. CHEMICAL CHANGES

Name Key

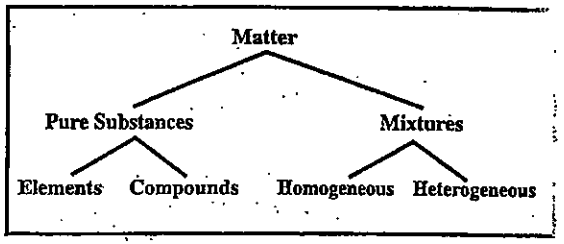
In a physical change, the original substance still exists, it has only changed in form. In a chemical change, a new substance is produced. Energy changes always accompany chemical changes.

Classify the following as being a physical or chemical change.

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

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 by 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. P table salt
2. M mixed nuts
3. P sugar
4. M fruit salad
5. P aspirin
6. M 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. HE oil & vinegar salad dressing
8. HE soil
9. HE seawater
10. HO mayonnaise
11. HO bronze
12. HO soda pop

Name Key Class ____ Date ____

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 — P (I)
2. Combustibility — C (I)
3. Hardness — P (I)
4. Density — P (I)
5. Mass — P (E)
6. Melting point — P (I)
7. Ductility — P (I)
8. Volume — P (E)
9. Failure to react with other substances — C (I)
10. Odor — P (I)
11. Weight — P (E)
12. Malleability — P (I)
13. Tendency to corrode — C (I)

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 — volume
15. Can easily be hammered into sheets. — malleability
16. 2.8 g/mL — density
17. Burns when heated in the presence of O_2. — combustibility
18. Stinks when heated. — odor
19. Can be scratched by a diamond. — hardness
20. 500°C — melting point
21. Can easily be drawn into a wire. — ductility

Name Key Class ____ Date ____

Classification of Matter

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

Word List

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

Matter that has uniform characteristics throughout is called (1) homogeneous matter. Matter that has parts with different characteristics is called (2) heterogeneous matter. A characteristic by which a variety of matter is recognized is called a(n) (3) property. A characteristic that depends upon the amount of matter in the sample is called a(n) (4) extensive property. A characteristic that does not depend upon the amount of matter is called a(n) (5) intensive property. A characteristic that can be observed without producing new kinds of matter is called a(n) (6) physical property. 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) chemical property.

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) element. A chemical combination of simple substances is called a(n) (9) Compound. A physical combination of different substances that retain their individual properties is called a(n) (10) mixture. Either an element or a compound may be referred to as a(n) (11) substance.

*Classify each of the following as an **element, compound, heterogeneous mixture,** or **homogeneous mixture.***

12. Water — compound
13. Carbon — element
14. Air — mixture (homo)
15. Table salt — compound
16. Sugar dissolved in water — mixture (homo)
17. Homogenized milk — mixture (homo)
18. Granite — mixture
19. Oxygen — element
20. Sand in water — mixture (hetero)

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.

M / dV

G
V = 200mL
D = 0.789g/mL

N
V·D = m
(200)(.789) = 157.80g/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)

G
m = 1896 g
V = 5.5 × 4.6 × 8.4
= 212.52 cm³

N
D = m/V
D = 1896 g / 212.52
D = 8.92 g/cm³

5. What volume of silver metal will weigh exactly 2500.0 g. The density of silver is 10.5 g/cm³.

G
2500 g = m
10.5 g/cm³ = D

N
V = m/D
V = 2500 g / 10.5 g/cm³
V = 238.10 cm³

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

G
V = 250mL
D = .8765 g/mL

N
m = V·D
(250mL)(.8765 g/mL)
= 219.13 g

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.

G
4.50 × 5.20 × 6.00
= 140.4 cm³
m = 1587 g

N
D = m/V
D = 1587 g / 140.4 cm³
D = 11.30 g/cm³

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.

G
28.5 g = m
V = 49.10 − 45.50
3.60 mL

N
D = m/V
D = 28.5 g / 3.60 mL
D = 7.916
7.92 g/mL

SEPARATION OF MIXTURES

Name Key

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

1. Sand and water filtering or decanting - evaporating water
2. Sugar and water distillation / evaporate water
3. Oil and water decanting density of water is more than oil.
4. Sand and gravel using a sieve / sifter to strain out smaller particles
5. A mixture of heptane (boiling point 98°C) and heptanol (boiling point 176°C) distillation through boiling points. Heptane boils off first.
6. A mixture of iodine solid and sodium chloride (Hint: Iodine is not soluble in water.) mix w/ water - sodium chloride will dissolve - then filter out iodine
7. A mixture of lead and aluminum pellets aluminum is less dense so you can separate by hand
8. A mixture of salt and iron filings iron is magnetic; separate using a magnetic