Lab: S’more Change Please

FOR THE TEACHER

Summary
In this lab, students will be able to demonstrate the difference between a physical and chemical change by making ooey, gooey, yet yummy S’mores!

Grade Level
Middle School

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

- Identify a physical change (breaking apart the cracker with their hands, chewing the cracker with their teeth, and melting the chocolate with the heat).
- Identify a chemical change (breaking the cracker down with salivary amylase, using the heat to break down the sugar molecules within the marshmallow).
- Apply the Scientific Method to a laboratory experience.

Chemistry Topics
This lab supports students’ understanding of

- Physical change
- Chemical change
- Chemical Reactions

Time
Teacher Preparation: 5-10 minutes
Lesson: 30 minutes

Materials
- (1) marshmallow per student
- (1) whole graham cracker per student
- (1) kabob stick per student (may be cut in half due to their length)
- (1) miniature chocolate bar (they just need 1 small square of chocolate)
- A Bunsen burner (or alternative heat source to roast the marshmallow)
- Flint (something to light the burner with)
- (1) paper towel per student
- Student handout
- Pencil

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.
• When lighting the burner, be cautious with the flame.
• An operational fire extinguisher should be in the classroom.
• Food in the lab should be considered a chemical not for consumption. (This is to your discretion as I allowed my kids to eat their finished product.)

Teacher Notes
• Demonstrate what the students will do first. Start with how to correctly line-up to obtain their material all the way to discarding their trash.
• Have each material already grouped either at each table or have a “buffet” style set-up on the counter for each student to quickly grab 1 and go. I would also recommend manning that station.
• Have the students develop their own hypothesis as well as write down any “before” observation for the cracker, marshmallow, and chocolate. In addition, have them write down the materials after they collect them. This keeps the sitting ones busy while the others are gathering materials.
• Background: physical changes are reactions that although physically change the object, it does not change what the substance is made of. In a chemical reaction either a new substance is formed or energy is given off or absorbed
• Differentiation: For the “lows” simply have them focus more on the before and after part of the results section vs focusing on giving a proper scientific method. The middles, keep experiment as is. For the “highs” have the students explain how the Digestive System further aids in the chemical reaction part; focusing more so on how Macromolecules within the marshmallow are broken down into their simpler parts. You can also have them identify the macromolecule as well as have them determine its simpler form.
• *Extension: When all of these food items enter our stomachs filled with digestive juices (such as acids) what do you think will happen to the food? Will it undergo more changes? If so, will they be physical or chemical?
• *Options: you could also have the students collect the mass of the material throughout the experiment to demonstrate conservation of mass
• Conclusion: The difference between a physical change and chemical change is: a physical change does not change the structure of atoms or molecules but it does change the overall structure of the ingredient. For example the cracker being broken down from a whole into 2 pieces. On the contrary, a chemical change will rearrange the bonds between atoms and produce new substances with new properties. As we demonstrated by breaking the cracker, melting the chocolate, and chewing the ingredients, physical changes took place as the contents were still the same just physically different. We also demonstrated chemical changes by burning the marshmallow and by allowing the enzymes within our saliva break down the food even further. From that point, the ingredients were changed and were no longer the same chemically.

FOR THE STUDENT

Lesson

S’more Change Please

Background
It’s important to know that matter (the “stuff” everything is made of) experiences physical as well as chemical changes. A physical change is when a substance will change how it looks but not what it’s made of. For example, if you were to step on a soda can and crush it, you would change how the soda can looked but not what the soda can is made of. A chemical change is when a substance experiences a change on the molecular level that changes not only how the substance looks but also what it’s made of. For example, a shiny iron pipe over time will become rusty because the Iron atoms react with Oxygen atoms causing the pipe to become rusty. Today we’re going to observe physical and chemical changes while making S’mores.
Pre-lab Questions

1. Define *Physical Change* in your own words and give an example.

2. Define *Chemical Change* in your own words and give an example.

Objective

While making a S’more, identify the chemical and physical changes that occur.

Materials

- (1) marshmallow
- (1) whole graham cracker
- (1) kabob stick
- (1) miniature chocolate bar
- A Bunsen burner (ask teacher before operating)
- Flint (ask teacher before operating)
- (1) paper towel
- Pencil

Safety

- Always wear safety goggles when handling chemicals in the lab.
- Wash your hands thoroughly before leaving the lab.
- 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.
- When lighting the burner, be cautious with the flame.
- Food in the lab should be considered a chemical not for consumption.

Procedure

1. Per your teacher’s instructions go to the materials table and gather the following materials:
   - (1) marshmallow
   - (1) whole graham cracker
   - (1) kabob stick
   - (1) miniature chocolate bar
   - A Bunsen burner (provided by your teacher)
   - Flint (provided by your teacher)
   - (1) paper towel

2. Use the paper towel as a clean surface for your ingredients.
3. Break your graham cracker into 2 pieces. Write down the observation in the before section of the data table that is labeled “Cracker.”
4. Put your chocolate onto 1 of your graham crackers. Write down the observation in the before section of the data table that is labeled “Chocolate.”
5. Place your marshmallow on the wooden skewer. Write down the observation in the before section of the data table that is labeled “Marshmallow.” *Don’t forget to
squeezed it.
6. Roast your marshmallow over the Bunsen burner. Please make sure that the marshmallow does NOT touch the burner. DO NOT MELT!
7. Quickly place the marshmallow onto the chocolate pieces and cover it with your second graham cracker.
8. Wait for it to cool and enjoy the sweet taste of success in chemistry! *If you choose not to eat it, you may share it with someone else or throw it away after you make your observations.
9. Make all after observations within each section of the data table below.
10. Discard trash in the trash can
11. Complete analysis and conclusion.

Data

<table>
<thead>
<tr>
<th>Observations</th>
<th>Cracker</th>
<th>Marshmallow</th>
<th>Chocolate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analysis

1. What did you notice about texture of the cracker before and after you broke it?
2. What kind of change (physical or chemical) did you display when you broke the cracker?
3. What did you notice about the texture of the cracker after you allowed it to sit in your mouth for a few seconds?
4. What kind of change (physical or chemical) was responsible for the cracker changing?
5. What physical change did you notice happen to the marshmallow as it was being burned?
6. Did the marshmallow taste “funny” after you burned it? Why do you think burning the marshmallow changed its flavor?
7. What did you notice about the chocolate before and after you placed the warm marshmallow on it?
8. What type of change (physical or chemical) was displayed?

Conclusion
Write a short conclusion statement that summarizes what you learned during this lab.