LESSON 10: MAGIC MILK

Students will experiment with how soap interacts with milk fats to create a beautiful plate of art.

OBJECTIVES

- [x] Name at least 2 molecules found in milk.
- [x] Describe how soap interacts with fats.
- [x] What is the evidence that a chemical reaction has occurred?

SUPPLIES

- 6 Styrofoam or plastic plates (one plate per group)
- 3 cups full-fat milk (1/2 cup milk per group)
- 3-4 Food coloring options
- Liquid dish soap (1 Tbsp x 6 groups)
- 6 plastic cups (1 cup per group)
- Q-tips

HOOK

5-10 min

What's the first thing we should do in the kitchen before we start to make anything? Wash your hands! Why? 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.

Guide the discussion by prompting students to think about washing with soap vs. without soap. Soap removes bacteria, while water may not be effective enough to get rid of all germs and dirt. Conclude the discussion by introducing today's experiment: we will be adding soap and food coloring to different liquids to understand how soap works.

HYPOTHESIS

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?

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CHEMICAL REACTION

A chemical reaction is where different substances (reactants) are changed into a new substance (product)

SIGNS

- change of color
- change of temperature
- change of smell
- production of gas
- production of a solid
- emission of light

KEYWORDS

- Fats
- Proteins
- Non-polar
- Molecule

EXPERIMENT

20-25 min

1. Divide class into groups with two students per group. Each group will be conducting and recording results of their experiment. Prepare 6 cups of soap--one tbsp for each group. (If you have enough plates, each student could perform their own).
2. Have students carefully pour a small amount of milk onto the plate. Emphasize that they should only have a thin layer of milk on the plate.
3. Have students add a few drops of food coloring into the milk. Students can use any colors they like, but have them add no more than 3 drops of food coloring per plate.
4. Have students dip q-tip into their cup of soap.
5. Next, instruct them to firmly press the q-tip into the center of the plate and then pick it up off the plate once the colors have stopped swirling.
6. Allow them to repeat this at a different location on the plate with a NEW q-tip. Remind students that they should not dip a used q-tip into the soap cup.
7. See who can create a more fun and beautiful art on their plate

OBSERVATION

5-10 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?

CONCLUSION

3-5 min

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?

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EXTENSION

5-10 min

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?
- What kind of milk produces the best color swirls: skim milk, 1% milk, 2% milk or whole milk?

EXPLANATION

5-10 min

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!

CLEAN UP & DISMISSAL

3-5 min

Students must then clean their workspace. Be careful with the plates of milk. Make sure to leave the classroom the way you found it.