



## Forensic Analysis of Inks using Paper Chromatography

A forged check was identified on campus and the local crime lab needs your help. They are backlogged with cases and hope your knowledge of chemistry can be put to use. There are four suspects and pens have been confiscated. Determine which pen wrote the forged check, if any at all.

**Background:** In this experiment, you're using a technique called chromatography. The name comes from the Greek words chroma and graph for "color writing." The technique was developed in 1910 by Russian botanist Mikhail Tsvet. He used it for separating the pigments that made up plant dyes.

Paper chromatography is also way to analyze mixtures, such as ink, by separating them into the original chemicals that are included in their makeup. Crime scene investigators use chromatography to identify and separate many different substances. Detectives often use chromatography to identify drugs from narcotics to aspirin in blood and urine. A solvent dissolves the substance and separates it based on its polarity. More polar substances dissolve and separate well in water. Non polar substances dissolve in non-polar solvents such as rubbing alcohol. In this experiment, you will use both water and rubbing alcohol in-order to separate four mixtures of inks found in different black markers.

### Objectives:

1. Examine and compare ink samples between the forged check (unknown) and known brands of black markers.
2. Learn about ink molecules, their degree of polarity using different solvents, and why molecules can be separated into different colors.

### Materials:

Black felt-tip suspect markers  
Crime scene chromatograms and forged check  
Chromatography paper strips (two per student)  
Plastic cup or beaker  
Water (polar solvent)  
Rubbing alcohol (nonpolar solvent)  
Ruler

### Crime lab protocol:

1. Measure 1 cm from the bottom edge of the chromatography paper and draw a straight pencil line from side to side. This is called the front line.
2. Each pen is to be dotted into its own "lane" on the front line. See the diagram on page 1 for details. Allow the spots of ink to dry. Label below each dot using pencil, a letter or number to represent each sample.
3. Place the spotted paper into a beaker (spotted edge down) of water. Make sure there is just enough water so that the water level does not touch the ink.
4. Once the water passes up the paper and the chromatogram has developed, remove it from the beaker and using a pencil, mark the final position of the solvent (water). This is called the solvent front.
5. Using a new piece of chromatography paper, repeat this process using rubbing alcohol as the solvent instead of water.

### Write a summary of findings to the FBI. The summary must include the following:

1. Explain how, chromatography, the laboratory method used to determine the identity of the marker, works to separate the ink.
2. Describe why the testing involved both water and alcohol as the solvent.
3. Explain the different separation results with the water and the rubbing alcohol?
4. Identify specific differences between the four black markers using the chromatogram data and type of solvent used.
5. How was a match between the pen, forged check and the chromatograms determined?