Reacting to Chemistry

Leader References

CHEMICAL REACTION: VINEGAR AND BAKING SODA

A chemical reaction occurs when two substances are put together and their nature causes the molecules to break apart and form new molecules. Sometimes during this process, a by product (third molecule) is made.

In the experiment with vinegar and baking soda, baking soda is a bicarbonate ($NaHCO_3$) and vinegar is an acetic acid (HCH_3COO). One of the products this reaction creates is carbon dioxide. The two molecules exchange an atom and during the process, as gas is released which is why the substance foams and flows over.

CHEMICAL REACTION: MILK AND DISH SOAP

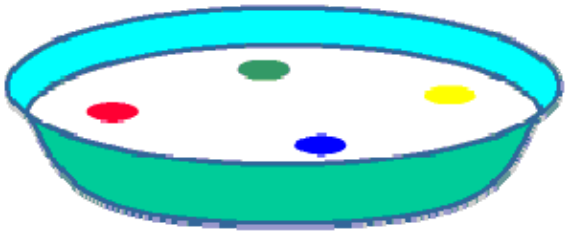
HOW DOES IT WORK?

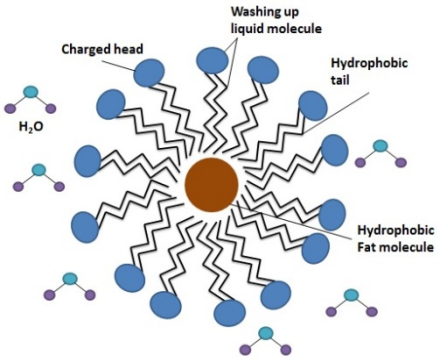
Milk is mostly water but it also contains vitamins, minerals, proteins, and tiny droplets of fat suspended in solution. Fats and proteins are sensitive to changes in the surrounding solution (the milk).

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.

Note: be sure to place the drops of color far apart on the surface of the milk. The result will be much more dramatic and the reaction more observable.



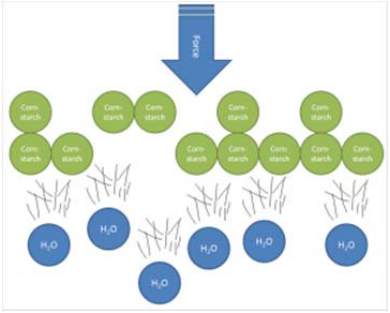


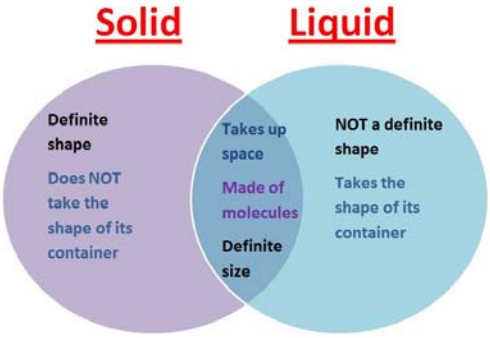
CHEMICAL SOLUTION: POLYMER

In some cases the molecules of two different substances to not change or dissolve in any way. They simply slide and slip around each other. In the case of Ooblek, the starch molecules and water molecules slide around. They do so very slowly, and so we can say that Ooblek is highly viscous.

Viscosity

Viscosity is a measure of a liquid's resistance to flow. Water, for example, flows easily whereas honey does not. So honey is more viscous than water. With this in mind, a Newtonian fluid's viscosity remains constant regardless of the force applied on it. A non-Newtonian fluid's viscosity varies with force applied. In addition to Oobleck, some everyday non-Newtonian fluids include: silly putty, yogurt and ketchup.





Water molecules slip through the cornstarch molecules. When the Ooblek is struck with great force or pulled apart, it behaves like a solid. Looking at the Venn diagram comparing solids and liquids, we can see that Ooblek shares properties of both.

Challenge students to decide and discuss whether or not Ooblek is a solid or a liquid.