LESSON 18: MAGIC MILK

SUPPLIES

TEACHER BRINGS

- Full Fat Milk (1/2 gallon)

MAIN BIN

- Waterproof Bowls (20)
- Dish Soap
- Plastic Cups (20)
- Food coloring (3)
- Q-tips (300)
- Spoons (20
- Tablecloth (2)

OBJECTIVES

- [x] Name at least 2 molecules found in milk.
- [x] Describe how soap interacts with fats.
- [x] Understand ways to tell that a chemical reaction has occurred.

HOOK

3 min

What's the first thing we should do in the kitchen before we start to make anything? Hopefully, washing our hands!

Have students discuss why washing their hands is important. Answers may include: to get rid of dirt and bacteria; to make sure we aren't passing around germs; to prevent our food from getting germs on it.

INTRODUCTION

2 min

Guide the discussion started in the Hook by prompting students to think about washing with soap vs. without soap. We use soap because it helps get us cleaner! Soap removes bacteria, while water may not be effective enough to get rid of all germs and dirt.

For today's experiment, we will be making a food coloring and milk concoction to understand and observe how soap works. We'll see how colors move and dance when we add just one drop of soap. It's not really magic, of course! It's all about how soap breaks apart the fat in the milk and makes the colors swirl around.

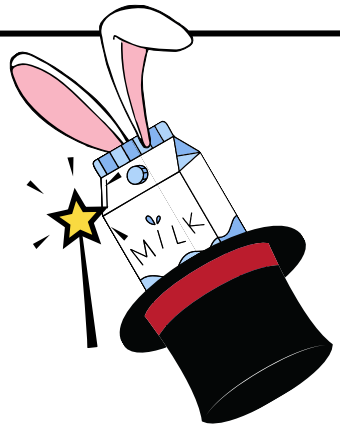
COLOR FACTOR

This experiment provides us with insight into how germs and bacteria are cleaned away.

We use the coloring in the milk to represent the germs and bacteria our bodies can pick up! Without the coloring, the soap and milk would be moving, but we wouldn't be able to see it because they are the same color. By adding colors like red, yellow, and blue, we are able to see the movement clearly. The results create something beautiful!

Think back to earlier experiments. How do we make secondary colors like purple, orange, and green? Can you make them using only primary colors?

MAGIC MILK



DISCUSSION

3-5 min

Show students the ingredients being used today. Discuss with students:

- What do you think milk is made of?
- What will happen if we add soap to milk?
- Why do you think we're using food coloring in this experiment?

ACTIVITY

20-25 min

1. Each student can make their own creation, or you can split students into groups of two. For each student or group, pass out: 1 bowl with a thin layer of milk (about 1/4 cup), 1 cup with dish soap (about 1 tbsp), Q-tips (about 5), Paper towel (about 1 square per student to wipe up any messes). NOTE: make sure to use tablecloths to protect tables.

2. Walk from group to group, ask them to choice colors, and add 3-4 drops of food coloring to their plate. NOTE: Only the instructor may use the food coloring. The drops should be fairly far apart from one another.

3. Ask students to dip one Q-tip into their cup of soap.

4. Instruct them to firmly press the Q-tip into the center of the plate. Once the colors have stopped swirling, they can take the Q-tip out and throw it away or put it on their paper towel.

5. Repeat this step using only the clean Q-tips
   - Do not put dirty Q-tips into soap cup, or the results will not be as dramatic!

   Have students observe and discuss the color and pattern of the food coloring on their milk. When they have concluded the observation, they may use a spoon to mix the milk together. Before they do so, have them guess what color it will become when everything is mixed together!

6. When cleaning up the classroom, do not let students walk to the sink with their plates (spills will happen!). Collect the bowls of milk yourself and pour them down the sink. Students must then clean their workspace. Make sure to wipe up any spills on desks, chairs, or the floor, and to leave the classroom the way you found it.

MAGIC MILK

OBSERVE & EXPLAIN

3-5 min

Ask students to discuss:

- What happened when we first put the food dye in the milk?
- What happened when we added the soap to the q-tip?

Ask students to share their findings.

- Why did the food coloring move after adding the q-tip with soap?
- Did the colors combine when moving the q-tip around?

Explain that milk is made mostly of water molecules, but it also has fat molecules and protein molecules. Like other oils, milk fat is a non-polar molecule, which means that it doesn't dissolve in water. When soap is mixed in, however, the non-polar(hydrophobic) portion of the micelles (molecular soap structures within the solution) break up and collect the non-polar fat molecules. The polar surface of the micelle (hydrophilic) then connects to a polar water molecule with the fat held inside the soap micelle. Thanks to the soap connection, the non-polar fat can then be carried by the polar water.

We have a lot of oils and other molecules on our body. Dirt and germs like bad bacteria can easily stick to these molecules, just like the food coloring sticks to the fat and protein molecules in milk. Water by itself can't move the germs that much - but using soap helps wash away all the dirt and germs stuck to those molecules, helping us stay clean and safe!

EXTENSION

If students have time to expand on this experiment, try one of these alternatives:

- Repeat the experiment using water in place of milk. Will you get the same eruption of color?
- Try adding drops/squirts of dish soap instead of using q-tips. Are the results as cool?

Exit Ticket

Ask each student the following questions as they walk out the door.

- Q: Can you name some of the kinds of molecules that we find in milk?
  - Milk has fat, water, and protien molecules!
- Q: Does soap help remove bacteria when we wash our hands?
  - Yes, it does! We have a lot of oils and other molecules on our body. Dirt and germs like bad bacteria can easily stick to these molecules, but using soap helps wash away all the dirt and germs.