

**SE 6.7B: The Properties of Matter****Concept Page for Teachers**

**Objective: (6.7B) Classify substances by their physical and chemical properties.**

**Scientific question:** How can physical and chemical characteristics be used to classify substances?



**Background information:** Physical and chemical properties are two important characteristics that allow scientists to study and classify matter. By knowing these properties, one can deduce new information from other materials or determine identities of unknown substances. This will be the focus of this lab.

**Physical properties** are characteristics of matter that are observed without permanently altering the condition of the substance. These can include: color, texture, **density**, mass, volume, odor, luster, hardness, **conductivity** of heat or electricity, and so on. **Chemical properties** are only observed as a result of performing a chemical reaction or permanently altering the substance so that it cannot usually return to its original conditions. An example of this would be **flammability**. If something is flammable, then it can be set on fire. However, if this were done to a substance then the original conditions of the substance would no longer be present. This is true for any chemical change since a new substance is always produced. Other examples of chemical properties include: **oxidation**, gas forming, solid forming, produced heat or absorbs heat and color changing.

**Points to clarify with students:** In this lab students will be exploring the physical and chemical properties of common household substances. Then they will use their observations to determine the identities of some unknown substances. It is important to stress the importance of careful and detailed observations of the substances, because it is by comparing this information to the observations of the unknowns that their identity will be determined.

**Vocabulary: physical property, chemical property, luster, conductivity, flammability, oxidation**

**physical property** – characteristics of matter that are observed without permanently altering the condition of the substance

**chemical property** – only observed as a result of performing a chemical reaction or permanently altering the substance so that it cannot usually return to its original conditions

**luster** – shininess of a material

**conductivity** – ability of the substance to allow either heat or electricity to pass through it easily

**flammability** – the ease to which a substance can be set on fire

**oxidation** – reacting with oxygen to form rust or tarnishing on metals



**Materials list:** Safety glasses, small plastic containers or paper cups, wax paper, toothpicks, baking powder, white flour, cornstarch, baby powder, baking soda, vinegar, water, pipettes or eye droppers, paper, pencil or pen

**Classroom set-up:** Bring in an unmarked clear container of one of the solid substances in this lab for a visual aid. Place a small amount of each solid in a plastic container or paper cup, 1 set per group. Be sure the materials are organized in a way that allows the groups to have one container or cup of each of the substances.

**Classroom introduction for students:** A strange thing happened today. I was preparing your lab, and forgot to mark my container. As a result I cannot remember what is in this container. I need your help to identify it. The only thing I can be certain of is that it will be safe to experiment with this, because I know it is one of these substances: baking powder, white flour, cornstarch, baby powder, or baking soda. Today we are going to come up with an experiment to determine the identity of this substance.

**Procedure:** Divide students into groups of 3 to 4 each and have them put on their safety glasses. Require the students to pick up their materials: several small plastic containers or paper cups, wax paper, toothpicks, baking powder, white flour, cornstarch, baby powder, baking soda, vinegar, and water. Have the students follow the steps outlined below.

Determine the physical properties of the substances by placing a small amount of each solid substance on one area of the waxed paper. Make sure to mark the identity of the substance so as to prevent confusion. Make observations about the substances' color and appearance on your paper.

Determine the chemical properties of the substances by adding several drops of water to each solid substance. Record all observations on your paper. Test the solid substances again with the vinegar. Make sure to use new samples for each test and do not combine samples in a test.

Now test a small amount of the unknown sample that the teacher has provided, using the same methods that you used to test the other solid samples. Use your observations about these solids to help you determine the identity of the unknown. Record your observations on your own paper.

**Extension:** Prepare mystery samples by mixing equal amounts of each powder listed in this lab. Ask the students to devise a way to determine the identity of the substances in a mixture of three known solids. Allow students to test their method with any combination of solid samples.

Name \_\_\_\_\_

Date \_\_\_\_\_

### The Properties of Matter

**Objective: (6.7B) Classify substances by their physical and chemical properties.**

**Scientific Question:** How can physical and chemical characteristics be used to classify substances?

**Equipment & materials:** Safety glasses, small plastic containers or paper cups, wax paper, toothpicks, baking powder, white flour, cornstarch, baby powder, baking soda, pipettes or eye droppers, vinegar, water, paper, pencil or pen

**Procedure:** Use the following instructions to determine the identity of an unknown solid by studying physical and chemical properties.

Determine the physical properties of the substances by placing a small amount of each solid substance on one area of the waxed paper. Make sure to mark the identity of the substance so as to prevent confusion. Make observations about the substances' color and appearance on your own paper.

Determine the chemical properties of the substances by adding several drops of water to each solid substance. Record all observations on your paper. Test the solid substances again with vinegar. Make sure to use new samples for each test and not combine your samples in a test. Now test a small amount of the unknown sample the teacher has provided, following the same steps you used to test the other solid samples. Use your observations about these solids to help you determine the identity of the unknown. Record your observations on your paper.

**Observations:** Record observations over the duration of the experiment on your own paper.

**Conclusion:** At the end of the experiment, my group learned that the identity of the unknown solid is \_\_\_\_\_. I used the following characteristics to prove the identity:

\_\_\_\_\_

\_\_\_\_\_

The Student Expectation we studied today was \_\_\_\_\_

\_\_\_\_\_