Color and Candy Chromatography

FRAMEWORK

I. Scientific and Engineering Practices
- 1. Asking questions
- 8. Obtaining, evaluating, and communicating information

II. Cross-Cutting Concepts
- 1. Patterns

III. Physical Sciences
- PS 1: Matter and its interactions

SKILLS/OBJECTIVES

- Practice making hypotheses about possible outcomes
- Explore the properties of colors
- Visual the mixing of colors to form others
- Carry out an experiment using chromatography
- Separate the out the colors in felt-tipped pens and candy dyes
- Understand the technique of "chromatography" for separating mixtures
- Understand capillary action

MATERIALS

- Magic Markers (at least two different colors)
- Plastic cups
- Water
- Straws
- Felt-tipped pens
- Rubbing alcohol
- Vinegar
- Coffee filter (or filter paper) cut into 1" strips
- Skittles candy
- Q-tips
- M & Ms

NOTES

- Try to have a large variety of colors of markers available for kids to use so that experiment is done with all of the colors.
- The second activity should be done in smaller groups
- Always make sure that the students do not wet their spots of color directly with the liquid. If the spots themselves are wet with liquid before the experiment begins, it will not turn out properly; they want the liquid to be carried by capillary action to the spots

BACKGROUND

- You know that there are primary colors and that there are secondary colors, and when you mix two colors you often get a new color.
    - What does the color wheel look like? What are primary colors and what are the secondary colors?
    - What do yellow and blue make?
    - * If younger kids have not gone over this idea then just have them list the different colors
- Today we are going to prove that a single color you see is actually made up of different colors.
    - Hold up a marker and ask the kids what color it is. Ask them what other colors they think might be in the marker's dye.
- We are going to do this by using chromatography.
- **Chromatography** is a technique used by scientists to separate mixtures. It comes from the Greek words for "color" and "writing."

Additional Information:

- The components of a mixture can be separated based on their different affinities for other substances. The colors which are more chemically attracted to the paper (the stationary phase) will not travel very far because they like to stick to the paper. The colors which are more attracted to the liquid (the mobile phase) will move farther up the paper.
- The liquid moves up the paper via capillary action: the ability of a liquid to flow in very narrow channels against gravity due to attractive forces between the liquid and the channel. This is how water moves up from the roots of plants.
- Some of the dyes we use everyday are actually mixtures of different colors. We can use chromatography to separate these colors, so we can see how many colors compose the dyes.

Activity #1	**Chromatography**
Materials	- 2 coffee filter strips - magic markers in 2 different colors - plastic cup - water - tape - 2 straws
Worksheet	No

1. Give each student 2 strips of coffee filters (about 1.5 inches in width), 2 magic markers of different colors, 2 straws, some tape, and a cup with ¼ inch of water in it.

2. Have the kids use the markers to draw lines on the coffee filters and then place them in the water. See the image below.

    a. **Using a marker, draw a thick, straight line about ½ inch up from the bottom of one of the filters.**

    b. **Place the filter in the water so that the colored line is above the water, and anchor the strip using the straw and the tape. The strip should hang down into the cup.**

    c. **Repeat for the second strip.**

3. In 5-10 minutes the water will have worked its way up the strip. Make sure that the kids keep an eye on the experiment and remove the filter from the water as soon as the water has reached the top of the paper.

    a. **Remove the filter from the water as soon as the water has reached the top of the paper.**

4. Before viewing the final product, have the kids make predictions about what colors the choice marker contains (ex: orange contains red and yellow, etc.). NOTE: Black is one of the most interesting colors to look at, if one of the students does not choose it make sure you do one or two of your own. Have the students discuss their results:

    a. What color did you start with? What colors do you see now? What different colors make up the marker color?

    b. Why does the color travel up the paper with the water?

        i. The dye in the marker is able to dissolve into the water and the filter paper absorbs the water.

http://library.thinkquest.org/28599/experiment_paper_chromatography.htm

Activity # 2	**Candy Colors**
Materials	o Strips of filter paper o Q-tips o Skittles and M&Ms o Cup of water o Cup of vinegar o Cup of rubbing alcohol
Worksheet	No

- **Break up students into small groups**
- **Toward the end of the filter strips, use a Q-tip to rub of color from the candies and onto the filter paper.** (It may take several times to get a dense spot of the color)
- **Let the spots dry**
- **Place that end of the papers into the glasses, but <u>don't' let the dot of color touch the water or alcohol</u>.**
- **Watch the water soak in and travel up the papers via "capillary action." The liquid will dissolve the colors and carry them up the paper.** If the dyes have radically different affinities for the paper, than they will be separated based on their chemical structure; if they have similar affinities, they should be separated based on their weight.
- **Now add vinegar to the water. What effect does this have on the color chromatography?** The dyes may be more attracted to the mobile phase, so they could be carried up farther.
- **What do the colors look like? Which have travelled the farthest? What does this say about the dyes?**

CONCLUSIONS

- Recap the primary and secondary colors, and which colors can be formed to mix others.
- Chromatography is used by scientists to analyze mixtures, identify their components, or remove impurities.
- This technique is employed in pharmaceutical companies, hospitals, and crime labs. For example, two different pens with different ink will appear different on the strips of filter. This method can be used to determine what type of pen was used to write a letter in order to solve a mystery.
- Next time you spill water on ink, don't think it's a mistake, think it's chromatography!