

# Unit 1 - Work Packet

## Unit 1A - Measurement

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## Unit 1B - Intro. to Chemistry

I. Conversion factor: Convert the following.

1) 1,500 mL to L

$$\text{___ mL} = \text{___ L}$$

2) 950 g to kg

$$\text{___ g} = \text{___ kg}$$

3) 1.5 kg to mg

$$\text{___ kg} = \text{___ mg}$$

4) 4,500 cm to  $\mu\text{m}$

$$\text{___ cm} = \text{___ } \mu\text{m}$$

5) 275 mm to cm

$$\text{___ mm} = \text{___ cm}$$

6) 0.075 m to cm

$$\text{___ m} = \text{___ cm}$$

7) 275 cg to mg

$$\text{___ cg} = \text{___ mg}$$

8) 85 nm to pm

$$\text{___ nm} = \text{___ pm}$$

9) 0.005 kg to g

$$\text{___ kg} = \text{___ g}$$

10) 300  $\mu\text{l}$  to ml

$$\text{___ } \mu\text{l} = \text{___ ml}$$

## II. Scientific Notation:

### A. Convert the following to scientific notation

1. 0.005 = \_\_\_\_\_

6. 0.25 = \_\_\_\_\_

2. 5,050 = \_\_\_\_\_

7. 0.035 = \_\_\_\_\_

3. 0.0008 = \_\_\_\_\_

8. 0.0045 = \_\_\_\_\_

4. 1,000 = \_\_\_\_\_

9. 450 = \_\_\_\_\_

5. 1,570,000 = \_\_\_\_\_

10. 6,000 = \_\_\_\_\_

### B. Convert the following to standard notation

11.  $1.5 \times 10^3 =$  \_\_\_\_\_

16.  $3.35 \times 10^{-1} =$  \_\_\_\_\_

12.  $1.5 \times 10^{-3} =$  \_\_\_\_\_

17.  $1.2 \times 10^{-4} =$  \_\_\_\_\_

13.  $3.75 \times 10^{-2} =$  \_\_\_\_\_

18.  $1.2 \times 10^4 =$  \_\_\_\_\_

14.  $3.75 \times 10^2 =$  \_\_\_\_\_

19.  $1.1 \times 10^{-1} =$  \_\_\_\_\_

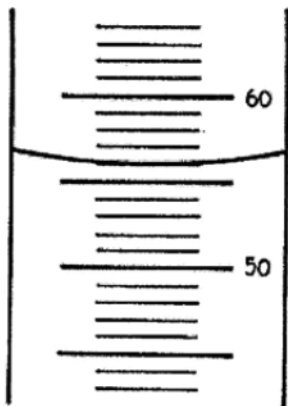
15.  $2.2 \times 10^5 =$  \_\_\_\_\_

20.  $4.5 \times 10^0 =$  \_\_\_\_\_

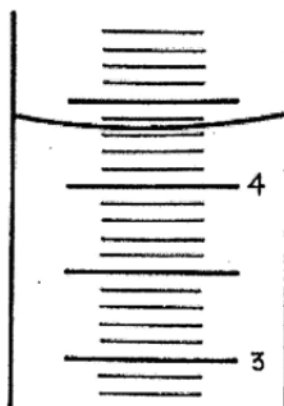
## III. Measuring

Measure the following graduate cylinders to the correct number of spaces. Do not forget one estimated measurement

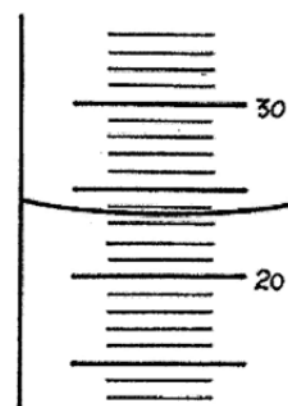
What volume is indicated on each of the graduated cylinders below? The unit of volume is mL.



a) \_\_\_\_\_

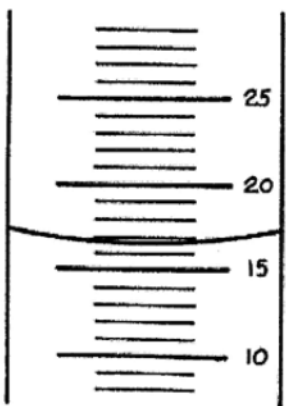


b) \_\_\_\_\_

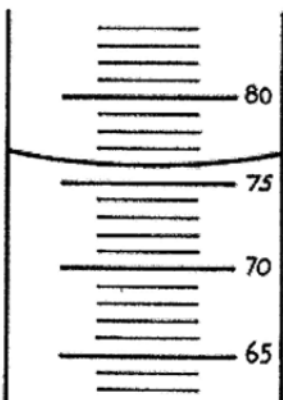


c) \_\_\_\_\_

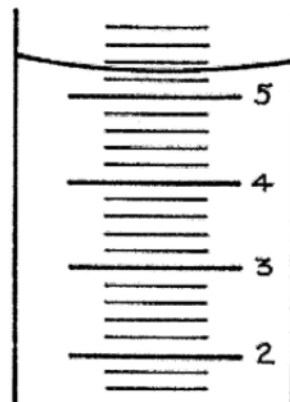
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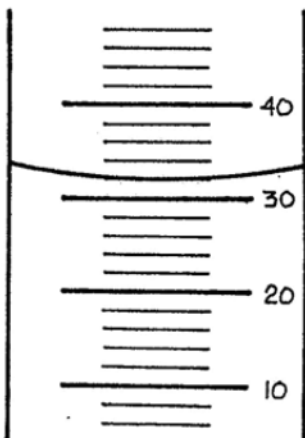
d) \_\_\_\_\_



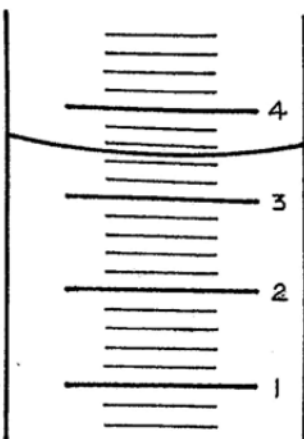
e) \_\_\_\_\_



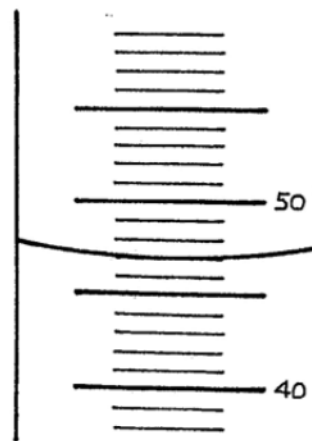
f) \_\_\_\_\_



g) \_\_\_\_\_



h) \_\_\_\_\_



i) \_\_\_\_\_

#### IV. Significant Figures

A. Determine the number of sig figs in the following numbers:

1. 0.02 \_\_\_\_\_

6. 5,000. \_\_\_\_\_

2. 0.020 \_\_\_\_\_

7. 6,051.00 \_\_\_\_\_

3. 501 \_\_\_\_\_

8. 0.0020250 \_\_\_\_\_

4. 501.0 \_\_\_\_\_

9. 10,001 \_\_\_\_\_

5. 5,000 \_\_\_\_\_

10. 0.1020 \_\_\_\_\_

B. Round the atomic masses to 3 significant figures

11. V: 50.9415 \_\_\_\_\_

14. Te: 127.60 \_\_\_\_\_

12. Rh: 103.906 \_\_\_\_\_

15. Rb: 85.4678 \_\_\_\_\_

13. N: 14.0067 \_\_\_\_\_

16. Mg: 24.305 \_\_\_\_\_

**C. Perform the following calculations and record with the correct number of significant figures**

17.  $0.4321 + 1.233 =$  \_\_\_\_\_

22.  $2.4101 \times 20.0 =$  \_\_\_\_\_

18.  $1.1 + 0.0234 =$  \_\_\_\_\_

23.  $400 \times 3.01 =$  \_\_\_\_\_

19.  $0.991 - 0.36 =$  \_\_\_\_\_

24.  $23.04 / 6.01 =$  \_\_\_\_\_

20.  $134.1322 - 45.012 =$  \_\_\_\_\_

25.  $0.03 \times 1.20 =$  \_\_\_\_\_

21.  $300.062 - 293.1 =$  \_\_\_\_\_

26.  $34.450 / 23.13 =$  \_\_\_\_\_

**V. Percent Error:** Calculate the percent error for the following

1. From an experiment, the density of iron (Fe) is found to be  $7.629 \text{ g/cm}^3$ . Using your reference tables, find the percent error.
2. The melting point of potassium (K) is found to be 341 K in an experiment. Using your reference tables, find the percent error.
3. The melting point of Zn is found to be 684 K in an experiment. Using your reference tables, find the percent error.

**VI. Density:** Solve each of the following problems. Be sure to show all work, including equation and numbers with units. **Be sure to take into account significant figures. Do not forget densities of elements can be found on Table S.**

1. What is the volume of a piece of silver (Ag) that has a mass of 3.5 grams?
2. A cube of unknown metal has a mass of 32.45 g. The length of one of the sides of the cube is 2.31 cm. Find the density of the cube.



## VII. Temperature Conversions:

Complete the following chart. All measurements are good to 1° C or better.

	°C	K	°F
1	0° C		
2			212° F
3		450 K	
4			98.6° F
5	-273° C		
6		294 K	
7			77° F
8		225 K	
9	-40° C		

## VIII. Conservation of Mass

- 1) A student carefully placed 23.0 g of sodium in a reactor with an excess quantity of chlorine gas. When the reaction is complete, the student obtained 58 grams of salt (sodium chloride). How many grams of sodium reacted?
- 2) 3.5 g of hydrogen gas reacts with 2.6 g of oxygen gas and produces water. Determine how much water forms.
- 3) A reaction between sodium hydroxide and hydrogen chloride gas produces sodium chloride and water. A reaction of 22.85 g of sodium hydroxide with 20.82 g of hydrogen chloride gives off 10.29 g of water. What mass of sodium chloride is formed in the reaction?
- 4) A thin strip of iron is placed into a solution containing 21.12 g of copper (II) sulfate. A reaction occurs forming copper and iron (II) sulfate. After a while, the reaction stops because all the copper (II) sulfate has reacted. The iron strip is found to have a mass of 8.33 g. The mass of copper is found to be 8.41 g and the mass of iron (II) sulfate is 20.10 g. What was the mass of the original iron strip?

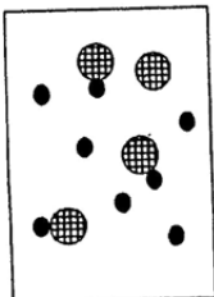
# Unit 1B: Introduction to Chemistry

Name \_\_\_\_\_

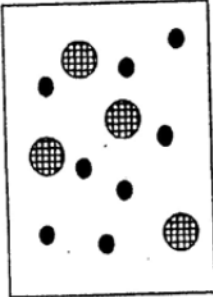
WKS: Mixtures vs. Substances

Directions: Read each question carefully & write your answers in the space provided.

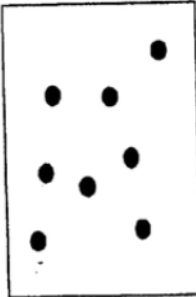
1. Look at the following models. Identify each as a substance or mixture. Then describe its composition as elements only, compounds only, or elements and compounds.



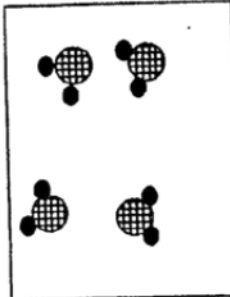
Choose: Substance or Mixture \_\_\_\_\_  
 Describe as elements only, compounds only, or elements & compounds. \_\_\_\_\_  
 Defend: \_\_\_\_\_



Choose: Substance or Mixture \_\_\_\_\_  
 Describe as elements only, compounds only, or elements & compounds. \_\_\_\_\_  
 Defend: \_\_\_\_\_



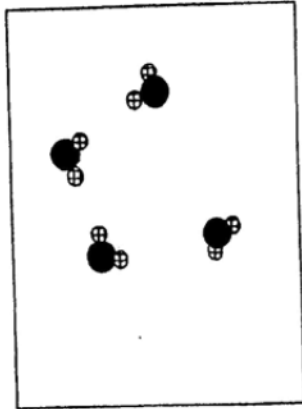
Choose: Substance or Mixture \_\_\_\_\_  
 Describe as elements only, compounds only, or elements & compounds. \_\_\_\_\_  
 Defend: \_\_\_\_\_



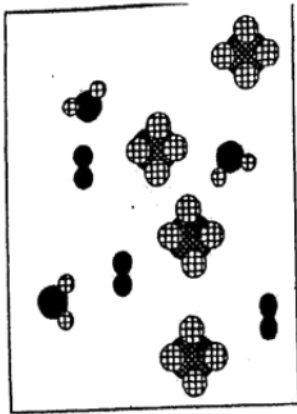
Choose: Substance or Mixture \_\_\_\_\_  
 Describe as elements only, compounds only, or elements & compounds. \_\_\_\_\_  
 Defend: \_\_\_\_\_

2. Match each description, i.e., a through d, with the appropriate diagram by writing in the box provided. Identify if it represents an compound, element, or both. Also, defend your answer.

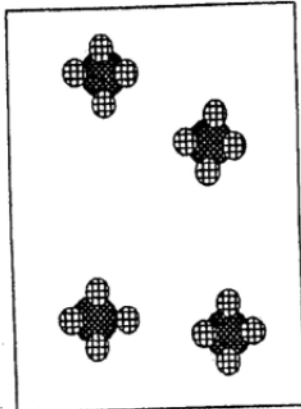
- a.  $N_2(g)$
- b.  $CH_4(g)$
- c. mixture of gases
- d.  $H_2O(g)$



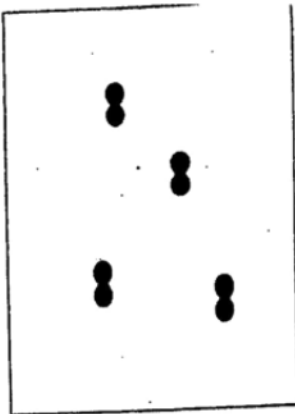
Description (choice a-d): \_\_\_\_\_  
 Elements, Compounds, or both \_\_\_\_\_  
 Defend: \_\_\_\_\_



Description (choice a-d): \_\_\_\_\_  
 Elements, Compounds, or both \_\_\_\_\_  
 Defend: \_\_\_\_\_



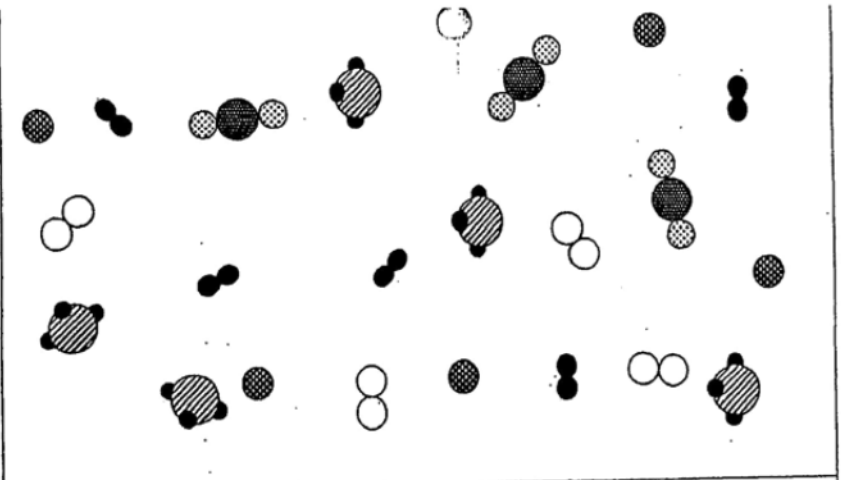
Description (choice a-d): \_\_\_\_\_  
 Elements, Compounds, or both \_\_\_\_\_  
 Defend: \_\_\_\_\_



Description (choice a-d): \_\_\_\_\_  
 Elements, Compounds, or both \_\_\_\_\_  
 Defend: \_\_\_\_\_

The following diagram represents a mixture of substances. Classify the components of the mixture as monatomic elements, diatomic elements, substances or compounds. Then draw each substance in the correct box.

Each circle represents a different type of particle or atom.

	<b>Monatomic Elements</b>
<b>Diatomic Elements</b>	
<b>Molecules</b>	
<b>Substances</b>	
<b>Compounds</b>	

8A

## 2 MATTER AND CHANGE

### PRACTICE PROBLEMS

Name \_\_\_\_\_

Class \_\_\_\_\_

Date \_\_\_\_\_

*In your notebook, solve the following problems.*

#### SECTION 2.1 MATTER

- Which of the following is *not* a physical change?
  - dissolving sugar in water
  - evaporating sea water to obtain salt
  - burning gasoline in an engine
  - slicing a piece of bread
- Which of the following is *not* a property of a gas?
  - has a definite shape
  - assumes the shape of its container
  - has no definite volume
  - is easily compressible
- Which of the following is *not* a physical property of sucrose?
  - solid at room temperature
  - dissolves in water
  - decomposes when heated
  - tastes sweet
- Which of the following is typically in a different physical state than the other three at room temperature?
  - salt
  - sugar
  - flour
  - water

5. Complete the following table.

physical state	definite shape?	definite volume?	readily compressible?
gas			no
	no		no
	yes		

Use Table 2.1 to answer the following questions.

- Which substance is a colored gas?
- Which liquids boil at a lower temperature than water?
- For which substances would 2 cm<sup>3</sup> have a mass greater than 6 g?

#### SECTION 2.2 MIXTURES

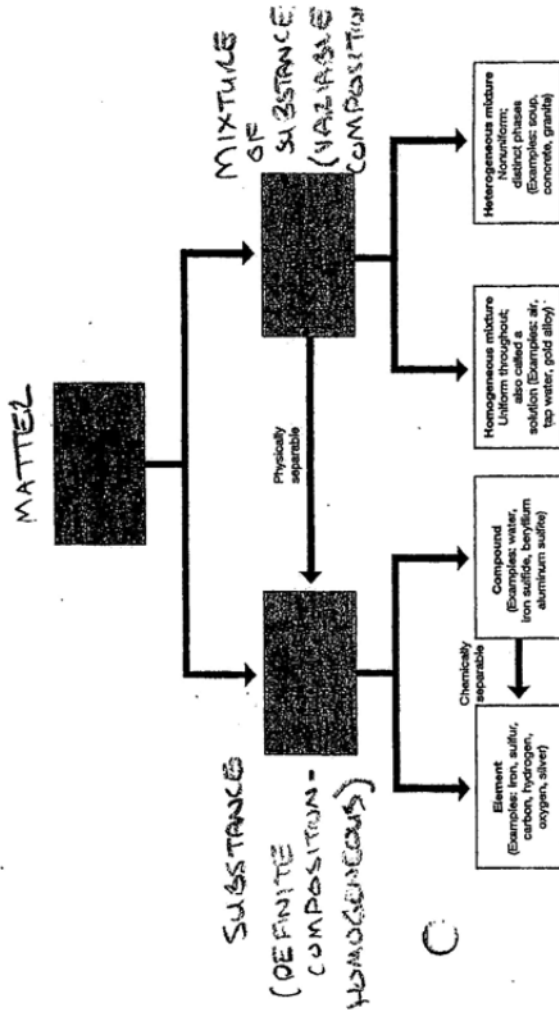
- How might one separate a mixture of water and salt?
- What is a homogeneous mixture?
  - gasoline
  - chunky peanut butter
  - oil and vinegar salad dressing
  - orange soda
- Which of the following mixtures are homogeneous? Which are heterogeneous?
  - gasoline
  - chunky peanut butter
  - oil and vinegar salad dressing
  - orange soda

8B



## 2 INTERPRETING GRAPHICS

USE WITH SECTION 2.3



- Which of the following are pure substances? Which are mixtures?
  - ethanol
  - vinegar
  - motor oil
  - helium
- Use the system types from Table 2.3 to describe each of the following solutions.
  - ethanol in water
  - sucrose in ethanol
  - carbon in iron
  - oxygen in water

### SECTION 2.3 ELEMENTS AND COMPOUNDS

- What elements make up chloroform, chemical formula  $\text{CHCl}_3$ ?
- Name the elements represented by the following chemical symbols.
  - Pb
  - K
  - Au
  - Fe
- Classify the following as elements, compounds, or mixtures.
  - salt
  - water
  - iron
  - sterling silver
- Write the chemical symbol for each of the following elements.
  - chlorine
  - sodium
  - silver
  - carbon
- A liquid is allowed to evaporate and leaves no residue. Can you determine whether it was an element, a compound, or a mixture?
- Which of the following is not an element?
  - copper
  - sulfur
  - ammonia
  - helium

### SECTION 2.4 CHEMICAL REACTIONS

- Which one of the following is a chemical change?
  - gasoline boils
  - lead is added to gasoline
  - gasoline burns
  - gasoline is poured into a tank
- Classify each of the following changes as physical or chemical.
  - dew is dried by the sun
  - grape juice is converted to wine
  - a dark cloth is faded by the sunlight
  - soap is dissolved in water
- In the chemical reaction carbon dioxide plus water  $\rightarrow$  carbonic acid, what does the arrow stand for?
- Name the product(s) in problem 3.
- Name the reactant(s) in problem 3.
- If 44 grams of carbon dioxide react completely with 18 grams of water, what is the mass of carbonic acid formed?
- In an engine, octane combines with oxygen to form carbon dioxide and water. If 22.8 grams of octane combine completely with 80 grams of oxygen to form 70.4 grams of carbon dioxide, what mass of water is formed?
- What is the name of the chemical law on which problems 6 and 7 are based?

Use the flowchart on the previous page, redrawn from Figure 2.8 in your textbook, to answer the following questions.

1. Motor oil is available in various grades (10W30, 10W40, etc.). Is motor oil a homogeneous mixture or a compound? Why?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. Iron ore is a heterogeneous mixture that contains iron oxide. Iron ore can be smelted to produce pure iron. Is iron smelting a chemical or physical process? Why?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. Classify each of the following as physical or chemical separations.

a. air → oxygen + nitrogen

b. water → hydrogen + oxygen

c. salt water → water + sodium chloride

4. Classify each of the following as mixtures or substances.

a. sulfur

b. air

c. concrete

d. water

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# 2.4 CHEMICAL REACTIONS

## SECTION REVIEW

### Objectives

- Differentiate between physical and chemical changes in matter
- Apply the law of conservation of mass

### Key Terms

- chemical reaction
- reactants
- products
- chemical property
- law of conservation of mass

### Part A Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

Compounds can be separated into their constituent elements 1. \_\_\_\_\_ only by 1. \_\_\_\_\_ reaction. A change in the properties of a substance 2. \_\_\_\_\_ without a change in the composition is a 2. \_\_\_\_\_ change. If the composition changes, then a 3. \_\_\_\_\_ reaction has occurred. In a chemical reaction, 4. \_\_\_\_\_ are converted to products. 5. \_\_\_\_\_ changes are often reversible; many 6. \_\_\_\_\_ changes are not easily reversible. The law of 7. \_\_\_\_\_ states that mass is neither created nor 7. \_\_\_\_\_ destroyed in any physical or chemical reaction. In other words, the 8. \_\_\_\_\_ of matter is unchanged during any physical or chemical reaction.

### Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

9. A physical change is reversible.
10. In a chemical reaction, reactants are changed into products.
11. The amount of matter present appears to change during a chemical reaction.

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Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

12. Matter can be created during a chemical reaction.  
 13. Substances formed in a chemical reaction are called reactants.

**Part C Matching**

Match each description in Column B to the correct term in Column A.

**Column A**

**Column B**

14. chemical reaction  
 15. reactants  
 16. products  
 17. chemical property  
 18. law of conservation of mass
- a. matter is neither created nor destroyed in a chemical reaction  
 b. starting substances in a chemical reaction  
 c. ability of a substance to undergo chemical reaction and form new substances  
 d. substances formed in a chemical reaction  
 e. process in which one or more substances change into new substances

**Part D Questions and Problems**

Answer the following questions in the space provided.

19. When 600 grams of wood are burned, 30 grams of ash remain. What happened to the missing 370 g of matter?  
 \_\_\_\_\_  
 \_\_\_\_\_
20. Some car batteries give off a potentially explosive mixture of gases. What kind of change is taking place in the battery?  
 \_\_\_\_\_  
 \_\_\_\_\_
21. 16 grams of methane gas combine with 64 grams of oxygen to form 44 grams of carbon dioxide, plus water. What mass of water is produced?  
 \_\_\_\_\_  
 \_\_\_\_\_

**PHYSICAL VS. CHEMICAL PROPERTIES**

Name \_\_\_\_\_

A physical property is observed with the senses and can be determined without destroying the object. For example, color, shape, mass, length and odor are all examples of physical properties.

A chemical property indicates how a substance reacts with something else. The original substance is fundamentally changed in observing a chemical property. For example, the ability of iron to rust is a chemical property. The iron has reacted with oxygen, and the original iron metal is changed. It now exists as iron oxide, a different substance.

Classify the following properties as either chemical or physical by putting a check in the appropriate column.

	Physical Property	Chemical Property
1. blue color		
2. density		
3. flammability		
4. solubility		
5. reacts with acid to form H <sub>2</sub>		
6. supports combustion		
7. sour taste		
8. melting point		
9. reacts with water to form a gas		
10. reacts with a base to form water		
11. hardness		
12. boiling point		
13. can neutralize a base		
14. luster		
15. odor		

## 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.

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

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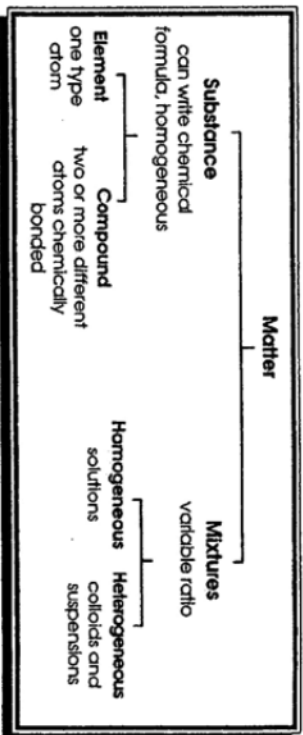
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12A

## MATTER—SUBSTANCES VS. MIXTURES

Name \_\_\_\_\_

All matter can be classified as either a substance (element or compound) or a mixture (heterogeneous or homogeneous).



Classify each of the following as to whether it is a substance or a mixture. If it is a substance, write Element or Compound in the substance column. If it is a mixture, write Heterogeneous or Homogeneous in the mixture column.

- | Type of Matter          | Substance | Mixture |
|-------------------------|-----------|---------|
| 1. chlorine             | _____     | _____   |
| 2. water                | _____     | _____   |
| 3. soil                 | _____     | _____   |
| 4. sugar water          | _____     | _____   |
| 5. oxygen               | _____     | _____   |
| 6. carbon dioxide       | _____     | _____   |
| 7. rocky road ice cream | _____     | _____   |
| 8. alcohol              | _____     | _____   |
| 9. pure air             | _____     | _____   |
| 10. iron                | _____     | _____   |

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12B