

**CHEMICALS AND THEIR PROPERTIES****I. INTRODUCTION**

In today's lab you will observe some physical properties of elements and some physical and chemical changes.

**Background**

1) A pure substance is a sample of matter that has a definite, fixed composition, and the same properties throughout the sample. Each pure substance has its own set of characteristic properties.

Physical properties can be observed without changing the chemical composition of the substance. Common physical properties that can be measured without changing the chemical composition are color, melting point, boiling point, solubility and density. Taste and odor are usually considered to be physical properties although they depend on the physiology of the person making the observations.

Physical changes do not cause a change in chemical composition, but only a change in appearance. When a substance simply changes from a solid to a liquid, liquid to a gas or vice-versa (liquid water to solid water, for example) without a change in composition it is a change in state. This is a physical change. (The three physical states are: gas, liquid, and solid).

Chemical properties describes the ability of a substance to react and change into another substance with a different chemical composition. The new substance would have new properties.

- 2) Evidence that a chemical change is taking place includes:
- A color change
  - A solid product, a precipitate is formed
  - A gas is formed
  - Energy such as heat, light or electricity is produced.

**Purpose:** To learn how to classify matter and its changes

**II. PROCEDURE**

Safety goggles **must** be worn at all times  
Hydrochloric acid (HCl) and sodium hydroxide (NaOH) can harm eyes, skin, and clothing. Handle with care. Any acid spilled on the skin should be rinsed with a large volume of water for 15 minutes.

Wash your hands before you leave the lab.

## A Classifying Physical and Chemical Change:

For the following, record your observations, decide if the change is chemical or physical, and give a reason for your conclusion

Perform the following tests at your lab bench.

1. Obtain a piece of magnesium ribbon from the reagent bench and place it in the burner, holding it with your crucible tongs.



**Do not look directly at the flame.**

Observation:

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Type of Change: \_\_\_\_\_

Explanation:

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Was a new substance(s) present at the end of this change? \_\_\_\_\_

2. Obtain about 2 ml of Copper sulfate solution from the reagent bench. Put it into a test tube. Add about 2 ml of sodium hydroxide solution and mix them together in the tube with your stirring rod.

Observation:

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Type of Change: \_\_\_\_\_

Explanation:

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Was a new substance(s) present at the end of this change? \_\_\_\_\_

3. In a 50 ml beaker obtain about 10 ml of milk in a beaker and mix with about 3 ml of acetic acid (vinegar). Stir with your glass stirring rod

**Note:** Do not pour any solid down the sink.

Observation:

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Type of Change: \_\_\_\_\_

Explanation:

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Was a new substance(s) present at the end of this change? \_\_\_\_\_

**Observe the following demonstrations by the instructor**

4. Your instructor will show you a distillation of Copper (II) Sulfate ( $\text{CuSO}_4$ ) solution.

Observation:

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Type of Change: \_\_\_\_\_

Explanation:

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Was a new substance(s) present at the end of this change? \_\_\_\_\_

5. Change of state of iodine

Observation:

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Type of Change: \_\_\_\_\_

Explanation:

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Was a new substance(s) present at the end of this change? \_\_\_\_\_

6. Electrolysis of water

Observation:

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Type of Change: \_\_\_\_\_

Explanation:

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Was a new substance(s) present at the end of this change? \_\_\_\_\_

7. Reaction of Zinc and sulfur

Observation:

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Type of Change: \_\_\_\_\_

Explanation:

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Was a new substance(s) present at the end of this change? \_\_\_\_\_

8. Reaction of sodium in water

Observation:

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Type of Change: \_\_\_\_\_

Explanation:

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Was a new substance(s) present at the end of this change? \_\_\_\_\_

## **B. Using Chemical and Physical Properties to Identify an Unknown Substance**

At the reagent bench are samples of 7 common substances. Your instructor will assign you an unknown, which is the same as one of the 7 known substances. Based on the observations of the chemical and physical properties of the known and unknown substances, you will determine the identity of the unknown. Procedures 3-5 do not need to be done in order. You will perform all of the tests on the unknown that you perform on each of the known samples.

1. Observe each sample, including the unknown, and then record your observations as to the color, texture and any other important properties in table 1.
2. In a spot plate place small pea-sized amounts of each substance in 2 different rows of wells. Be careful to note which substance is in which well. Do not use more than a small pea-sized amount, or it will be difficult to perform the tests. (On a paper towel write the name of each substance in the order it is placed in your spot plate, and place this paper towel next to the spot plate.)
3.
  - a. Into the first row of wells of the different substances, put about 1 ml of de-ionized water. See if the substances dissolve completely or partially, or change in any other way. Record any evidence of change that occurs in table 1.
  - b. In the row of wells that contains the substances mixed with water, put 3 drops of universal indicator. Record any evidence of change in table 1.
4. In the other row of wells containing the samples put 3 drops of dilute acetic acid (vinegar) and record any evidence of change in table 1 below.
5. Cover your wire gauze with a piece of the aluminum foil that is set out on the reagent bench. Place about pea-sized amounts of each substance onto the foil covered gauze. Make sure there is plenty of space between each sample on the foil. Place the gauze on the ring stand and ring apparatus that is in the fume hood. Light the burner and place the heat under each sample to see if any change occurs. Record any evidence of change in table 1.

Using the data that you recorded in table 1, determine the identity of the unknown sample and answer the questions that follow the table.

**Table 1: Determining the identity of an Unknown substance**

	Appearance (1)	Change with water (2)	Change with universal indicator (3)	Change with acetic acid (vinegar) (4)	Change with heat (5)
Sodium Chloride					
Sugar (Sucrose)					
Baking Powder					
Baking Soda (Sodium Bicarbonate)					
Citric Acid					
White Flour					
Calcium Carbonate					
Unknown #					

Unknown # \_\_\_\_\_

Based on you observations in the above table identify the unknown \_\_\_\_\_

Explain the reason for you answer to the above question:

### **C. Classifying Elements by Physical Properties :**

A number of elements in labeled bottles are on display. Your instructor will show you a sample of sodium. Based on the physical properties you have learned for metals and nonmetals, classify the samples as metals, nonmetals and those you are unsure of. Put them in the table below that shows their symbol in the appropriate column.

**Table 3: Classifying Elements by Appearance**

<b>Metals</b>	<b>Nonmetals</b>	<b>Unsure</b>

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Name \_\_\_\_\_

Date \_\_\_\_\_

Lab Section \_\_\_\_\_

Initials \_\_\_\_\_

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### A Classifying Physical and Chemical Changes:

For the following, record your observations, decide if the change is chemical or physical, and give a reason for your conclusion.

1. Magnesium in the flame.

Type of Change: \_\_\_\_\_

Was a new substance(s) present at the end of this change? \_\_\_\_\_

2. Copper sulfate solution mixed with sodium hydroxide solution the tube.

Type of Change: \_\_\_\_\_

Was a new substance(s) present at the end of this change? \_\_\_\_\_

3. Acetic Acid (Vinegar) mixed with milk.

Type of Change: \_\_\_\_\_

Was a new substance(s) present at the end of this change? \_\_\_\_\_

### **Demonstrations by the instructor**

4. Distillation

Type of Change: \_\_\_\_\_

Was a new substance(s) present at the end of this change? \_\_\_\_\_

5. Change of state of iodine

Type of Change: \_\_\_\_\_

What substance(s) is (are) present at the end of this change? \_\_\_\_\_

6. Electrolysis of water

Type of Change: \_\_\_\_\_

Was a new substance(s) present at the end of this change? \_\_\_\_\_

7. Reaction of Zinc and sulfur

Type of Change: \_\_\_\_\_

Was a new substance(s) present at the end of this change? \_\_\_\_\_

8. Reaction of Sodium in water

Type of Change: \_\_\_\_\_

Was a new substance(s) present at the end of this change? \_\_\_\_\_

**B. Using Chemical and Physical Properties to Identify an Unknown Substance**

**Table 1: Determining the identity of an Unknown substance**

	Appearance	Change with water	Change with universal indicator	Change with acetic acid (vinegar)	Change with heat
Sodium Chloride					
Sugar (Sucrose)					
Baking Powder					
Baking Soda (Sodium Bicarbonate)					
Citric Acid					
White Flour					
Calcium Carbonate					
Unknown #					

Unknown # \_\_\_\_\_

What was the identity of the unknown substance? \_\_\_\_\_

### C. Classifying Elements by Physical Properties :

Table 3: Classifying Elements by Appearance

Metals	Nonmetals	Unsure

**Questions:**

1. Explain the difference between chemical and physical change? (You can use examples from this lab in your explanation.)

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2. What is the difference between a compound and an element? (Besides the fact that they have different properties)

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3. Explain how today's lab did or did not help you understand the difference between chemical and physical change?

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4. Explain how you determined the identity of your unknown.

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