

Buttery Science

Make butter using materials around the house while exploring life and physical science concepts!

Materials

- Clear jar with lid
- Paper towels (for clean up)
- Heavy whipping cream
- Small Container
- Plain paper (Optional Deep Dive Activity)
- Water

Concepts to Explore

- Physical changes
- Concentration
- Lipids
- Mixtures
- Energy
- Cell Structure/ Anatomy

Activity Format

- As students work through the activity, you may choose to have them write down **detailed observations** and include **drawings when directed**.
- Students may answer the focus questions using the “**Claim, Evidence, Reasoning**” format:
 - Claim that answers the question
 - Evidence from students' data
 - Reasoning that involves a rule or scientific principle that describes why the evidence supports the claim

Procedure

1. Pour heavy whipping cream into a clear jar, about 1/3 full. Cap the jar tightly with the lid. Save some cream for the **Deep Dive Activity** outlined in the **Extension** section.
2. Vigorously shake the jar up and down for four minutes. Record any changes that occur to the cream. There should be a solid forming (**Phase 1 in Photo References**).
3. Resume vigorously shaking the jar until there is both a solid **and** a liquid in the jar. (**Phase 2 in Photo References**).
4. Open the jar and pour the liquid (**buttermilk**) into a separate container. Keep the solidified butter in the jar.
5. Fill the butter jar with water and close the lid. Shake the water/butter mixture for several seconds. Drain the water and repeat two more times. Record your observations.
6. Save the butter and buttermilk if you plan to conduct the **Deep Dive Activity**.

Focus Questions

Grades 4-5

1. What physical states of matter (solid, liquid or gas) did you observe in this activity?
2. Compare the texture, color and physical state of each substance.
3. Are your observations and drawings measurable? If not, how might you change this activity to collect measurable data?
4. This activity uses cream, with no other substances added, to make two new substances: butter and buttercream. What might this information tell you about cream?

Grades 6-8

1. Compare the butter you made to store-bought butter. Are they the same substance? What properties of each substance support your claim?
2. Some substances are considered fatty substances. How would you describe a fatty substance? What is fat?
3. The following is a list representing the concentration of fat in the three substances involved in the activity: 82%, 36%, and 2%. Match the percentage of fat with the substance you believe it corresponds to: Cream, Buttermilk or Butter. How is percentage representative of concentration?
4. For this question, assume that butter has a higher fat concentration than cream. The butter you made came directly from the cream, with nothing added. Explain how this butter can have a higher concentration of fat than something from which it was derived. Draw a model explaining your answer.

Grades 9-12

1. An input of energy is necessary to derive butter from cream. Draw a model of the butter making process and label where potential energy and kinetic energy exist, or is of use, in the process.
2. Is the process of making butter a chemical or physical reaction? Use evidence to explain your answer.
3. Too little fat intake can be detrimental to one's health. Name two areas of the body (specific tissues, organs, organelle/cell parts) that require fat, and describe why fat is necessary to these areas.
4. Fat, otherwise known as lipids, have unique properties in water. Explain these properties and how these properties function in the structure of the cell membrane.

(Optional Extension) Deep Dive Activity:

1. On a plain sheet of paper, draw four circles, label in order: water, cream, butter, buttermilk
2. Dip your finger into water and spread the water in the appropriately labeled circle
3. Melt the butter and repeat the above process for the cream, butter and buttermilk. Allow the paper to dry for at least 30 minutes, before observing the results.

Focus Questions:

1. Compare the results inside of the circles on the paper for each substance tested. Substances that are fatty will produce a transparent appearance. Which substances are fatty?
2. Do the results on the Deep Dive activity match the concentration of fat in the substances? What was the purpose of using water in this experiment?

Photo References:



Phase 1 - "Solid" only



Phase 2 - Butter "Solid"



Phase 2 - Buttermilk Liquid