Magical Milk Experiment

TIME	TASK	DESCRIPTION	NEEDS
5 MIN	**INTRODUCTION**	**Teacher Instruction:** The teacher will explain the overall task and introduce the students to spectroscopy.	• Have slides with types of electric motors.
10 min	**Group Read**	Read the reading out loud to talk about the big ideas.	
10 MIN	**VIDEO**	**Video Review:** Students will watch a video explaining how the 1. What causes the color movement? 2. What do the words hydrophobic and hydrophilic mean? 3. What does the fat in milk have to do with this movement? 4. What would happen if this happened in water?	• Copies of the lab plan • Have instructional video cued and embedded in the PowerPoint.
5 MIN	**VIDEO ANALYSIS**	Students will write their answers down in their lab books	• have questions on the slide
10 MIN	**LAB REVIEW**	Student and Teacher team will read the lab aloud in preparation.	• have questions and task on the slide
20 MIN	**LAB COMPLETION**	Students will complete the lab	• have questions and task on the slide
5 MIN	**SMALL GROUP PRESENTATION**	Students will present their working motors and explain how they work.	• have questions and task on the slide
10 MIN	**VIDEO EXPLANATION**	All the students in the group will record a video of themselves explaining how the motors work.	
10 MIN	**CLEAN UP**		

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Introduction
This laboratory explores how the fats in milk can interact differently with water in milk. We are able to keep water in our body while keeping water out because our cells use this same principle.

Group Read
Milk is mostly water, but it also contains vitamins, minerals, proteins, and tiny droplets of fat suspended in solution. Fats and proteins are sensitive to changes in the surrounding solution (the milk).

The secret of the bursting colors is the chemistry of that tiny drop of soap. Dish soap, because of its bipolar characteristics (**nonpolar on one end and polar on the other)**, weakens the chemical bonds that hold the proteins and fats in solution. The soap's polar, or ***hydrophilic*** (water-loving), end dissolves in water, and its ***hydrophobic*** (water-fearing) end attaches to a fat globule in the milk. This is when the fun begins.

The molecules of fat bend, roll, twist, and contort in all directions as the soap molecules race around to join up with the fat molecules. During all of this fat molecule gymnastics, the food coloring molecules are bumped and shoved everywhere, providing an easy way to observe all the invisible activity. As the soap becomes evenly mixed with the milk, the action slows down and eventually stops.

Try adding another drop of soap to see if there's any more movement. If so, you discovered there are still more fat molecules that haven't found a partner at the big color dance. Add another drop of soap to start the process again.

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Reading Notes

Directions: Use the space below to write down the definition to the key ideas in the reading.

What was the big idea from the reading?	
What does bipolar mean?	
What does hydrophilic mean?	
What does hydrophobic mean?	

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Video Analysis

Directions: Use the space below to explain what you learned from the video.

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Lab Review
Here are the directions for the laboratory:

(1) Pour enough milk in the dinner plate to completely cover the bottom to the depth of about $^1/_4$ inch. Allow the milk to settle before moving on to the next step.

(2) Add one drop of each of the four colors of food coloring—red, yellow, green, and blue—to the milk. Keep the drops close together in the center of the plate of milk.

(3) Find a clean cotton swab for the next part of the experiment. Predict what will happen when you touch the tip of the cotton swab to the center of the

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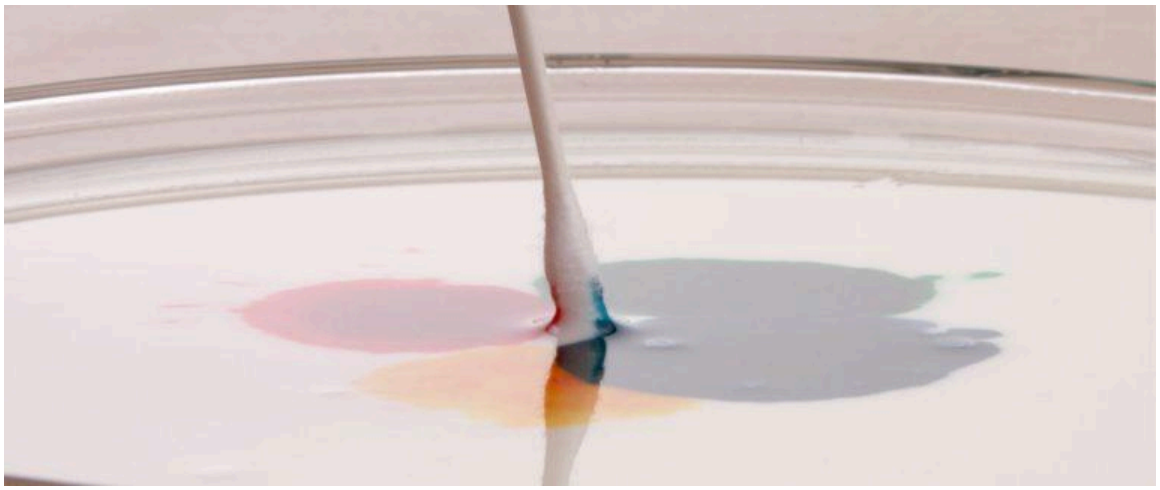
milk. It's important not to stir the mix—just touch it with the tip of the cotton swab. Go ahead and try it.



(4) Now place a drop of liquid dish soap on the other end of the cotton swab. Place the soapy end of the cotton swab back in the middle of the milk and hold it there for 10 to 15 seconds. Look at that burst of color! It's like the Fourth of July in a plate of milk.

(5) Add another drop of soap to the tip of the cotton swab and try it again. Experiment with placing the cotton swab at different places in the milk. Notice that the colors in the milk continue to move even when the cotton swab is removed. What makes the food coloring in the milk move?

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Lab Completion

Follow the directions about and complete the lab.

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Small Group Presentation

Directions: Use the space below to prepare a 1-minute presentation that explains what happened in this experience. In your video presentation use words like Hydrophobic and Hydrophilic.

Video Explanation

Record a short video of you explaining what happened.

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