

Tie-Dye Lab

THEORY: organic chemistry, aldehydes (define it and give an example)

PRELAB: show conversions $\frac{3}{4}$ cup to mL and then to gallon & watch: <http://www.bestdye.com/> to see how tie dyeing is done and its significance to chemistry!

PURPOSE: Dyes have been used for thousands of years. The original dyes were called natural dyes and were made from such things as tree bark, plant roots and snail shells. By the middle 1800s, chemists were beginning to synthesize dyes. The purpose of this activity is to observe the reaction of modern synthetic dyes with various kinds of materials AND to make an awesome shirt to be worn in May for the AP CHEM exam!

PROCEDURE: You are expected to bring a washed cotton, white T-shirt. You can bring in a black t-shirt and tie dye with bleach.

1. Make fixer (sodium carbonate) solution for your lab group. Mix $\frac{3}{4}$ cup dye fixer with 1 gallon warm water. This makes a 0.4 M solution approximately. There will be 4-6 shirts in a bucket of fixer, so label your tag with a pencil. Convert $\frac{3}{4}$ cup to ml and measure fixer in beaker.
2. For dyes, add 2-3 tsp. of powder and 1 cup of hot (preferably) water into a squeeze bottle.
3. Mix shirt into fixer and soak for 10-15 minutes.
4. Decide on a pattern. (consult handout for GRATEFUL DYES) Practice doing folds BEFORE dye is added. Remember that wherever the cloth is constricted, no dye will penetrate. Tie your material with rubber bands. Decide on the colors that you want (2-3 colors are best)
5. Set up tie dyeing area. Use newspaper and wear gloves and apron. Put a garbage bag under the newspaper.
6. Apply dye using sorted bottles, droppers, sponge, and paint brushes.
7. After dye is applied, the fabric needs 4-18 hours for the chemical reaction to go to completeness. Put your item(s) on cardboard or a rack (plastic, plated, or wooden only).
8. The following day, untie your fabric and following these steps for washing:
 - A. Rinse in cold water until water runs clear.
 - B. Rinse in warm water until water runs clear.
 - C. Wash (by itself) in a machine or bucket with a small amount of shampoo. It can be washed normally in the future after the first wash.
9. Congratulations!!! You have successfully completed the experiment and will have a long, lasting tie-dye material that will make you remember chemistry fondly!!!

DATA: Observations Days 1 & 2

Use pH paper to measure the pH of the sodium carbonate solution.

DISCUSSION:

1. The pK_a of $\text{HCO}_3^-/\text{CO}_3^{2-}$ is 10.2 Use the approximate pH value and the Henderson-Hasselbalch equation to calculate the approximate ratio of HCO_3^- to CO_3^{2-} . Show the equation used and your work here.
2. What is natural dye? Describe some natural dyes.
3. What is a synthetic dye? Describe some synthetic dye?
4. Is the manufacture of dyes regulated by the federal government? Why/Why not?
5. Are dyes that are used in foods regulated by the federal government?
6. How do the dyes used in the US compare to dyes used in other countries?

RESOURCES: NEEDED

CONCLUSION: