Activity: A Physical vs. Chemical Challenge

FOR THE TEACHER

Summary
In this activity, students will first complete a card sort to best categorize examples of change as physical or chemical change. Then they will compete in teams to identify whether given situations represent a physical change or a chemical change, or a physical or a chemical property.

Grade Level
Elementary School, Middle School, or High School

NGSS Alignment
This activity will help prepare your students to meet the performance expectations in the following standards:
- **5-PS1-3**: Make observations and measurements to identify materials based on their properties.
- **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

Objectives
By the end of this activity, students should be able to
- Determine and support if examples are physical or chemical properties.
- Determine and support if examples are physical or chemical changes.

Chemistry Topics
This activity supports students’ understanding of
- Physical Properties
- Chemical Properties
- Physical Changes
- Chemical Changes

Time
**Teacher Preparation:** 20 minutes
**Lesson:** 30 minutes

Materials
- 2 Fly-Swatters
- Student Sorting Cards (1 set per group)
- One set of Game Show Cards
- Following materials for Demo Clues
  - Ice Cube
  - Salt
  - Spoon
  - Water
  - 3 Clear cups or beakers
  - Rubbing alcohol
  - 2 Pie pans
  - Lighter
  - Effervescent tablet
Safety
- Always wear safety goggles when handling chemicals in the lab.
- 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.
- Always use caution around open flames. Keep flames away from flammable substances.
- Always be aware of an open flame. Do not reach over it, tie back hair, and secure loose clothing.
- Open flames can cause burns. Liquid wax is hot and can burn the skin.
- Exercise caution when using a heat source. Hot plates should be turned off and unplugged as soon as they are no longer needed.
- When lighting the match and wooden splint, be cautious with the flame.
- An operational fire extinguisher should be in the classroom.

Teacher Notes
- There are two different parts to this activity. Part 1, “Sorting Cards” can be used as an introduction to a lesson on physical and chemical changes. Part 2, is a Game Show review style team challenge of the concepts learned.

Sorting Cards:
- Print one set of sorting cards for each table group of students in your class. For example, I have nine tables of 3-4 students, so I print off nine sets of cards. The teacher can prepare the sorting cards by cutting them apart and putting them in envelopes to be distributed to teams or can have the teams cut them apart.
- Give teams 5-10 minutes to sort them into two piles: Physical Properties and Chemical Properties. After all teams have their cards sorted, go through cards as a class to see if students properly placed them.

<table>
<thead>
<tr>
<th>Physical Changes</th>
<th>Chemical Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ice Cube Melting</td>
<td>Mixing baking soda in vinegar</td>
</tr>
<tr>
<td>Shredding Paper</td>
<td>Battery powered toy</td>
</tr>
<tr>
<td>Mothballs Evaporating</td>
<td>Burn a cashew nut</td>
</tr>
<tr>
<td>Blowing up a balloon</td>
<td>Rusting steel wool</td>
</tr>
<tr>
<td>Dissolving salt in water</td>
<td>Burning wood</td>
</tr>
<tr>
<td>Sanding wood</td>
<td>Sour milk in a carton</td>
</tr>
<tr>
<td>Food coloring in water</td>
<td>Burning alcohol</td>
</tr>
<tr>
<td>Cutting up cloth</td>
<td>Polishing silver with cleaner</td>
</tr>
<tr>
<td>Sharpening a pencil</td>
<td>Eating peanut butter &amp; jelly</td>
</tr>
<tr>
<td>Mixing peanut butter &amp; jelly</td>
<td>Hand warmer</td>
</tr>
<tr>
<td>Condensation of water on glass</td>
<td>Leaves change color in the fall</td>
</tr>
<tr>
<td>Crumbling cookies</td>
<td>Plants making food by photosynthesis</td>
</tr>
<tr>
<td>Carving wood pieces</td>
<td></td>
</tr>
<tr>
<td>Boiling water</td>
<td></td>
</tr>
<tr>
<td>Melting butter</td>
<td></td>
</tr>
<tr>
<td>Melting wax</td>
<td></td>
</tr>
<tr>
<td>Solid air freshener</td>
<td></td>
</tr>
</tbody>
</table>
- Dehydrate food
- Puddles drying up
- Breaking glass
- Freezing ice cream
- Water boiling at 100 °C
- Sponge growing in water
- Making snow balls
- Dry ice evaporating
- Diamonds cutting glass

**Game Show Review:**
- Print one set of the clue cards on cardstock or paste on cardstock. This is a great review after concepts have been introduced and can be used in a variety of ways. Some suggestions and variations are:
  - Students sit (or stand depending on height of table) face to face across from each other with flyswatters perpendicular to the table. Put an “X” or sticker on the table beforehand. When the clue is read by the teacher, the student who smacks the “X” first gets to answer the question for their team. If they answer incorrectly, then the other person gets to try. The flyswatters are a fun way to simulate buzzers and keeps things light-hearted.
  - Points are awarded for correct answers. The teacher can award a point for the correct answer and an additional point when students can support their answer choice. (Additional point is an optional modification to game)
- **Options for Choosing Teams:** Deciding teams can be a challenge. Sometimes it is hard to get everyone to participate and the same students want to keep coming up to play. But here are some options:
  - Boys vs. Girls
  - One side of room vs. Other side
  - Two different colored slips of paper that are numbered 1 through 15 (if you have 30 students) randomly distributed to students. The color represents the team, the number represents the contestant number and who they are competing against. This is MY favorite method that ensures everyone participates.
  - Prizes can be awarded to winning teams, but I like to have students put their names on their color-number slips of paper and do drawings at the end for prizes.
- **Preparation for the Demo Clues:** Put demo materials behind a cardboard barrier so students can’t see what is being prepared, then reveal the clue to students in a fun-surprising manner. I like to remain silent during demos to allow students to process what is going on.
  - Ice Cube Melts: Just hold an ice cube in your hand as it melts and say nothing!
  - Salt dissolve in water: Say nothing as you pour some salt in a cup of water and stir it.
  - A substance burns: Light a match, or light a butane/handheld lighter.
  - Effervescent Tablet: Drop tablet into clear cup with water and say nothing.
  - Baking soda & vinegar: Pour a small amount of vinegar to some baking soda already put in a cup.
  - Crumpling a paper: With all the dramatics and flare that a teacher can provide, crumple a piece of paper!
  - Magnet and paper clips: Put some paper clips on the table where the contestants are sitting and pick them up using a magnet.
• Sharpening a pencil: I like silently using a hand-held sharpener with intense and deliberate concentration.

Discussion: Many of these clues spark some clarifying discussions with students. Use this opportunity to clear up misunderstandings.

• Optional: Have students complete an Exit Ticket (Ex: 3-2-1: Three examples of physical changes, two examples of chemical changes, one question you still have.) Or have students explain when a change occurs, how they know if it is a physical change or chemical change.

FOR THE STUDENT

Lesson

Physical or Chemical Changes

Background
A physical change only changes the shape or form of a substance. During a chemical change, the original substance is changed into something new.

Objective
As a group categorize the examples written on cards in the most appropriate category. Which examples represent physical changes? Which represent chemical changes?

Procedure
1. Cut the cards apart.
2. As a group, sort them into two piles:
   a. Physical Changes
   b. Chemical Changes

Results
Share your results with your class, and record your results below:

<table>
<thead>
<tr>
<th>Examples of Physical Changes</th>
<th>Examples of Chemical Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analysis
1. Which examples were easy to determine?
2. Which ones were difficult? What made them difficult?
   3. How can you determine if a physical change or chemical change has occurred?