

# Investigation Seven – Comparing Physical and Chemical Changes

<b>Standard I</b> Students will understand that chemical and physical changes occur in matter.
<b>Objective 2</b> Evaluate evidence that indicates a physical change has occurred.
<b>Objective 3</b> Investigate evidence for changes in matter that occur during a chemical reaction.
<b>Intended Learning Outcomes</b> <ol style="list-style-type: none"><li>1. Use science process and thinking skills.</li><li>2. Manifest scientific attitudes and interests.</li><li>3. Understand science concepts and principles.</li><li>4. Communicate effectively using science language and reasoning.</li></ol>

**Standard I**

Objective 2

Objective 3

## Background Information

Physical changes and chemical reactions are taking place all around us and all the time. This activity will challenge students to identify some of those physical changes and chemical reactions and share what they discover with the class. Conduct this activity at the end of this unit when your students have a good understanding of physical changes and chemical reactions. You can use this activity as an assessment of students' understanding of physical changes and chemical reactions.

### *Activity One: Physical Changes*

#### Pre-Assessment/Invitation to Learn

Challenge the class to name as many types of physical changes as they can, and list their responses on the board. The list may include the following: cutting, sawing, sanding, breaking, denting, squeezing, stretching, snapping, soiling, dying, heating, cooling, expanding, contracting, melting, freezing, boiling, evaporating, condensing, mixing, dissolving, soaking, drying, etc.

#### Instructional Procedure

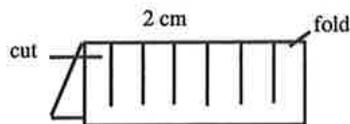
1. Pass out scissors and a 8 ½ X 11 sheet of paper.
2. Begin by showing the class the paper and scissors telling them they are going to cut a hole in the paper large enough for you to walk through.

#### Materials

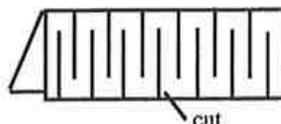
For each student:

- One sheet of 8 ½ x 11 paper
- Scissors

- Instruct the students to fold the paper in half and make a series of straight cuts from the folded side about 2 cm apart. Stop about 1 cm from the opposite edge of the paper.



- Now make cuts starting from the other side of the paper and ending about 1 cm from the opposite edge of the paper.



- Next cut off all the folded ends except for the first and last strip at each end of the paper.
- Carefully open the paper. Have them walk through the hole.
- Ask the class to describe the physical properties of the paper before and after the hole was cut in it. Was the paper changed chemically or physically? (*Physically. Only the physical properties of the paper were changed; no new substances were formed by cutting the paper.*) Adapted from: Invitations to Science Inquiry by Tik L. Liem

## ***Activity Two: Chemical Changes***

### **Pre-assessment/Invitation to Learn**

Challenge the class to name the indicators of a chemical reaction, and list their responses on the board. The list should include: production of a gas, change of temperature, formation of a new substance, production of a solid, production of light, and change of color. Also have students list examples of chemical changes such as: burning paper, a rusting can, baking cookies, boiling an egg, mixing vinegar and baking soda, etc.

### **Instructional Procedure**

#### **Materials**

For each team:

- Piece of steel wool
- Vinegar
- Glass pop bottle
- Balloon
- Water

#### **Wooly Wonder and the Scientific Methods**

- Soak some steel wool in vinegar for about an hour before giving them to the students.
- Push a piece of steel wool that has been soaked in vinegar into a glass bottle. Put five drops of water into the bottle and stretch a balloon over the opening.
- Ask the class to suggest possible hypotheses to this question: What will happen to the balloon when the steel wool begins to rust? *Some possible hypotheses are: nothing will happen to the balloon, the balloon will inflate on top of the bottle, the balloon will turn inside out and inflate inside the bottle, the balloon will change colors, the balloon will inflate and pop, etc.*

4. Put the items on a table and let them sit for a day.
5. Observe the items and have students conclude which of the hypotheses was correct. *(The balloon turned inside out and inflated inside the bottle.)* Ask students to suggest reasons why this happened.

## Curriculum Extensions

### *Science –*

- To help students further understand phase changes, set out a piece of dry ice and have students observe it. Since dry ice (frozen carbon dioxide) sublimates, goes from a solid to a gas at room temperature, students will be able to watch it disappear. Have them describe the properties of the dry ice before and after it sublimates. How have the physical properties changed? *(Solid to a gas)*. Have any new substances been created? *(No, just a phase change)* How could the carbon dioxide be changed back into a solid again? *(Getting it cold enough)* (ILO 1)
- Complete the Chemical Reaction Physical Change student sheet found on page 29. (ILO 3)

### *Language Arts –*

- With the Venn Diagram found on page 31 list the similarities and differences of physical and chemical changes. *(Standard VII, Objective 3)*

## Assessment Suggestions

- Look over the students' work from activities one and two for correctness and understanding.
- Discuss or assess the student worksheets provided in the Curriculum Extensions.

References to Assessment Section:

Unit Test	Multiple Choice	Constructed Response	Performance Test
1	5, 6, 7, 8, 9, 10, 11, 12	3, 4	Testing for Physical Properties
2	3, 5, 6, 7, 8, 9, 10, 11	1, 2, 3, 4	Chemical Change Log Chemical or Physical

## Chemical Reaction Physical Change

Which of the following are examples of physical changes and chemical reactions that occur in daily life? Place a "P" by each example that shows a physical change. Place a "C" by each example that is a chemical change. Explain why after "P" or "C".

P = Physical Change  
C = Chemical Reaction

1. Making a Cake	
2. Rotting fruit or food spoiling	
3. Water evaporating into the atmosphere	
4. Soil Erosion	
5. Boiling an egg	
6. Butter melting in a pan	
7. Soda freezing in the freezer	
8. Making Bread	
9. Plants decaying	
10. Silver tarnishing	
11. Chocolate bar melting in the sun	
12. Chopping a block of wood in two pieces	
13. Burning wood	
14. Driving a nail in a board	
15. Digesting food	
16. Blowing up a balloon	
17. Popping popcorn	
18. Burning a candle	

## Answer Key to the Handout

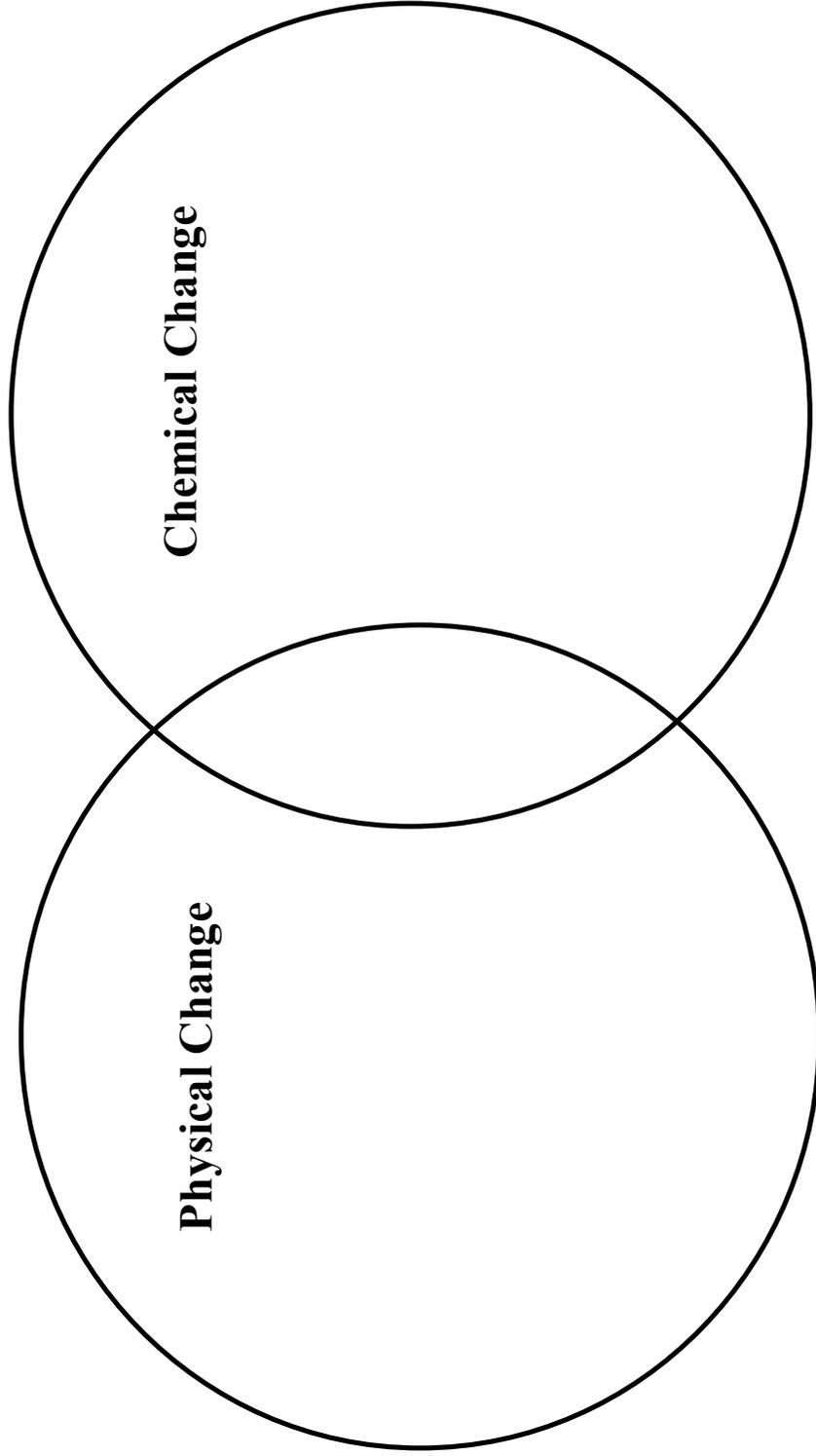
Which of the following are examples of physical changes and chemical reactions that occur in daily life? Place a “P” by each example that shows a physical change. Place a “C” by each example that is a chemical change. Explain why after “P” or “C”.

P = Physical Change  
C = Chemical Reaction

1. Making a Cake	C
2. Rotting fruit or food spoiling	C
3. Water evaporating into the atmosphere	P
4. Soil Erosion	P
5. Boiling an egg	C
6. Butter melting in a pan	P
7. Soda freezing in the freezer	P
8. Making Bread	C
9. Plants decaying	C
10. Silver tarnishing	C
11. Chocolate bar melting in the sun	P
12. Chopping a block of wood in two pieces	P
13. Burning wood	C
14. Driving a nail in a board	P
15. Digesting food	C
16. Blowing up a balloon	P
17. Popping popcorn	P
18. Burning a candle	C

Note: Popcorn is often a difficult one for students to identify correctly. The popcorn is only changing physically as it is popped. The hotplate or microwave is supply the heat, not the popcorn.

# Venn Diagram



## Resources

### *Websites –*

- <http://www.askjeaves.com>
- <http://www.strangematterexhibit.com/index/html>
- <http://www.bbc.co.uk/schools/revisewise/materials/index.html>

### *Videos –*

- Changes in Properties of Matter – Schlessinger Media, 2000.
- Behavior of Matter – Encyclopedia Britannica, 1982.
- Changes in Matter – Altschul Group Corporation, 1999.
- Properties of Matter – Schlessinger Media, 2000.

### *Books-*

- Bonnet, Bob, and Kan Keen. Science Fair Projects Chemistry. New York: Sterling Publishing Company, Inc. ISBN: 0-8069-7771.
- Fullick, Ann. Chemicals In Action. Chicago: Heinemann Library. ISBN: 0-157572776-5.
- Fried Hoffer, Bob. Science Lab in a Supermarket. New York: Grolier Publishing. ISBN: 0-531-11335-3.
- Gardner, Robert. Science Projects Ideas about Kitchen Chemistry. Berkley Heights, New Jersey: Enslow Publishing, Inc. ISBN: 0-7660-1760-0.
- Moje, Steven W. Cool Chemistry. New York: Sterling Publishing Company, Inc. ISBN: 0-8069-6349-2.
- Oxlade, Chris. Materials, Changes, and Reactions. Chicago: Heinemann Library. ISBN: 1-58810-197-5.