

Games, Nature, & Experiments

Tie-Dye Milk

Estimated time: 15 minutes

Age range: 3rd - 5th grade

What you need: milk (preferably whole, or with some fat), dish soap, cotton swab or Q-tip, food coloring, small container (like a cereal bowl or Tupperware)



Background Information:

Milk is mostly made up of water, but it also contains vitamins, minerals, proteins, and tiny droplets of fat. Dish soap weakens the chemical bonds that hold proteins and fats together. The soap has both **hydrophilic** (water-loving) parts which dissolve in water, and **hydrophobic** (water-fearing) parts which attach to fat droplets. The combination of these is what makes soap so good at getting oils and fats off of dishes!

When soap is added to milk, the **hydrophobic** parts of the soap will race around, trying to join up with the fat molecules in the milk. This will cause the fat molecules in the milk to bend, roll, twist, and contort in all directions. While these fat molecules are moving around, the food coloring molecules are bumped and shoved everywhere, providing an easy way to observe all the invisible activity. Many of these particles are **microscopic**, meaning that they are too small to see with just the human eye! We use **microscopes** in order to view them.

Additionally during this **experiment**, you will look for evidence of **physical changes** and **chemical changes**. When a physical change occurs, the composition of a substance does not change. In chemical changes, the composition is changed. An example of a physical change is freezing water into ice cubes. The ice is still composed of H₂O, just like the water, but it is a solid instead of a liquid. If the ice were melted, there would be the same amount of water that you had started with. An example of a chemical change is burning wood. The change creates heat and light, and the action cannot be easily undone. Wood cannot be un-burnt.

Teacher Tips:

Have students fill out appropriate parts of the scientific method before, during, and after the experiment.

New Words:

A **chemical formula** tells what a substance is made up of, by listing the elements, and how many atoms of each there are.

A **molecule** is the smallest possible amount of any substance that can exist and still be that substance. Since the chemical formula for water is H₂O, one molecule of water would have 2 hydrogen atoms and 1 oxygen atom.

Some molecules have **hydrophilic** and **hydrophobic** parts. Hydrophilic means “water-loving” and hydrophobic means “water-fearing”. Hydrophilic substances dissolve in water, while hydrophobic substances do not.

Microscopic things are too small to be seen with the naked eye.

We use a **microscope** to be able to see things that are microscopic

A **chemical change** occurs when a new substance is created.

A **physical change** occurs when molecules of a substance are rearranged, but their composition is not changed.

An **experiment** is a scientific process done to test a hypothesis and learn something new.

A **hypothesis** is a statement predicting the outcome of an experiment.

The scientific method is the process that scientists use to test hypotheses and conduct experiments.

Observations are things that you notice happening during an experiment.

Today we are going to use the **scientific method** to do an experiment.

Instructions:

1. Pour 1 cup of milk into a small container.



2. Add about 5 drops of food coloring to the milk. Try to keep each drop of food coloring separate from each other.



3. Cover the end of the cotton swab with the dish soap.



4. Dip the end of the cotton swab into the milk in different spots.



5. Watch the experiment unfold and write down your **observations**.



Scientific Method

What will happen to the food coloring in the milk when you add dish soap?

Hypothesis:

If _____, then _____

because _____.

Data Collection/Observations:

Analysis:

What chemical changes did you notice? What makes these chemical changes?

What physical changes did you notice? What makes these physical changes?

Are there any other conclusions that you can make based on your observations?

Conclusion:

What was the result of the experiment? Was your hypothesis correct? Why or why not?

Conclusion (continued):

Think of some ways you could do this experiment differently to scatter the food coloring even more.
Describe what you would change.

How could you do the experiment that would cause the food coloring to scatter less? Describe what you would change.

How could you create some artwork or patterns using this experiment? Give it a try!

Answer Key:

Chemical change - the soap breaking the bonds of the fat molecules is a chemical change.

Tie-Dye Image: <https://www.fastcasual.com/blogs/starbucks-employees-hoping-the-tie-dye-frapp-will-just-die/>