



Chemistry in the Library:

What's in a Color?

<http://mdchem.org/citl/citlmain.html>

e-mail: chemists4fun@yahoo.com

Safety Rules

- ❑ **Wear safety goggles.** This means from when you're told to put them on until you're told they can come off.
- ❑ **Detect odors safely.** Use you hand to wave fumes to your nose. Never stick your nose directly into anything.
- ❑ **Wash spills immediately.**
- ❑ **No running, pushing, or shoving.**
- ❑ **Clean up your mess!**
- ❑ **Get help.** If you have any questions, please ask before proceeding.
- ❑ **No eating or drinking.**
- ❑ **No unauthorized experiments.** Only do the things the leader tells you to.

Experiment 1:

Color changing markers are often associated with magic but there is no magic in the chemistry involved. Do this short experiment to understand how the color changing markers really work!!

Materials:

1 set Magic Markers	Small amount bleach (5 ml) - sodium hypochlorite (NaOCl)	Small amount citric acid (5 ml) - ($H_3C_6H_5O_7$) can try to substitute lemon juice ... this is not concentrated citric acid but might work
4 Cotton swabs	Small amount sodium carbonate (5 ml) - (Na_2CO_3) can try to substitute baking soda in water (add baking soda to water until solution is saturated (it leaves some solid on the bottom when being mixed)	Small amount sodium sulfite (5 ml) - ($Na_2SO_3 \cdot 7H_2O$) - used in photography as a preservative - might be able to easily get some from a photography store

1) In the box below, draw horizontal (left to right) lines with each of your magic pens that connects the arrows together.

	"Magic Pen"	Bleach	Citric Acid (acid)	Sodium Carbonate (base)	Sodium Sulfite (reducer)
Red	>				<
Orange	>				<
Yellow	>				<
Green	>				<
Blue	>				<
Purple	>				<
Black	>				<

2) Using the white color-change wand, draw a straight, vertical line (top to bottom) under the space marked "Magic Pen" that crosses all color lines.

3) Dip 1-cotton swab in the bleach. Touch the tip of the bleach cotton swab to each of the colors in the column. Repeat with a new cotton swab for each of the solutions: citric acid, sodium carbonate and sodium sulfite solutions. Don't "draw" a line down...just touch the line with the cotton swab

4) Describe and compare the effects that the wand, bleach, acid (citric acid), base (baking soda), and reducer (sodium sulfite) solutions have on all of the colored lines. Are the pens sensitive to acids, bases, or reducer? Which of these chemicals is in the color changing marker??

Experiment 2: Lets investigate how the color changing markers work.

Materials:

1 set Magic Markers - you only need to use 3 of them for this experiment: recommend using blue, purple, & black	3 small vials	Chromatography strips - the plastic backed strips work the best - need strips about 2 $\frac{1}{2}$ " long x $\frac{3}{8}$ " wide
1 plastic pipette	Small vial or cup of water	

- 1) Make a spot with one of your markers about $\frac{1}{4}$ " from the bottom of one of your chromatography strips. Now put another spot at the top of your strip. This is your control spot and allows you to compare any changes after your experiment.
- 2) Mark two more strips in the same manner with your **purple** and **black** markers.
- 3) Using your plastic pipette, transfer 1 squirt of water into each of your three vials.
- 4) Place one strip into each of the vials.
- 5) Wait for the water to move about 1.5" up the strip (about to the neck of the vial), then remove from the water and lay them flat on a dry napkin.
- 6) Observe what happens to your spots. What happens when the water moves up your chromatography strips? Compare the end result to your control mark.

The ink is really a mixture of several inks. Can you see the color that the marker changed to in our first activity on the paper strip in this experiment?

Blue	→	blue + turquoise
Purple	→	pink + blue
Black	→	yellow/orange + dark blue

Experiment 3:

Materials:

Used chromatography strips from Experiment #2	Cotton swabs	Sodium sulfite solution
---	--------------	-------------------------

Take a chromatography strip from experiment 2. How many different colors can you identify? Now dab some sodium sulfite on each color on the paper. What happens?

The color changer reacts with some of the inks and makes some colors disappear, changes some, and does not affect others.

Blue	→	blue + turquoise	→	turquoise only
Purple	→	pink + blue	→	pink only
Black	→	yellow + dark blue	→	yellow/orange



Did you know?

- All colored materials absorb certain wavelengths of visible light and reflect other colors. We see the reflected color!
- Sodium sulfite is a reducing agent and has the formula Na_2SO_3 . In chemistry, a reducing agent gives or donates electrons.
- Sodium carbonate is a base and has the formula Na_2CO_3 . A base is a substance that reacts with hydrogen ions (H^+).
- Citric acid is an acid and has the formula $\text{H}_3\text{C}_6\text{H}_5\text{O}_7$. An acid gives hydrogen ions when it reacts.

Experiment 4:

Materials:

Cotton swabs	Plant samples (suggestions: 2 or 3 different types of leaves, some grass, petals from different flowers)	Solutions from Experiment #1
--------------	--	------------------------------

1) Rub your plant samples in different boxes in the space below. Be sure to label the rubbing with the name of the plant you used to create it. Rubbing the plant on paper removes the waxy coating that protects the plant and allows you to rub off some of the pigments in the plant cells.

2) Using a cotton swab, touch the citric acid (acid), sodium bicarbonate (base) and sodium sulfite (reducer) to each plant rubbing in different locations in the box. Be sure to label each spot with "acid", "base", or "reducer".

3) Observed what happens.

NAME:	NAME:	NAME:
NAME:	NAME:	NAME: