



# Separation of Pen Inks by Paper Chromatography

## OBJECTIVES

- Demonstrate proficiency in qualitatively separating mixtures using paper chromatography.
- Determine the  $R_f$  factor(s) for each component of each tested ink.
- Explain how the inks are separated by paper chromatography.
- Observe the separation of a mixture by the method of paper chromatography.

## MATERIALS

- 12 cm circular chromatography paper or filter paper
- distilled water
- filter paper wick, 2 cm equilateral triangle
- isopropanol
- numbered pens, each with a different black ink, 4
- pencil
- petri dish with lid
- scissors



FIGURE A Paper chromatography reveals the different colored dyes that black ink contains.

## BACKGROUND

### Paper Chromatography

Details on this technique can be found in the Pre-Laboratory Procedure “Paper Chromatography” on page 848.

### Writing Inks

Most ballpoint pen inks are complex mixtures, containing pigments or dyes that can be separated by paper chromatography, as shown in **Figure A**.

Black inks can contain three or more colors; the number of colors depends on the manufacturer. Each ink formulation has a characteristic pattern that uniquely identifies it.

In this experiment you will develop radial paper chromatograms for four black ballpoint pen inks, using water as solvent. You will then repeat this process using isopropanol as the solvent. You will then measure the distance traveled by each of the individual ink components and the distance traveled by the solvent front. Finally, you will use these measurements to calculate the  $R_f$  factor for each component.

## SAFETY



For review of safety, please see **Safety in the Chemistry Laboratory** in the front of your book.

## PREPARATION

1. Determine the formula, structure, polarity, density, and volatility at room temperature for water and isopropanol. The following titles are sources that provide general information on specific elements and compounds: *CRC Handbook of Chemistry and Physics*, McGraw-Hill *Dictionary of Chemical Terms*, and *Merck Index*.