

## Experiment 1

# Physical and Chemical Changes

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### Pre-lab Assignment

Before coming to lab:

- Read the lab thoroughly.
- Answer the pre-lab questions that appear at the end of this lab exercise.

### Purpose

In today's lab you will observe some physical and chemical changes. You will also use some physical properties to determine the identity of an unknown white powder.

### Background

In the first part of this experiment, you will become familiar with the difference between a chemical change and a physical change. Physical changes do not cause a change in chemical composition, but only a change in appearance. For example, when a substance changes from a solid to a liquid as when ice melts and forms liquid water, it is a physical change. Mixing salt and water would also be a physical change since no new compound has formed. Chemical changes describe when a substance reacts and changes into another substance with a different chemical composition. The new substance would also have new properties.

Evidence that a chemical change is taking place includes:

- a. A color change
- b. A solid product (a precipitate) is formed when two solutions are mixed.
- c. A gas is formed when two solutions are mixed.
- d. Energy such as heat, light or electricity is produced.

In the second part of the experiment, you will observe the properties of several substances and use your observations to identify an unknown white powder. A substance's properties can either be classified as physical properties or chemical properties. Physical properties can be observed without changing the chemical composition of the substance. Common physical properties 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. Chemical properties describe how one substance interacts with another substance. Examples would include that gasoline is flammable (gasoline is reacting with oxygen in the air) or that zinc reacts with acids to form hydrogen gas.

## 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.

### Waste

Place all waste in waste container in the fume hood unless otherwise directed.

### Part A Classifying Physical and Chemical Change:

For the following, record your observations, and decide if the change is chemical or physical.

1. Obtain about 2 ml of 0.1 M Copper (II) sulfate ( $\text{CuSO}_4$ ) solution from the reagent bench. Put it into a small test tube. Add about 2 ml of 0.1 M sodium hydroxide (NaOH) solution and mix them together in the test tube with your stirring rod.

Observation: \_\_\_\_\_

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

2. In a small beaker obtain about 10 ml of milk 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: \_\_\_\_\_

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

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

3. In a small test tube, add about 1 mL of water and about 1 mL of hexane. Stopper the test tube and shake gently a few times.

Observation: \_\_\_\_\_

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

4. In a small test tube about 1 mL of 3.0 M HCl and about 1 ML of 3.0 M NaOH.

Observation: \_\_\_\_\_

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

5a. Add a pea size amount of NaCl (Sodium Chloride) to small test tube. Add 1 mL of water and stir.

Observation: \_\_\_\_\_

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

b.. Add 5 drops of 0.1 M Silver nitrate ( $\text{AgNO}_3$ ) to the mixture that you just made in the previous step.

Observation: \_\_\_\_\_

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

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

On 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. Based on your observations, make a guess as to the identity of your known.
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. (To keep track of your samples, write the name of each substance on a paper towel in the order it is placed in your spot plate, and place this paper towel next to the spot plate.)
  - a. Into the first row of wells of the different substances, add about 1 ml (20 drops) of de-ionized water using your plastic dropper.. Mix each sample gently with a glass stirring rod. 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.
3. In the other row of wells containing the solid samples, add 3 drops of dilute acetic acid (vinegar) and record any evidence of change in table 1.
4. Cover a large piece of 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 burner 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.

Name \_\_\_\_\_

Unknown number: \_\_\_\_\_

Hypothesis (Initial guess as to the identity of the unknown before performing tests):

\_\_\_\_\_

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

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

**Based on your observations in the above table, identify the unknown** \_\_\_\_\_

## Post Lab questions

1. Are the following chemical changes or physical changes?

- a. lead melting
- b. a wooden log burning
- c. a glass bottle breaking
- d. food spoiling
- e. a lead weight sinking to the bottom of a bottle of water
- f. gasoline being distilled from crude petroleum

2. If you need to measure out about 1 mL of a liquid, what is a convenient, rough estimate of this volume?

**Name** \_\_\_\_\_

**Pre-lab Assignment for Physical and Chemical Changes**

1a. Define the term physical change.

b. Given two examples of physical changes

2a. Define the term chemical change.

b. Given two examples of chemical changes

3. What safety precautions should you take when doing this experiment?