

Julianne Higgs
Brenda Patterson
Spring 2004

Unit: Investigating Chemical and Physical Changes

Introduction Lesson: Magic Powders

Abstract: During this introductory lesson, the students will be introduced to physical and chemical changes by looking at how different powders react to a variety of substances (i.e. vinegar, iodine, water). Students will learn through observing and investigating. Students will need to be able to identify the difference between physical and chemical change on a mystery powder.

Grade Level: 5th Grade

Utah Elementary Core Curriculum Standards:

Topic: Physical and Chemical Change

Standard 1: Students will understand that chemical and physical changes occur in matter.

Objective 2: Evaluate evidence that indicates a physical change has occurred.

- Compare changes in substances that indicate a physical change has occurred.
- Describe the appearance of a substance before and after a physical change.

Objective 3: Investigate evidence for changes in matter that occur during a chemical reaction.

- Identify observable evidence of a chemical reaction (e.g., color change, heat or light given off, heat absorbed, gas given off).
- Compare a physical change to a chemical change.
- Hypothesize how changing one of the materials in a chemical reaction will change the results.

In Class Instructional Time: 60 minutes

Terminology:

Chemical Change - The composition of the matter changes and the new kinds of matter have different properties from the old matter. Evidence of a chemical change may include production or use of energy such as heat or light, the new production of a gas or solid, or a change in color.

Physical Change – The appearance of matter changes, but composition of the matter does not change.

Chemical Reaction - A process in which one or more substances are changed chemically into a different substance.

Iodine - a nonmetallic halogen element obtained usually as heavy shining blackish gray crystals and used especially in medicine, photography, and analysis.

Learning Outcomes:

- Students will make observations, collect, record, and analyze data.
- Students will draw inferences and discover evidence of chemical and physical change.
- To investigate some characteristics of chemical change and physical change.
- To learn that a chemical reaction occurs when two reactants combine to form a new product.
- To learn that color change is an indicator of chemical change.

Background:

A physical change occurs when the appearance of matter changes, but composition of the matter does not change. Changes in size, shape, color, odor, hardness, or in state such as gas, liquid, or solid are all considered physical changes.

A chemical change occurs when new kinds of matter are formed. The composition of the matter changes and the new kinds of matter have different properties from the old matter. Evidence of a chemical change may include production or use of energy such as heat or light, the new production of a gas or solid, or a change in color.

The five mystery powders in this activity have different physical properties, even though they are all white. Also, they will have different chemical reactions. Some will not react at all with the tested substance, only creating a physical change (wetting). Others will produce obvious chemical reactions.

The following changes and reactions can be expected in this activity:

1. Baking soda fizzes with vinegar (chemical reaction).
2. Cornstarch turns black with iodine (chemical reaction).
3. Plaster of Paris turns hard and warm with water (warm: chemical reaction; hard: physical change).
4. Sugar turns brown, then black with heat (chemical reaction).
5. Salt tastes salty; sugar, sweet (physical change).
6. Sugar and salt dissolve in water (physical change).
7. Iodine changes powders to its own color, but not a new one (physical change).

In this lesson, five powders and five tests are provided for students to explore chemical and physical properties, changes, and reactions.

Materials:

For the Student: (Groups of 5)

- Hand lens
- small microscope or other viewer
- 5 mystery powders, about 1 tablespoon of each, in paper cups or zip- lock baggies labeled A, B, C, D, and E.
- Baking soda
- Cornstarch
- Plaster of Paris
- Sugar
- Salt
- 3 substances in jars with lids (One or two drops of each liquid will be mixed with each powder)
- Iodine liquid (Can be purchased at a drug store)
- Water
- Vinegar
- Heat source (votive candle is good)
- 1 metal lid without a plastic liner (such as the lid from a soup can)
- 1 clothespin
- 3 eye droppers
- 5 sheets of aluminum foil
- 'Mystery Powders' directions and recording sheet for each student

NOTE: Cafeteria trays or ice cream buckets provide an excellent way of passing out complete lab setups to each group.

Assessment of Prior Knowledge:

A K-W-L will be used throughout the lesson to assess the students' prior knowledge and growing knowledge of chemical and physical change. Students will be given a K-W-L sheet at the beginning of the lesson and, as a class, will discuss what they already **Know** and write down what they **Want** to know. As the students are doing the activity, the teacher will look at the things they want to know and address these questions during the class discussion at the end of the lesson. To conclude the lesson, students will fill out the portion of what they **Learned** from doing this investigation. The K-W-L helps guide teacher instruction and keep students on track.

Instructional Procedures:

Step 1: Read the book Changing Materials by Robert Snedden. This will introduce your students to how materials change both physically and chemically. After reading the book, discuss the difference between chemical and physical changes.

Step 2: Divide the students into groups of 5. Explain that two observations will be made in these experiments.

Step 3: Each group should have a copy of the directions and the recording sheet. [See attached Mystery Powders Lab Directions and Recording Sheet.] Before giving students directions, remind them about care in experimenting. Introduce them to the iodine substance and talk about why it's important to use the substance carefully (it stains clothing). Remind them to never taste unknown substances.

Step 4: Allow students to conduct their investigations using the 'Directions for Mystery Powders' sheet [see attached].

Step 5: When all students are finished, explain the difference between physical and chemical change. Have the class identify, based on their observations, their results as being either physical or chemical changes.

Step 6: After group comparison of results, provide each group with a mystery sample and see if they can identify where physical and chemical changes occur as they explore how the variety of powders react to their sample.

Assessment Strategies:

Step four may be used as an assessment. The students will be assessed on the following criteria:

- Students used their knowledge about physical and chemical change to infer what the mystery powder was.
- Students cooperated with their groups.
- Students correctly identified physical and chemical changes that occurred in their sample.

Show the children sugar and Kool-Aid. Instruct them to describe the physical properties they observe. Mix the two. Ask them to identify it as a physical or chemical change. Instruct them to justify their answer. Show students vinegar and baking soda. Instruct them to describe the physical properties. Mix the two. Tell them to identify the result as a physical or chemical change. Instruct them to justify their answer.

Reference: <http://www.uen.org/Lessonplan/preview?LPid=2176>

Author: Utah LessonPlans, Kirstin Reed

Created: August 23, 2002

DIRECTIONS FOR MYSTERY POWDERS

NAME

DATE

- Each student will conduct one experiment with each of the five mystery powders.
- Determine which student will conduct each experiment.
- Each student will place a small amount of each mystery powder, about 1/4 teaspoon, in each of five locations on the aluminum foil.
- Label each powder by letter.
- Describe the physical properties of each powder and record data on worksheet.
- One at a time, testers will conduct their experiment. All members of the group should watch each test and record the results.

- Experiment 1: Place 1-2 drop of iodine on each powder. Note any color changes. (Is the powder now a different color than the original color of the iodine?)

- Experiment 2: Place 1-2 drops of water on each powder. Note any changes.

- Experiment 3: Place 1-2 drops of vinegar on each powder. Note any changes.

- Experiment 4: Taste a small amount of each powder. Note: These powders are safe to test; iodine is not safe. Taste only powders.

- Experiment 5: Heat each powder. This can be done by putting a small sample on 5 different areas of a metal lid. Label each powder. Hold the lid with a clothespin over a lighted votive candle. Carefully note any changes.

- All members of team should record results on the worksheet.

MYSTERY POWDERS RECORDING SHEET

Names _____

1. Describe the physical properties of each powder in the A, B, C, D, and E boxes.
2. Describe the reaction in the appropriate box.
3. In each box, identify the reaction as a PHYSICAL or CHEMICAL change.

POWDER	#1 iodine	#2 water	#3 vinegar	#4 taste	#5 heat	What is it?
A						
B						
C						
D						
E						

Julianne Higgs
Brenda Patterson
Spring 2004

How Does Bird Excrement (Poop) Affect a Variety of Water Samples?

Abstract: Students will hypothesize about what will happen when bird poop is added to samples of water from the Great Salt Lake, a pond, and fresh drinking water. They will record the temperature, salinity level, pH level, and color of each water sample prior to adding the bird poop. They will then observe and record daily what occurs within each of these areas during their experiment. Students will conclude and present their findings of what chemical and physical changes occurred during the experiment to the class.

Grade Level: 5th Grade

Utah Elementary Core Curriculum Standards:

Topic: Physical and Chemical Change

Standard 1: Students will understand that chemical and physical changes occur in matter.

Objective 2: Evaluate evidence that indicates a physical change has occurred.

- Compare changes in substances that indicate a physical change has occurred.
- Describe the appearance of a substance before and after a physical change.

Objective 3: Investigate evidence for changes in matter that occur during a chemical reaction.

- Identify observable evidence of a chemical reaction (e.g., color change, heat or light given off, heat absorbed, gas given off).
- Hypothesize how changing one of the materials in a chemical reaction will change the results.

In Class Instructional Time: 30 minutes; in addition, 5 minute daily observation sessions

Terminology:

Chemical Change - The composition of the matter changes and the new kinds of matter have different properties from the old matter. Evidence of a chemical change may include production or use of energy such as heat or light, the new production of a gas or solid, or a change in color.

Physical Change – The appearance of matter changes, but composition of the matter does not change.

Chemical Reaction - A process in which one or more substances are changed chemically into one or more different substances.

Salinity – The amount of salt contained in a sample of water.

pH - A measure of acidity and alkalinity of a solution that is a number on a scale on which a value of 7 represents neutrality and lower numbers indicate increasing acidity and higher numbers increasing alkalinity and on which each unit of change represents a tenfold change in acidity or alkalinity and that is the negative logarithm of the effective hydrogen-ion concentration or hydrogen-ion activity in gram equivalents per liter of the solution.

Intended Learning Outcomes:

- Students will make observations, collect, record, and analyze data.
- Students will draw inferences and discover evidence of chemical and physical change.
- To investigate some characteristics of chemical change and physical change.
- To learn that color change is an indicator of chemical change.

Background:

A physical change occurs when the appearance of matter changes, but composition of the matter does not change. Changes in size, shape, color, odor, hardness, or in state such as gas, liquid, or solid are all considered physical changes.

A chemical change occurs when new kinds of matter are formed. The composition of the matter changes and the new kinds of matter have different properties from the old matter. Evidence of a chemical change may include production or use of energy such as heat or light, the new production of a gas or solid, or a change in color.

Bird excrement is a solid composed of predominantly uric acid. It reacts with water to create both a physical and chemical change in the water. When bird poop is introduced to fresh water as well as salt water samples, it increases the salinity and pH of the water and also causes the water to change in color, demonstrating both chemical and physical changes. These changes occur over time and can be observed and recorded.

Materials:

- Three jars
- Water samples from Great Salt Lake, a pond, and fresh drinking water
- Spoons
- Bird excrement
- Salinity meter
- Thermometer
- pH tester
- Paper towels
- Scale
- Measuring cups
- Recording sheet (see attached)

Assessment of Prior Knowledge:

A K-W-L will be used throughout the lesson to assess the students' prior knowledge and growing knowledge of chemical and physical change. Students will be given a K-W-L sheet at the beginning of the lesson (different from the one in the introductory lesson) and, as a class, will discuss what they already **Know**. Throughout the time of experiment (including observation sessions), the students will record things they **Want** to know and the teacher will address these questions as they are asked. To conclude the lesson, students will fill out the portion of what they **Learned** from doing this investigation.

Instructional Procedures:

Step 1: Ask students what they remember about the book and the magic powders activity in the introductory lesson. Discuss what they learned from that lesson about physical and chemical changes. Explain to students that they will be continuing to investigate the properties of physical and chemical change by putting bird poop into different water samples and looking at how the bird poop affects the water.

Step 2: Have students write a hypothesis about what will happen when the bird poop is added to each water sample and give their reasoning why they think this. (i.e. "I think the bird poop will affect the water by.....because.....")

Step 3: Model to the class how they will be setting up their experiment and how to use the salinity meter as well as the thermometer and pH tester. Discuss what salinity and pH are and why they are important to identifying a change in the water and analyzing results. Make clear what kind of behavior is expected during the investigation.

Step 4: Divide students into groups of three or four.

Step 5: Provide groups with all needed materials, including attached recording sheet, and instruct them on how to set up the experiment.

- Measure out equal amounts of water from each sample into separate jars.
- Using the thermometer, take the temperature of each water sample and record.
- Using the salinity meter, test the salinity of each water sample and record.
- Using the pH tester, test the pH of each water sample and record.
- Observe the color of each water sample and record your observations.
- Using the scale, measure equal amount of bird poop (one for each sample).
- Add the bird poop to the water samples and place all jars in a place away from direct sunlight, heat, or cold.

Step 6: Observe water samples daily for one week. Test the temperature, salinity, and pH of each sample daily. In addition, observe the color of the water daily. Record results in all areas on the recording sheet.

Step 7: After one week, have students share and compare their results with the rest of the class. Have a class discussion on how their samples changed both physically and chemically and identify specific changes in each sample.

Assessment Strategies:

Students will be assessed on the following criteria:

- Students cooperated with their groups.
- Students recorded daily observations in each area on their recording sheet.
- Students correctly identified physical and chemical changes that occurred in their samples.
- Students presented their results to the class in a professional manner.

Reference: Julianne Higgs and Brenda Patterson

Physical and Chemical Changes

Recording Sheet

DAY 1

	Temperature	Salinity	pH	Color
Great Salt Lake water				
Pond water				
Fresh drinking water				

DAY 2

	Temperature	Salinity	pH	Color
Great Salt Lake water				
Pond water				
Fresh drinking water				

DAY 3

	Temperature	Salinity	pH	Color
Great Salt Lake water				
Pond water				
Fresh drinking water				

DAY 4

	Temperature	Salinity	pH	Color
Great Salt Lake water				
Pond water				
Fresh drinking water				

DAY 5

	Temperature	Salinity	pH	Color
Great Salt Lake water				
Pond water				
Fresh drinking water				

DAY 6

	Temperature	Salinity	pH	Color
Great Salt Lake water				
Pond water				
Fresh drinking water				

DAY 7

	Temperature	Salinity	pH	Color
Great Salt Lake water				
Pond water				
Fresh drinking water				