Minds in Motion

Magnificent Milk Magic!

Activity Rundown:

Throughout the day, we see and undergo countless chemical reactions in our environment and bodies! Simple things like baking a cake, the digestion of food, and even breathing are all examples of such everyday chemical reactions. While many chemical reactions are teeny tiny and unfortunately not visible to the naked eye, there are still plenty that we can observe! In this activity, we'll be using ingredients you might already have in your kitchen to perform a wonderfully colourful chemical reaction.

You will need:

- Milk (Whole or 2% works best for this experiment. The more fat content in the milk, the better!)
- Dish soap
- Shallow dish
- Small cup
- Q-tips
- Food colouring

Let's do it!

1. Pour the milk into a shallow dish until the bottom is completely covered.
2. Add drops of food colouring to the shallow milk. It's best to use multiple colours and to space out the drops.

Your milk should look something like this!

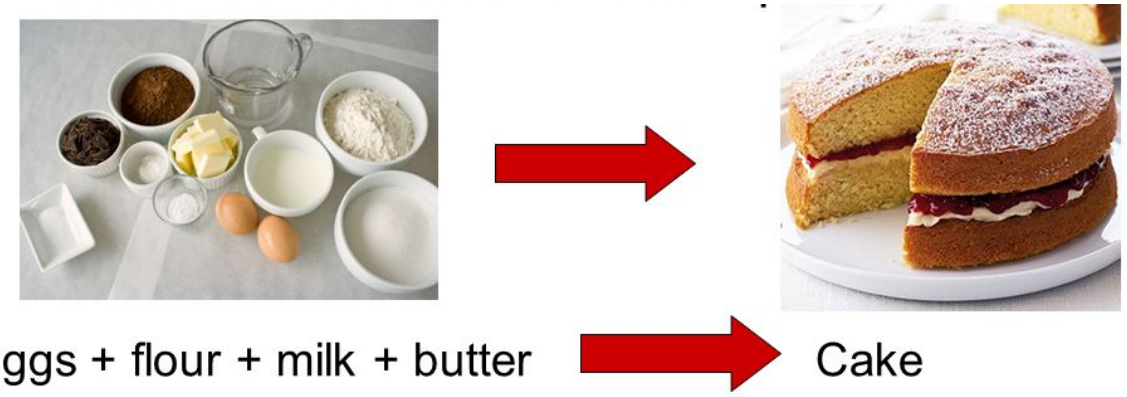
3. Add a couple of tablespoons of dish soap to a separate small cup or dish. Take a Q-tip and generously apply dish soap to one end.

4. Take your soapy Q-tip and dip it in the milk next to a drop of colour. Does anything happen?
5. Next, try to gently and slowly drag the Q-Tip through different dots of colour. You may need to grab a new Q-Tip and reapply the dish soap.
6. Play and investigate until all the colours mix into a brown sludge colour! If you want to try again, you can wash up your plate and start again at step #1.

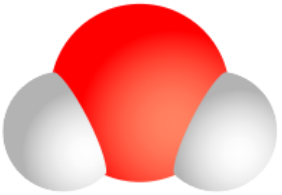
Background:

What is a chemical reaction?

- To put it simply, a chemical reaction is when one (or multiple) substances are changed into one (or multiple) substances. A great example is the chemical reaction that takes place when you mix flour, eggs, milk, sugar, and add some heat! What do you get? A delicious cake!



- In more scientific terms, the **bonds** that hold chemical **molecules** together are broken and reformed to create new molecules.
    - Chemical bonds: Invisible attraction between two elements (elements can be found on the periodic table!) that link them together into a chemical molecule. For example, when you take two hydrogen atoms and one oxygen atom you get water.



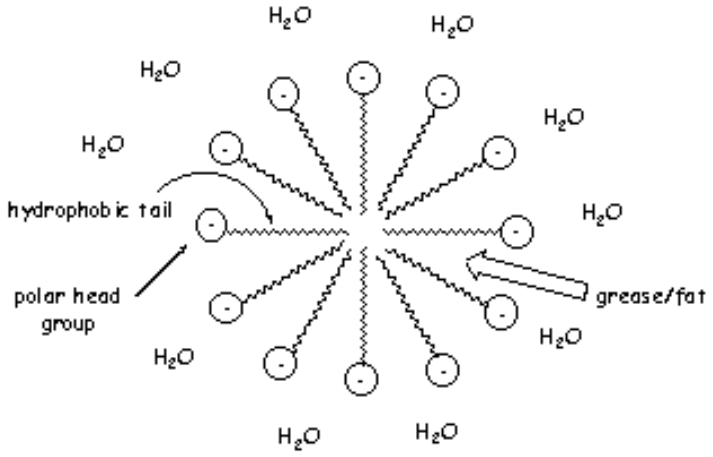
Water molecule showing one oxygen atom (red) and two hydrogen atoms (white). The chemical bond existing between them holds them together.

The science behind magic milk:

- Milk is great for young mammals (calves, infants, and many more) because it's stocked full of important nutrients to help small mammals grow big and strong. Milk is made up of water and important nutrients such as minerals, proteins, and fat!
    - Minerals are much like the vitamins you might take to help your body with its regular functions. (Examples: Calcium and magnesium)
    - Proteins build, maintain, and replace the tissues (organs, muscles, etc.) in your body.
    - Fat is used as a fuel source, and fat is the major storage form of energy in the body.
- Proteins and fat are super sensitive to any changes in their environment (the milk).
- Milk fat is a **nonpolar** molecule and that means it doesn't dissolve in water, which is **polar**. Another popular nonpolar substance is oil. Have you ever tried to mix oil and water together? You probably noticed that the oil will float on top of the water and won't mix. This is because the oil is nonpolar and the water is polar.

Oil and water mixture. See how the yellow oil is sitting on top of the clear water? They don't want to mix!

- Substances like milk fat and oil are **hydrophobic**, meaning they don't like mixing with water.
- When soap is added to the milk, the nonpolar (and hydrophobic) portions of soap start running around trying to find their nonpolar friends, the milk fat. Similarly, the polar part of the soap starts to look for their polar friend, water!
- When the two groups finally find each other, they create a milk fat, water, and soap sandwich. The polar part of soap links with the surrounding polar water, trapping the nonpolar milk fat inside with the nonpolar soap portions.



- The fat molecules bend, roll, and twist 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. Without the food colouring, we wouldn't be able to see the reaction at all!
- As the soap becomes evenly mixed with the milk, the action slows down and eventually stops. This is why milk with a higher fat content produces a better explosion of color, there's just more fat to combine with all of those soap molecules.

Fun fact: You can try this same experiment with water instead of milk and pepper instead of food colouring!

Resources:

https://www.stevespanglerscience.com/lab/experiments/milk-color-explosion/

Reach out!

We would love to hear from you about all the amazing STEM projects you are doing at home! Show us your finished products on any of the following social media platforms by tagging us or by using the following hashtags. We hope these projects have brought some excitement to your day during these difficult times.

Let us know how we did! Please click here to fill out a short survey on how well we did and what you would like to see more of in the future. Thank you!

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