

Activity: Which Ink Is Which?

(adapted from Facts on File: Forensic Science)

Introduction:

Because manufacturers use different ink formulations, black pens from different sources may contain a mixture of colors. In the first part of this experiment, you will use a technique called paper chromatography to separate the colors used in different black pens. Because most fiber-tipped pens use water-soluble ink, you will use water as a medium for the chromatography.

Sometimes criminals add additional words to a check that has already been written. Forensic investigators can examine such checks and determine what ink was used for each of the words (hoping the criminal has used a different pen from the original pen used to write the check). In the second part of the experiment, you will “alter” a check fraudulently and perform paper chromatography on the ink to determine which part of the writing was altered.

Materials:

3 black pens from different manufacturers (use roller-ball, gel, or fiber-tipped pens, not ballpoint pens and not permanent marker)

five 2 cm wide strips of white blotting paper or filter paper, each 17 cm long
stapler

glass rod (or craft stick)

masking tape

pencil

reusable adhesive putty (optional)

1 liter beaker

approx. 40 ml water

eyedropper

sheet of aluminum foil

ruler

scissors

clock or stopwatch

2 sheets of paper towel

2 paper clips

Procedure:

Part A: Testing the pens

1. Using masking tape and a pencil, label each pen 1, 2, 3.
2. Measure the depth of the beaker and then cut 3 strips of blotting/filter paper each 2 cm longer than the depth of the beaker.
3. Place the glass rod or craft stick over the top of the beaker and fold a strip of blotting/filter paper over it so that the lower end of the strip touches the bottom of the beaker. Remove the paper from the glass rod/craft stick while holding the position of the folded edge. Staple the paper fold in place about 1 cm from the fold.

4. Fold over and staple the two remaining strips, making sure they are the same length as the first. Use the pencil to label each strip 1, 2, and 3 at the folded end. Use the pencil again to draw a line 1cm from, and parallel to, the unfolded end of each strip.
5. Using the correctly labeled pen for each strip, make a 2 mm diameter dot on the center of the pencil line at the unfolded end of each strip.
6. Thread the strips onto the glass rod and place it over the top of the beaker.
Optional: Use a small amount of re-usable adhesive putty to hold the rod in place. Move the strips so that they do not touch each other.
7. Use the eyedropper to carefully add about 20 ml of water to the bottom of the beaker. Be careful not to splash the blotting/filter paper.
8. Cover the top of the beaker with aluminum foil and observe the strips every few minutes for about 25 minutes.
9. Remove the strips from the water and slide them carefully from the glass rod. Place the strips on the paper towel and allow them to dry for about 15 minutes.
10. When strips are dry, staple them to the correct column of the data table.

Part B: Detecting the Fraud

1. Choose two pens (X and Y) from Part A that show different ink patterns.
2. Use pen X to make out the check (handout included) for the sum of “one hundred dollars,” writing the words on the line and filling in the box with the number 100.
3. Use pen Y to squeeze the word “thousand” between the word “hundred” and the word “dollars,” and add three zeros to the number in the box. The check now appears to be made out for the sum of \$100,000.
4. To show that a forgery has taken place, cut out the word “hundred” and the word “thousand,” making sure that you do not cut out any of the line under the writing.
5. Prepare two strips of blotting paper/filter paper following the procedure in steps 2 and 3 of Part A. Use the pencil to draw a line 1 cm from, and parallel to, the unfolded end of each strip.
6. Use a paper clip to attach the cutout word “hundred” to one strip and the word “thousand” to the other. The ink must be on the side that touches the blotting/filter paper, and the lower edge of the cutout word must touch the pencil line.
7. Follow steps 6 to 9 of Part A.

Analysis:

Part A: Testing the Pens

1. What did you observe on the paper strips after you added the water?
2. Did all the ink dots move?
3. Did all the ink dots form the same pattern?

Part B: Detecting the fraud

1. Were you able to identify the inks used for the different words?
2. Why were you careful not to cut out any of the line when you cut out the writing?