

GEORGIA AG EXPERIENCE

A MOBILE CLASSROOM POWERED BY



LESSON TITLE: "From Milk to Butter"

Subject: Agriculture	Grade Level: 3 – 5 th grade	Estimated Time: 120 minutes
Resources & Materials: 1. Making Butter Observation Sheet 2. From Milk to Butter Reading Sheet 3. The Dairy Alliance Meet a Farm Videos 4. Heavy whipping cream at room temperature 5. Baby food jars or small jam jars, 1 per group 6. Timer, 1 per group 7. Kitchen scale 8. Butter knife, 1 per group 9. Crackers 10. Glass bowl 11. Microwave 12. Hand Mixer 13. 11" x 17" piece of white paper for each student		
Suggested Companion Resources: • Let's Make Butter • From Moo to You Video • The Journey of Milk		
Standards: • S5P1. Obtain, evaluate, and communicate information to explain the differences between a physical change and a chemical change. a. Plan and carry out investigations of physical changes by manipulating, separating, and mixing dry and liquid materials. b. Construct an argument based on observations to support a claim that the physical changes in the state of water are due to temperature changes, which cause small particles that cannot be seen to move differently. c. Plan and carry out an investigation to determine if a chemical change occurred based on observable evidence (color, gas, temperature change, odor, new substance produced)		
Learning Objectives: • The students will be able to investigate the chemical to physical change that occurs as milk is turned into butter.		
Guiding Background Knowledge & Fun Facts: • It takes 2.5 gallons (21.8 pounds) of whole milk to make 1 pound of butter.¹ • On opening day of the Minnesota State Fair, the state dairy princess, known as Princess Kay of the Milky Way, has her likeness carved in a 90-pound block of Grade A butter.¹ • Butter is most frequently made from cow's milk, but can also be made from the milk of other animals including sheep, goats, and buffalo.		

INTEREST APPROACH: Butter Making

Estimated Time: 10 minutes

1. Ask the students to identify products made from milk. Examples include milk, butter, cheese, yogurt, cottage cheese, sour cream, ice cream, whipped cream, pudding, and cream cheese. List the items on the board.
2. Explain to the students that all of these products begin on a dairy farm. Take the class on a virtual field trip to a dairy farm by viewing a video from [the Dairy Alliance Website](#).

LEARNING ACTIVITY #1: The Cow: A Master Recycler

Estimated Time: 60 minutes

Resources & Materials:

1. [Making Butter Observation Sheets](#)
2. Heavy whipping cream at room temperature
3. Baby food jars or small jam jars, 1 per group
4. Timer, 1 per group
5. Kitchen Scale
6. Butter knife, 1 per group
7. Crackers
8. Glass bowl
9. Microwave
10. Hand mixer

Vocabulary:

- **Buttermilk:** the liquid that is left after butter has been made from milk or cream
- **Chemical Change:** a change that results in the formation of a new chemical substance through the making or breaking of bonds between atoms
- **Churn:** to make (butter) by stirring or shaking cream
- **Colloid:** a substance in which particles of one substance are dispersed through another substance
- **Emulsion:** a mixture of liquids in which small drops of one liquid are mixed throughout another liquid
- **Homogenized:** to treat (milk) so that the fat is mixed throughout instead of floating on top
- **Physical Change:** a change from one state (solid, liquid, or gas) to another without altering the chemical composition of the substance

Instructor Directions:

1. Organize students into small groups. Provide each group with a small jar, heavy whipping cream, a timer, access to a kitchen scale, crackers, and a butter knife.
2. Each group should weigh their empty jar with the lid and record the weight on their [Making Butter Observation Sheets](#).

3. Instruct the groups to pour the whipping cream into the jars until each jar is half full. Have the students note the appearance and consistency of the cream and record their observations. The groups should seal the lids tightly, weigh the jar, and record the weight.
4. Tell the groups to start their timers and begin shaking the jars. Group members should take turns shaking. You may choose to play music to encourage the movement.
5. Instruct the groups to stop shaking, pause their timers, and observe the contents of their jar every two minutes. Have them note the appearance and consistency of the cream and how it is changing on their observation sheets.
6. The groups should stop their timers and record the time when the solid butter has separated from the buttermilk. It will take 4-10 minutes to get to this point.
7. Allow time for the groups to weigh their jar of butter and buttermilk with the lid. Record the weight. Ask students to compare the weight of the heavy whipping cream to the weight of the butter and buttermilk. Did the weight change? Explain to the students that the weight of matter stays the same when it changes form.
8. Have the students spread their freshly made butter onto the crackers for a taste test.
9. Use the *Background Agricultural Connections* section of this lesson to discuss the difference between chemical and physical changes. Ask the students, "Is turning cream into butter a chemical change or a physical change and why?" (*It is a physical change because the change did not alter the chemical composition of the cream.*) "What factor caused the physical change?" (*churning*) "What states of matter were observed during the different stages of the butter-making process?" (*The cream is a colloid. When it is churned, it first turns into a foam (whipping cream) and then separates into a solid (butter) and a liquid (buttermilk).*)
10. Remind students that physical changes are reversible. Demonstrate the process of changing butter back into cream. In a microwave, melt the butter in a glass bowl. Pour in the buttermilk that was left over from making the butter. Use a hand mixer to beat the mixture until it reaches the consistency of cream.

Content/Procedure: Engage, Explore, Test and Improve

Engage:

Students will learn about the butter making process through an activity where they will need to churn their own butter.

Explore:

Students will learn to churn their own butter by shaking heavy whipping cream in a small jar. They will learn vocabulary definitions of each stage in the process as well as the difference between a physical and chemical change.

Test and Improve:

Students will explore the process of butter making through a scientific investigation which will be recorded in their activity booklet created in the next lesson.

LEARNING ACTIVITY #2: Changing Variables

Estimated Time: 60 minutes

Resources & Materials:

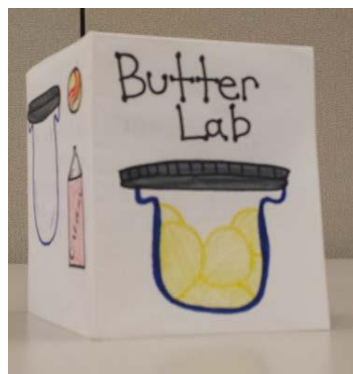
- 11" x 17" piece of white paper per student
- Coloring pencils, crayons, etc.

Vocabulary:

- **Variables** – a quality that can change or vary
- **Hypothesis** – a prediction or educated guess that can be tested
- **Procedure** – a series of steps that must be taken in order to do something
- **Observation** – the act of perceiving the environment through one of the senses (smell, taste, hear, touch)

Instructor Directions:

1. Discuss the idea that changing variables when making butter may affect the outcome. Temperature, time, container size, types of milk, and the addition of an agitator like a marble are examples of variables that can be tested.
2. Place students back into the same groups from *Activity 1*. Show the students the materials you collected for changing variables. Explain to the class that each group will develop a question and hypothesis regarding how a variable change might affect the butter-making process. Limited to the materials in front of them, the groups will plan and carry out an investigation to test how a changed variable affects the outcome of the butter.
3. Hand out an 11 x 17 piece of white paper to each student. Have each student create a foldable booklet for recording their data and observations and sharing their groups' findings.
4. Fold the paper in half vertically (hot dog fold) and crease.
5. Open the paper to the original size and fold in half horizontally (hamburger fold) and crease. Fold each side up from the opening to the middle and crease. The page should be folded to show impressions for eight identical pages.
6. Cut or tear the center crease line from the middle fold to the first crease.
7. Open and fold like an accordion to make a continuous book.
8. Write the title of your group's investigation on the front cover. Label each page in order—Question, Hypothesis, Procedure, Observations/Results, Conclusion. The back cover can be left blank or decorated.
9. After the investigations and booklets are completed, have each group share a summary of their group's investigation with the class.



Content/Procedure: Engage, Explore, Test and Improve

Engage:

Students will learn to investigate changing variables in the butter making process.

Explore:

Students will create an investigation booklet to go through the scientific process.

Test and Improve:

Students will complete a scientific investigation on the butter making process and share their findings with the class

SUMMARY:

Estimated Time: 5 minutes

Questions for review:

After conducting these activities, summarize the following key points:

- Milk, typically produced by cows, is used to make butter, cheese, ice cream, yogurt, and other dairy products.
- A physical change takes place when a substance changes from one state (liquid, solid, or gas) to another state without altering the chemical composition of the substance.
- Changing milk to butter is a physical change.

EVALUATION:

Estimated Time: 30 minutes

Formative: The completion of the changing variables booklet.

Summative: The decision is up to the teacher to choose if a summative assessment is needed.