

Cheese Science

Make Cheese using easy-to-find materials while exploring chemistry and physical science concepts!

Materials

- 2 cups or containers
- Cheesecloth or fine strainer
- Milk (whole milk is best, but 2% and lowfat work, as well)
- Small sauce pot/stove (may work without)
- Distilled white vinegar (preferred)

Concepts to Explore

- Physical changes
- Acids, pH
- Mixtures
- Acid precipitation (chemical) reactions

Activity Format

- As students work through the activity, you may choose to have students 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. Warm approximately 1 cup of milk in a small sauce pot on a stove for 2-4 minutes. **DO NOT BOIL.**
2. Remove the warm milk and place in a cup.
3. Mix in approximately 2-3 tablespoons of distilled white vinegar. Stir the mixture. Record observations.
4. Solid white clumps should begin to form. If they do not, add 2-3 more tablespoons of vinegar. Stir until you feel no more **curds** are forming.
5. Separate the solid curds from the liquid whey by straining the mixture into another cup, either through cheesecloth, or through a fine strainer.
6. Record your observations.

Focus Questions

Pre-K - 2:

1. What color was the milk before you added in the vinegar? What color was the liquid after the vinegar was added?
2. You took milk and vinegar and made cheese and whey. Which of these are solid and which are liquid? Was there a solid at the start of the activity? At the end?

Elementary:

1. What physical states of matter (solid, liquid or gas) did you observe in this activity?
2. In this activity, the ingredients: milk and vinegar, react to produce two new substances: cheese curds and whey. Describe the differences and similarities between the ingredients and the curds and whey.
3. Can the curds and whey be put back together to make the original ingredients (milk and vinegar)? What observations lead you to your answer?
4. What is the purpose of heating the milk? Is heating a necessary step in the reaction? How might we test this?

Middle School:

1. Describe the physical properties of the ingredients: milk and vinegar, prior to combining them. Describe the physical properties of the substance(s) produced after the milk and vinegar were combined. Are these the same or different? Do you think milk and vinegar are still present in the final product?
2. This activity is a type of reaction that can be expressed as an equation with the reactants on one side of the equation and the products on the other side. The initial ingredients are the “reactants”. What substances would be the products? Use this information to write out an equation that expresses the reaction that occurred when you made cheese.
3. The pH of a substance indicates its level of acidity. A pH of 7 is neutral, below that number is considered “acidic”, with 1 being strongly acidic. Above 7 indicates that a substance is basic; the higher the number, the more basic it is. Vinegar has, on average, a pH of 2.4. Milk generally has a pH of 6-7. What does this information tell you about the acidity of these substances? What would you predict the acidity of whey to be?
4. What indicates whether a chemical or physical reaction has occurred? Do you think the reaction in this activity was a chemical reaction? What evidence from this activity supports your answer?

High School:

1. Whole milk, which has a fat concentration of 3.5%, is suggested for use in this activity. 2% and low fat milk (1.5% fat) may also be used. What impact does the fat concentration of the reactant have upon the reaction in this activity?
2. Consider your answer to the question above. How might you experimentally test your answer?
3. What do you think the addition of acid did to the milk to cause it to curdle? Would other acidic food substances work the same? How might you test this?
4. Consider that the substances involved in this activity are all made up of molecules. What effect did heating the milk have upon these molecules? What effect did this have upon the reaction, itself?

Optional Extension: Test various types of milk to see the effect upon the reaction. Conduct the activity with milk at different temperatures.

Photo References:



After adding vinegar and heat



Straining the whey from the curds



Solid curds, liquid whey