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## HIDDEN COLORS IN MARKERS!

Mad Scientist-to-Go


## With this experiment, you'll be able to see all sorts of different colors out of the ink from your markers!

## MATERIALS:

- Two white coffee filters (paper towels also work)
- Scissors
- Ruler
- Drawing markers (not permanent): any colors, but we recommend black in particular
- At least one pencil
- At least two tall water glasses (one for each color you will be testing), four inches or taller
- Water
- Two binder clips or clothespins
- Drying rack or at least two additional tall water glasses (one for each color you will be testing)
- Pencil or pen and paper for taking notes


## Hidden Colors Experiment

## INSTRUCTIONS:

1.Take either your coffee filters or your paper towels and cut them into strips that are about one inch wide and at least four inches long. The amount of strips depends on the amount of markers you'd like to test (one strip per marker).
2. Draw a line with the marker you're testing across your strip. It shouldn't touch the bottom or the sides of the strip, but it should be pretty close (see left).
3. Write the name of the color and brand of the marker at the top of the strip with pencil (if you write it with marker, it'll fade away in the next steps).
4. Repeat steps two and three for the amount of strips (and markers!) you're using.
5. Fill your glasses with water. The goal is to have the water barely touch the bottom of each strip, but not touching the marker line (see diagram below for the set up).
6. Before you add your strips to the water, write down some predictions. What will happen once the water touches the marker ink?
7. Using either a binder clip or a clothes pin, attach your strip to a pencil. Lie the pencil on top of your glass, so that the strip dangles down to the water.
8. Repeat steps 5-7 for each strip you have (you can either do them all at once, or in rounds, depending on how many glasses you have access to).
9. Watch as the water rises up. What do you see happen?
10. Once the water reaches the top (which may take up to 10 minutes), write down some observations. How many colors can you see? Is there more of one color than another? Did one color travel farther than another?

11. Move the wet strip either to an empty cup or a drying rack, so that it can hang to dry. If you leave the strip in the cup with water, the marker ink might get into the water (which would affect future tests).

## HOW DOES IT WORK?

This whole experiment is based on the concept of chromatography, or the separation of mixtures. In this case, the mixture we separated is the ink in the marker. Paper chromatography, which is what this experiment is, uses a solvent to separate some particles of a solution from each other. The water we used in this experiment acts as the solvent.

In each marker, the color you see in the ink may actually be made up of multiple different colors. Some markers may only show one color, like yellow, because they are primary colors. Other colors, like brown or black, are mixes of these primary colors. While these colors mix and look the right way to our eyes, the molecules that make up these colors are still separate. All these different molecules also have different weights. So, when our solvent (water) interacts with the mixture (the ink), some colors move faster and separate farther than others. This creates the separated look that you see on your strips!

## OTHER QUESTIONS TO EXPLORE

- Are the same color of marker from different brands (particularly black and brown) made up of the same ink? Would they create different results?
- How does the ink of a drawing marker compare to that of a pen? Would the ink travel as far up the paper?
- What happens when you draw the ink line further up the strip? Or draw multiple lines on one strip?


## FUTURE EXPERIMENTS!

With the help from an adult, try creating a similar effect with permanent markers! Replace the water with isopropyl rubbing alcohol. Between a permanent and a non-permanent marker of the same color, are they made with the same mixture of colors? Will they separate the same way?

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This experiment was inspired by a project highlighted on Scientific American's website: www.scientificamerican.com

