

The Case of the Missing Donut

To reward her class for receiving top scores in their state science exam, Ms. Montano, a science teacher at Strange School Academy, brought a chocolate donut for each of her students. Michael, a student in Ms. Montano's class was out of the class when Ms. Montano passed out the donuts. When he returned to class he found that his donut had been stolen and note left in its place that read:

YUMMY DONUT.... LOL!

Ms. Montano decided to put the class' science skills to the test to determine who stole Michael's donut. Since the note was written in marker, a process called chromatography can be used to determine which student wrote the note. Five students had a marker on their desks; the following are the five suspects.



1



2



3



4



5

What is Chromatography? Chromatography is the physical separation of a mixture (two or more substances that are mixed together, but not chemically combined) into its individual components. Paper chromatography can be used to separate the components of inks and dyes. Combinations of dyes are used to make a specific color marker and the separation pattern will be unique to that one specific marker.

Student Chromatography Lab Sheet

Who stole Michael's Donut?

Since, for today, you are a student at Strange School Academy, you will be running the chromatography lab. Your teacher already solved the crime, so she/he has marked a filter paper with the marker used to write the note. You will attempt to match the sample to the markers in the packet given to you by your teacher.

Materials you will need:

Coffee filter

Unknown sample (filter paper with mark from marker used by thief)

Water

Markers collected

Clear plastic cup

Masking tape

Directions:

1. On the bottom of each marker place a piece of masking tape and label the markers with a number 1-5. EX: Marker #1, Marker #2..,
2. Cut out five strips of filter paper (coffee filter paper works well) about 1" wide and 4-5" long.
3. Write the numbers "1" to "5" at one end of each blank strip of filter paper. Make a line on strip #1 using marker #1; draw the line about 1" from the end of the strip. Do the same for strip #2 and marker #2 and so on for all of the markers. (the line should run horizontal)

4. Obtain a clear plastic or glass cup or container. Put in only enough water to make the water about 1/4" deep in the bottom.
5. Now add the strips with the ink mark down. Put the strips in just far enough so that the water just touches the paper. Don't put the strip in so far that the ink mark is under water. When each strip is just right, fold the strip over the side of the cup to keep the strip in place. Make sure to add the strip from your teacher from the note written to Michael.(unknown)
6. Wait several minutes for the water and ink to diffuse, then take out the strips and compare the results with the unknown.

Why do the filter papers look so different?

Colors separate out of the black ink mark from a marking pen line on a coffee filter. As water seeps up the filter paper, the molecules of color are carried with them. They can be separated because they are in a mixture rather than being chemically combined. They will attach themselves to the cellulose in the paper, but with differing affinities depending on their chemical nature. Some cling hard, others are only weakly held. Those that are weakly attached to the cellulose travel further up the paper than those with the stronger bond, and they will spread further.

Answer the following questions:

What colors did your group observe in each of the black ink samples?

Do the colors occur in the same order on all the samples? Explain.

Which marker matched the unknown? _____

Who Stole Michael's Donut Lesson

Objective: Students will learn about chromatography in the use of forensic science and use paper chromatography to solve a crime.

Before the lab: Make sure and cut and mark a section of filter paper to use as the "Unknown sample". Make sure each group gets five markers and one "unknown sample" marked with one of the five markers. Keep the thief the same for each group.

Materials needed:

Coffee filters

Unknown sample (filter paper with mark from marker used by thief)

Water

Markers collected

Clear plastic cups

Masking tape

Procedure:

1. Read with the class "The Case of the Missing Donut".
2. Review Directions with the class
3. Hand out material
4. Hand out student direction/work sheet
5. As students begin answering the questions at the bottom their work sheet, once they complete the lab, let the class know which marker belonged to which suspect.

Closure: Lead a discussion of the lab guided by questions on student work sheet.

SOURCES:

<http://www.sciexperiments.com/chromatography/ChromatographyDetective.html>

<http://sciencespot.net/Pages/classforsci.html#chroma>