California State University of Bakersfield, Department of Chemistry

Tie-Dye Experiment

Standards:
7th: 6 a, b, e, f- Understanding the properties of light and color.

Introduction:

Can art and chemistry be combined? Today, we will create some designs in a piece of cloth. After today, you can put some art and chemistry in your t-shirts, of course, if your parents allow you to.

You are probably thinking what does this have to do with chemistry? This experiment has to do with the concepts of solubility, color mixing, and the movement of molecules. We all know that Sharpies are permanent markers, and they will not wash away with water because they are made of permanent ink. The ink inside these markers is hydrophobic, meaning it does not mix with water. What if we used another type of solvent? Like alcohol? This solvent carries the different colors of ink with it as it spreads in a circular pattern from the center of the shirt. Since pigment molecules are large and not very polar, they are soluble in solvents that are less-polar than water and containing long carbon chains, like rubbing alcohol.

Materials:

- Pre-washed white t-shirt
- Sharpie permanent markers (preferred colors)
- Rubbing alcohol

- Dropper bottle or medicine dropper
- Plastic cup or bowl
- Rubber band

Safety:

- Always have an adult with you to help you during your experiment.
- Always wear eye protection and gloves when doing chemistry experiments
- Rubbing alcohol is flammable, so it must be kept away from any open flames or heat

Procedure:

1. Take a piece of your white shirt.
2. With markers of different colors, make a dotted circle with an open center about the size of a quarter.
3. Position the opening of the cup directly under the section of the shirt that you decorated and secure it over the top with a rubber band. If the design is bigger, you will need a bigger cup.
4. In the open center of the circle, pour 5-10 drops of rubbing alcohol. Keep adding rubbing alcohol as needed. Observe what happens and record in the back of this handout.
5. Allow the developed design to dry for 3 to 5 minutes before moving on to a new area of the shirt.
6. You can now play around and create some very cool designs with different shapes and sizes. You could even mix colors and see what happens!
7. It is important to heat set the colors by placing the shirt in the laundry dryer for approximately 15 minutes. It is also suggested to rinse the shirt in a solution of vinegar and water to set the colors.

Data and Observations:

Record your observations in the following space.

Questions:

1. What concepts of chemistry demonstrated by this experiment?

2. Why does the experiment work with alcohol but not water?

3. Would it be better to rinse the shirt in the vinegar and water solution and then put it in the dryer? Do you think that will have an effect in the setting of the colors?

References:

1. Stevespanglerscience.com
http://www.stevespanglerscience.com/experiment/sharpiepenscience
(accessed July 18, 2012).