Lab: Chemical and Physical Changes

FOR THE TEACHER

Summary
In this lab, students will observe and analyze a number of examples in order to determine if a chemical or physical change occurred.

Grade Level
High or Middle School

NGSS Alignment
This activity will help prepare your students to meet the performance expectations in the following standards:

- **MS-PS1-2**: Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

- **Scientific and Engineering Practices**:
  - Analyzing and Interpreting Data
  - Engaging in Argument from Evidence

Objectives
By the end of this lab, students should be able to

- Understand vocabulary related to chemistry.
- Identify whether a physical or chemical change has occurred.
- Provide evidence supporting which change has occurred.

Chemistry Topics
This lab supports students understanding of

- evidence of a chemical reaction
- mixtures
- physical changes
- chemical changes
- states of matter

Time
**Teacher Preparation**: 1 hour
**Lesson**: 30-50 minutes

Materials
- AgNO₃ solution (0.1M)
- Alka-Seltzer tablets
- Aluminum foil
- Antacid
- Baggies
- Baking soda
- Beakers
- CaCl₂
- CaCO₃
- Copper wool
- HCl solution (1.0M)
- KCl
- Kool Aide powder
- Whole Milk
- Mini candy bar
- Purple Cabbage juice
- Sugar cubes
- H₂SO₄ solution (6.0M)
- Vinegar
- Water
- Zinc
- Ice cubes
- Matches
- Paper
- Dixie cups
- Eyedropper
- Test tubes and rack
- Measuring Spoons (1 tsp)
- Hot Plate

- Hammer
- Plastic spoons
- Petri Dish
- Disposable gloves

Safety
- Always wear safety goggles when handling chemicals in the lab.
- When working with acids, if any solution gets on students’ skin, they should immediately alert you and thoroughly flush their skin with water.
- Students should wash their hands thoroughly before leaving the lab.
- When students complete the lab, instruct them how to clean up their materials and dispose of any chemicals.

Teacher Notes
- For a smooth rotation during this activity:
  - Each station will have a numbered notecard/printout with directions.
  - Students may work individually or in pairs.
  - Students will begin at a station and rotate clockwise until each station has been completed.
  - Some stations may not be suitable for middle school students.
  - Choose as many stations as time allows for your classroom.
  - After the activity, discuss each station with the class.

- Set up each of the following stations and provide a numbered file card or print out with student instructions for each:

1. Alka-Seltzer tablets and Dixie cups of water:
   Instructions: drop tablet into cup of water.
   Clean-up: pour liquid down the sink and place the cup in the trash can.

2. Crushed ice, beaker and warming plate:
   Instructions: Place a small amount of ice in a beaker. Place the beaker on warming plate and heat for 3-5 minutes.
   Clean-up: Pour down the sink and return the beaker to the station.

3. Sugar cube in baggie, hammer:
   Instructions: Strike the sugar cube several times.
   Clean-up: Place baggie in trash can.

4. 1 tsp calcium carbonate in Dixie cup and beaker of vinegar with eyedropper:
   Instructions: Add 1-2 droppers of vinegar to powder in the cup
   Clean up: Rinse contents of cup into sink. Place cup in the trash can.

5. Purple cabbage juice in a Dixie cup, baking soda and plastic spoon:
   (Purple cabbage juice can be made by boiling a few leaves of cabbage. Remove leaves and boil juice to further concentrate.)
   Instructions: Sprinkle baking soda into juice in the cup.
   Clean up: Pour contents of cup down the sink. Throw the cup in the trash can.

6. Spoonful of Kool Aide powder in Dixie cup, plastic spoon and beaker of water:
   Instructions: Pour water into cup filling half way. Stir with spoon.
   Clean up: Pour contents into sink. Throw cup into trash can.
7. Sugar cube in petri dish, eyedropper and 6M sulfuric acid (Disposable gloves should be available for student use at this station):
   Instructions: Carefully drop one drop of acid on the sugar cube. WARNING strong acid!
   Clean up: Place petri dish and contents into receptacle provided. Wash your hands thoroughly.
   (Teacher may need to neutralize residual acid before disposal)

8. Matches:
   Instructions: strike match and then blow out.
   Clean up: run match under water and throw into trash can.

9. Paper:
   Instructions: Tear paper into small pieces.
   Clean up: Place paper pieces into the trash can.

10. 1M HCl, piece of zinc in test tube and dropper:
    Instructions: Carefully use the dropper to dispense a small amount of acid into test tube.
    Clean up: Pour contents into container provided.
    (Teacher will need to neutralize the acid before disposal. Remaining zinc may be rinsed and placed in the trash)

11. Aluminum foil:
    Instructions: Take a piece of foil and make into a ball.
    Clean up: Place foil into trash can.

12. Test tube containing small piece of copper wool, silver chloride solution. (Copper wool can be found in most grocery stores):
    Instructions: Use a dropper to add a small amount of silver chloride solution to the test tube.
    Clean up: Pour contents into receptacle provided.
    (Teacher will need to flush remaining wool with water and filter from mixture. Place solid in the trash.)

13. Ziploc baggie with 1 tsp CaCl₂, beaker of water:
    Instructions: Add small amount of water to baggie and seal. Mix by kneading the baggie with your fingers.
    Clean up: Pour liquid down the sink and throw away the Ziploc baggie.

14. Test tube filled ¼ of the way with silver nitrate solution, salt:
    Instructions: Add a small amount of salt to test tube and swirl.
    Clean up: Pour contents down the sink. Rinse the test tube and return to the empty test tube rack.

15. Whole milk in Dixie cup, dropper and beaker of vinegar:
    Instructions: Add 1-2 droppers filled with vinegar to the milk.
    Clean up: Pour contents down the sink and throw the cup in the trash can.

16. Optional (Not to be done in the lab setting!): After students complete clean-up and have washed, return to desks in classroom. Provide each student with a mini candy bar. Have them eat it and describe whether a physical or chemical reaction occurs.
FOR THE STUDENT
Lesson

Identifying Physical and Chemical Changes

Background
Every day of our lives, we are surrounded by chemical and physical changes. Rivers flow downstream causing erosion along the banks. Acid rain causes metal buildings to corrode. Scientists study the effects of these changes and find ways to prevent more damage from occurring. Usually a physical change will result in a change in state of matter, size or shape. There may also be a mixture formed. When a chemical change occurs, there may be fizzing/bubbling observed as a gas is formed. You may observe a change in color, odor or temperature. Light may be given off, ash may form or there may be a precipitate. A change in color such as painting a house is not a chemical change. In this lab, you will learn to recognize whether a physical or chemical change has occurred. In the provided data table, you will record observations that will help you decide which type of change has occurred. After analyzing your data, you will determine if there is evidence for a physical or chemical change. Remember that when a chemical change occurs, a new substance must be formed.

Prelab Questions
Define the following terms:

1. State of matter:
2. Pure substance:
3. Mixture:
4. Physical change:
5. Chemical change:

Objective
Determine what type of change has occurred after performing the task at each station.

Safety
- Always wear safety goggles when handling chemicals in the lab.
- Wash your hands thoroughly before leaving the lab.
- Follow instructions for clean-up of your materials and disposal of any chemicals.
- When working with acids and bases, if any solution gets on your skin immediately rinse the area with water.
- Food in the lab should be considered a chemical not for consumption.

Procedure
1. Put on your goggles and lab apron.
2. Begin at the station assigned to you by your teacher.
3. Follow the instructions at each station.
4. Write down your observations being sure to record the station number.
5. Decide whether a physical or chemical change has occurred and indicate observations that support your conclusion.

6. Once a station is complete, move clockwise to the next station until all activities are complete.

**Data**

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<th>Station Number</th>
<th>Activity Description</th>
<th>Observations</th>
<th>Physical or Chemical Change?</th>
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**Analysis**

1. Did you have difficulty classifying the type of change at any station? Indicate the specific station and why you had difficulty.

2. List three possible observations that indicated a chemical change has occurred.

3. Was there an instance where a color change did not indicate a chemical change? Use an example to support your answer.

4. Give an example of a physical change and a chemical change that you observe in your daily life: