Name:

Date:

School:

Facilitator:

10.02 Ink Chromatography

**Required materials:**

* 4 **different brands** of black felt tip pens or fine tip markers
* White paper
* Two coffee filters (if coffee filters are not available, try white copy paper
* one small cup
* rubbing alcohol (water can sometimes be used as the solvent)
* pencil
* paper towels

**Procedure: Read the entire procedure before you begin!**

1. Cut the coffee filters into five strips 2.5 cm wide.
2. On each of these five strips, draw a line with a pencil 2.0 cm from the bottom.
3. On one of the strips, have someone to place a dark spot of ink from ONE of the pens on the pencil line. Do not watch them do it because the goal is to use chromatography techniques to determine which pen was used to make the mark. This spot of ink will represent the unknown ink from a “note” found at a crime scene.
4. Pour rubbing alcohol into a small cup so that it will not be above the 2.0 cm line you drew on the filter paper. Hang the filter paper with the note on the side of the cup so that the paper barely touches the solvent. Do not let the filter fall down in the cup. See image below. ink doesn't touch the solvent (water or alcohol). See image. 
5. If the ink does not start to move (separate into colors) after being in the alcohol 10-15 minutes, you can try water. You will have to get someone to make a mark on a new piece of filter paper and repeat the procedure above. Some inks separate better in water than alcohol.
6. After you decide which solvent (alcohol or water) works best, you will continue with the remaining coffee filter strips.
7. Place a dark spot of ink from each pen on the pencil line of the four remaining strips of coffee filters. Be sure to identify each pen using #1-4 at the top of the strip. Write this number in pencil so it does not smear.
8. Again, hang these four strips of filter paper on the sides of the cup so that the paper barely touches the solvent (alcohol or water). See image above.
9. Leave the strips of coffee filters in the solvent until the black ink starts to separate into colors and you no longer see changes. The time will vary depending on the type of ink. You must watch them carefully and take them out of the solvent before the colors run off the end of the filter paper.
10. Next, remove the coffee filter strips from the solvent and place on a paper towel or white sheet of paper. Save these until your lab has been graded.
11. Determine which pen was used to write the “note” by examining the colored banding patterns of the pens. This is called a chromatographic pattern. See image below. The pattern on one of the four strips should match the pattern found on the paper that has the unknown ink mark. 
12. Measure the distance from the original spot to the bottom of the colored bands. Measure in centimeters. For example, if the note has yellow bands, you would measure from the pencil line to the yellow color in centimeters. If the note has the color red in it, you would measure from the pencil line to the red color in centimeters. Remember that you only use decimals when measuring in centimeters. For example, 1.5 cm. Record all measurements on the chart below.
13. Measure the different colored bands for each pen and record your data on the student data sheet. Each pen may not have all of the colored bands. Remember, although they are all black, each brand of ink is created in a different way.
14. Place an X in the box under Match for the note and the numbered pen that has a matching chromatographic pattern. Place an X in the box under No Match for the note and the numbered pens that do not have matching chromatographic patterns.
15. Circle the chromatographic pattern on the coffee filter of the unknown pen. Circle the chromatographic pattern of the pen that matches the note.
16. Take a picture of your five coffee filter strips and insert it in the box below.

**Data:**

Take a picture of your results and insert it below. Clearly indicate the written note and the pen sample you believe matches in your picture.

|  |
| --- |
| **Insert image here:** |

For each sample, measure the distance from the original spot to the bottom of the colored band. Use this data as well as the visual data to determine the sample match.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Known ink sample** | **Yellow** | **Red** | **Blue** | **Black** | **Match** | **No match** |
| Note |  |  |  |  |  |  |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |

**Analysis:**

1. Which pen wrote the note? Explain your answer.
2. Why does the ink separate when placed in the solvent?
3. Explain why pens with the same color of ink have different patterns of ink chromatography.
4. Did you have any problems with the experiment? If so, how did they influence the experiment?