

LESSON 1: DISCOVER DAIRY . . . *and Milk Quality & Safety*: LAB COMPONENT

Part I: Milk Quality

What you will need:	2% or whole milk	Food coloring
	Dishwashing liquid	Cotton swab
	Plate	Part 1 Lab Handout

Milk is tested up to 17 times before it reaches the grocery store shelf to ensure it is safe for you to drink. Milk is tested for quality and safety at the farm level, in route to the dairy processing plant, and at several points during processing. It is tested to make sure it doesn't contain any harmful contaminants and is safe to drink.

In this lab, students will simulate testing milk. Students will test how milk reacts when food coloring is added to it. When food color is added to water, the water changes colors. But it takes a special ingredient to change the color of milk.

Steps:

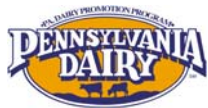
1. Pour enough milk onto a plate to cover the bottom.
2. Drop food coloring into milk. Record what happened on your hand-out.
3. Dip a clean cotton swab into the milk. Record what happens.
4. Now dip the cotton swab in dishwashing detergent liquid.
5. Touch the coated swab to the milk in the center of the plate.
6. Do not stir the milk.
7. Record what happened and answer questions on handout.

How it works: *(Read after completing experiment)*

Milk consists of many different molecules, including fat, protein, sugars, vitamins, and minerals. If you'd touch a clean cotton swab to the milk, not much would have happened. The cotton is absorbent, so you would have created a current in the milk, but you wouldn't have seen anything especially dramatic happen.

When you introduce detergent to the milk, several things happen at once. The detergent lowers the surface tension of the liquid so the food coloring is free to flow throughout the milk. The detergent reacts with the protein in milk, altering the shapes of those molecules and setting them in motion.

The reaction between the detergent and the fat forms micelles, which is how detergent helps to lift grease off of dirty dishes. As the micelles form, the pigments in the food coloring get pushed around. Eventually equilibrium is formed, but the swirling of the colors continue for quite awhile after stopping.



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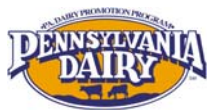
NAME: _____

Milk Testing Lab Reporting Form:*Answer the question below before conducting the lab:*1. What do you think will happen when you put the food coloring in the milk? _____
_____*Answer the questions below while conducting the lab:*

1. What happened when you put the food coloring in the milk? _____

2. Why do you think the milk reacted differently to the food coloring than water does? _____
_____3. What happened when you dipped the clean cotton swab into the milk? _____
_____4. What happened when you dipped the coated cotton swab into the milk? _____
_____5. How do you think the dishwashing detergent changed the way the milk reacted to the food coloring? _____
_____6. *Read the "How It Works" explanation at the bottom of Page 1.* How did this explanation compared to your answer to question #4 above? _____

_____7. What changes could you make to the experiment to make the milk react differently? _____
_____**Additional Lab Questions:**1. How do you think this lab experiment may compare to actual milk quality and safety testing done in the marketplace? _____
_____2. What other products do you think are tested in the marketplace? _____
_____3. How do you think chemistry play a role in the safety of our food supply? _____

_____

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Part II: Fermenting Milk

What you will need:	500 mL whole milk	50 mL buttermilk
	Fine-mesh cheesecloth	Hot plate
	Thermometer	Cotton twine
	50 mL, 500 mL and 600 mL containers	Crackers
	50 mL, 500 mL and 600 mL measuring devices	4 pieces Litmus paper

In this activity, you will be fermenting milk products. The action of bacteria in milk causes a buildup of lactic acid, which causes the milk to curdle, forming a solid curd and a liquid whey. This is the first step in making cheese. Once the curd is made, it must be separated from the whey and aged to make cheese. The physical characteristics of the cheese that you buy at the grocery store depend on many factors, including how long it is aged, what is used in the process, and what type of flavoring is added to it.

Cautions:

- ◆ *Work involved with this lab will occur over a four-day period.*
- ◆ *Your hands must be washed thoroughly with antibacterial soap and water before and after each step.*
- ◆ *Be ware of shock and burn hazards when using the hot plate.*

Steps:*Day 1:*

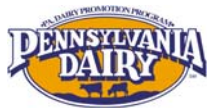
1. Use your Litmus paper to take the pH of both the butter milk and the whole milk.
2. Record both on the form on the back of this page. Also record the physical characteristics of both the whole milk and buttermilk (color, thickness)
3. Pour 500 mL of whole milk into your 600 mL container and 50 mL of buttermilk into your 50 mL container.
4. Heat whole milk to 37 degrees Celsius.
5. Add the buttermilk to the whole milk and stir well.
6. Cover the container with cloth or paper.
7. Incubate at between 25 - 35 degrees Celsius for 48 hours or until firm curd separates from whey.

Day 2:

1. Prepare piece of cheesecloth that will be thick and large enough to hold your curd.
2. Pour your curd into the cloth.
3. Use the Litmus paper to take the pH of the curd and record it on the back page. Record the physical characteristics of the curd
4. Collect the whey in the 500 mL container.
5. Use the Litmus paper to take the pH of the leftover whey and record it on the back page. Record the physical characteristics of the leftover whey.
6. Gather the edges of the cloth to form a bag.
7. Tie the bag with twine and hang it to continue draining.
8. After it is fully drained, discard whey and place bag in refrigerator.

Day 4:

1. Remove the cheese and taste with crackers.
2. Record what you learned on the reporting form.



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NAME: _____

	Whole Milk	Buttermilk	Curd	Leftover whey
pH recording				
Is it acidic or a base?				
Color (white, off-white, yellow, gray)				
Thickness (watery/liquid/solid)				
Amount/Weight	500 mL	50 mL		

Answer the questions below related to the milk fermentation experiment: On Day 1, answer the first three questions; on Day 2, answer questions 4 - 5; and on Day 4, answer questions 6 – 7.

Day 1:

1. What do you expect to happen to the mixture of whole milk and buttermilk? _____

2. Why do you think it is important to wash your hands before each step? _____

3. Why do you think it is important to cover the mixture of whole milk and buttermilk before you incubate it? _____

Day 2:

4. What characteristic in the buttermilk made the whole milk curdle? _____

5. What role do you think heating the milk has in the experiment.? _____

Day 4:

6. What does the curd taste like? _____

7. What do you think will happen to the curd over time if it is left to age? _____

