

# MOO-VELOUS BUTTER!

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## Lesson Summary for Grade 3

Students investigate how temperature and motion (energy) create a chemical change that turns cream (a liquid) into butter (a solid). Students create a class pictograph of their favorite milk choices (white, chocolate, or strawberry) and draw a bar chart of the data; they read the books *No Moon, No Milk!* and *The Milk Makers*; and they study the production of milk and careers in the dairy industry.

### Featured Fiction Books

Babcock, C. *No Moon, No Milk!*; Scholastic: New York, 1994. (ISBN 0-590-48788-4)

Rob's cow Martha refuses to give any milk until she can follow in the steps of her great-great-grandmother and walk on the moon.

Gibbons, G. *The Milk Makers*; Macmillan: New York, 1985. (ISBN 0-590-45964-3)

This book explains the process of milk-making from cow to cup, including how cows produce milk, how milk is processed, and how milk travels to grocery stores.

## Part 1: Building Bridges

1. Decorate the classroom with a cow theme. Read the book *No Moon, No Milk!*, by Chris Babcock. Before beginning the story, have the students look at the front cover and predict what the book is about. Someone usually makes the connection to the nursery rhyme "Hey Diddle Diddle." Have the class say the nursery rhyme aloud together. Give the students a "cow's favorite morning snack" of Oreo<sup>®</sup> cookies (black and white) and milk.
2. Review cafeteria manners and food choices that the students make each day. Have them guess whether most students prefer white milk, chocolate milk, or strawberry milk (if available at your school). Make a class Venn diagram and record each student's name in the appropriate place on the diagram to show the type of milk he or she chooses most often for lunch. Observe the Food Pyramid and discuss why milk is a healthy food choice.
3. Draw a milk carton pattern and make a copy for each student.
4. Have the students keep their milk cartons from lunch and bring them back to the classroom to rinse out. Then have each student cut out a milk carton pattern and color it to match the color of the kind of milk they drank at lunch. Use the milk carton patterns to form a class pictograph entitled, "Our Favorite Milk Choice." The actual milk cartons can be taped to the wall to show milk choices for the entire class.
5. Using the information from the pictograph, teach the students how to make a bar graph with title, horizontal and vertical axes labels, and a key.
6. Have the students work in groups to list as many milk products as they can. Make a class list of all the products. Add to that list throughout the week as students discover additional items. As a home connection for this lesson, send home a note asking parents to help students find pictures or containers for three milk products. Students can use these at school to create a hall display.

7. Discuss with the students how they think milk gets from the cow to the grocery. Have them read *The Milk Makers*, by Gail Gibbons, and make a list of the milk-making steps described in the book. Also have students put together a milk production booklet. Introduce vocabulary words such as producer, production, goods, services, consumer, and consumption and identify the numerous occupations involved. Review the traits that make a cow a mammal and discuss what other animals fit into this classification. Have students complete the “Milk to Butter” worksheet.
8. Using cup, pint, quart, half-gallon, and gallon containers, have the students experiment with measurement.

## **Part 2: Science Activity: Will Cool Cream or Room-Temperature Cream Turn Into Butter First?**

*Students conduct an experiment to determine how the temperature of cream affects the amount of time it takes to turn the cream into butter.*

Key Science Topics:

- energy
- liquids
- solids

Key Process Skills:

- observing
- predicting
- estimating
- gathering data
- interpreting data
- comparing and contrasting characteristics
- forming conclusions

### **Materials**

Per class

- 6 clean, pint-size, clear jars with tight-fitting lids
- 3 pints of whipping cream
- ½-cup measuring cup
- salt
- 2 bowls
- rubber spatula
- box of crackers
- plastic table knives
- 3-ounce paper cups (one for each student)
- plate
- napkins (one for each student)
- insulation (bubble wrap, washcloth, etc.)

### **Getting Ready**

1. Be sure the jars and lids have been washed before you use them.
2. Label four of the jar lids: A, B, C, and D. These jars will be used by the students.
3. Keep jars A and C at room temperature.
4. Put jars B and D into a refrigerator for at least 24 hours before the experiment. Keep them cold until you begin the experiment.

5. About two hours before you begin the experiment, set out 1½ pints of cream in the room.
6. Keep the other 1½ pints of cream very cold until you need them.
7. Wrap some type of insulation (bubble wrap, washcloth, etc.) around one of the remaining jars. Keep it in the refrigerator. Keep the last jar at room temperature.

The butter-making experiment (Day 2) takes at least an hour of class time from beginning to end. To help reduce the amount of time needed for the actual experiment, you may wish to fill the refrigerated jars with the cool cream the day before. At that time, the students can observe and discuss the physical properties of cream and compare the cream to the milk they drink each day.

## **Procedure**

### **Part A: Observations and Predictions (Day 1)**

1. Review the physical states of matter and the characteristics of solids and liquids. Discuss the differences between physical and chemical changes. As an example of a physical change, mention water going from a liquid to a solid (ice), then going back to a liquid again. Explain that, in a chemical change, a new type of matter is formed that cannot be turned back into the original matter. Tearing paper is an example of a physical change, but burning it (using heat energy) creates a new form of matter (ash) that cannot be cooled and turned into paper again. Let the students predict whether a physical or chemical change takes place as the cream turns into butter.
2. Explain to the students how scientists follow a scientific procedure when conducting an experiment. On a large piece of poster board, write the question, “Will cool cream or room-temperature cream turn into butter first?” Make two columns labeled Cool Cream and Room-Temperature Cream. Have the students write their names on Post-it<sup>®</sup> Notes and have each student place the note in the column that he or she predicts will be correct. Divide the class into four groups and hand out the “Let’s Make Butter!” worksheets—one to each group. Assign each group a letter from A to D. Based on their individual predictions, have the groups work out a group hypothesis and complete Part I of the worksheet.

### **Part B: Shaking the Cream (Day 2)**

1. Have the students divide into the same four groups. Make sure the students have their “Let’s Make Butter!” worksheet from the day before, with their group predictions.
2. Pour ½ cup room-temperature cream into each of the two room-temperature jars (with lids marked A and C). Give these jars to two groups.
3. Pour ½ cup cool cream into each of the two refrigerated jars (with lids marked B and D). Give these jars to the remaining two groups.
4. Pour ½ cup cool cream into the refrigerated, insulated jar. Pour ½ cup room-temperature cream into the last jar and place it on the table for observation only.
5. Demonstrate shaking the refrigerated, insulated jar that contains the cool cream.
6. Have the student groups observe their jars of cream, agree on group answers, and mark on the “Let’s Make Butter!” worksheet what state of matter the cream is in. (Part II, question 1).
7. Have each student in each group shake the group’s jar 10 times and then pass the jar. Tell the students to make a tally mark on the group worksheet (Part II, question 2) before passing the jar to the next student in the group.
8. Have students look for changes in the liquid as they shake the jar. They should observe that the cool cream goes through a longer “whipped cream” stage than the room-temperature cream.

9. The jar becomes clear and easy to see through as the butter forms a lump. As each group's cream turns into butter, have them set their jar on the table until all the groups are finished.
10. Have each group count the tally marks and record the total number of shakes required to make their butter. As each group shares their results with the class, have all groups write down the other group's results (Part II, question 3).

### Part C: Observing the Changes

1. One by one, pour off the remaining liquid from each group jar into the  $\frac{1}{2}$ -cup measure, then into a jar or bowl. Show the students how much/how little liquid is left over. Let the students guess what the remaining liquid is called. *Buttermilk*.
2. From each group's butter, squeeze out the remaining buttermilk into the jar or bowl you've been pouring it into. Put the butter on a plate and add some salt to enhance the flavor. Discuss what state of matter the butter is in. *Solid*.
3. Observe the room-temperature cream in the room-temperature jar that was left on the table. Did any changes take place? *No*.
4. Observe the cool cream that you shook in the refrigerated, insulated jar. What changes took place? *It is thick but no butter has formed. This helps show that a certain temperature must be reached for the butter to form.*
5. Also ask the students what conditions were needed for the butter to form. *The students should conclude that shaking the jar (adding energy) and having an increase in the cream's temperature are both needed for the butter to form, since the cool cream in the insulated jar did not change.*
6. If the students are still unsure whether a physical or chemical change took place, melt some of the butter to show that it will not turn into cream again. Place the butter into the refrigerator to show that the butter becomes very hard (experiences physical change) but can soften again (another physical change) when at room temperature.
7. Have the students complete the remaining questions in their "Let's Make Butter!" worksheet.

### Part D: Enjoying the Experiment

1. Pour a small amount of the buttermilk into a small paper cup for each student to sample.
2. Add the butter to crackers for the students to taste. Let students discuss how butter tastes different than margarine.

## Part 3: Lesson Extensions

### Citizenship Activity

1. Have the students study the production of milk and careers in that field.
2. Use map skills to follow Martha's trip to a lunar surface in the book, *No Moon, No Milk!*

### Language Arts Activity

*As an introduction to the study of milk production, students read The Milk Makers by Gail Gibbons and put together a milk production booklet.*

### Procedure

1. Record the students reading the narrator and character parts of the book, *No Moon, No Milk!* by Chris Babcock.
2. Have the class make a story web of the book listing title, author, illustrator, main characters, setting, problem, and solution.
3. *No Moon, No Milk!* can be used to highlight the use of quotation marks and contractions.

## Science Vocabulary Extensions

Lunar surface, crater, Museum of Natural History, Neil Armstrong, bovine, domesticated animals, and astronaut are all topics or vocabulary words in *No Moon, No Milk!*

## Assessment

1. Use the “Let’s Make Butter!” worksheet to assess the students’ involvement in the experiment.
2. Have students use the “Milk to Butter” worksheet to number the steps of making butter in the proper sequence.
3. Have students complete the rest of the “Milk to Butter” worksheet, which includes writing a paragraph (using the steps in the sequence) to tell someone how to make butter.

## References

AIMS Education Foundation Seasoning Math & Science, Book B 1987.  
Teacher Created Materials, Inc. Thematic Unit: *Food*, 1993.

## Handout Masters

Masters for the following handouts are provided:

- Milk to Butter—Worksheet
- Let’s Make Butter!—Worksheet

Copy as needed for classroom use.



