



## Forensic lab

### Objective:

The student must find out who stole the piece of cake by using ink and the crumbs left behind to match the suspect to the crime.

### Introduction:

Crime scene: someone stole a piece of Mrs. Bakers freshly baked cake. “Who done it”?

Someone left a note saying they were hungry and stole a piece of cake – and we sampled the ink and cake crumbs from the crime scene.

We will compare the crumbs left at the crime scene with crumbs we found on the shirts of 5 suspects by comparing the crumbs under a microscope and seeing if we can match them to the crime scene. We also found pens in each of the suspects’ pockets and can compare the ink on the pens with the ink left on the crime scene note.

We can ask: Do the same suspects match with the crumbs and the ink?

\* Either experiment can be done by itself or as a pair.

### Materials:

- Chromatography paper: Whatman 3mm or similar chromatography paper
- Ink Pens:
  1. For the crime scene (#4): Papermate 1.0 M stick pen (black ink) Product number PAP3331131
  2. For Suspect 1: Uni-ball 207 0.7mm retractable vibrant gel pen (black ink) (says

Signo on the clip) Product number SAN33951

3. For Suspect 2: Pilot Precise V5 Premium rolling ball extra fine 0.5mm capped pen (black ink).
4. For Suspect 3: Pilot G2 Premium gel roller retractable black fine 0.7mm pen (black ink). Product number 31020 G27 – BLK
5. For Suspect 5: Pentel EnerGel 0.5mm ball Needle Tip capped pen (black ink). Product number BLN25-A.

Note: these work well for chromatography with alcohol. If water is used instead, use the same assortment of pens, but make #2 (Pilot Precise V5 pen 35334 PV5 – BLK) or #5 (Pentel EnerGel BLN25-A) the crime scene pen as these two give very distinct patterns in water and in alcohol, while pen number 4 is not soluble in water. (Note that pen #1 is not soluble in alcohol, but that's okay as long as it isn't the crime scene pen).

- Microscope, glass slides, crumbs (see below)

## Protocol:

### Part I --- Microscopy:

1. Place samples on glass slides and cover them with scotch tape and label the slides "Suspect 1", "crime scene", etc. Students can then move slides back and forth under different microscopes. Make 1 set of each sample for each available microscope. Make sure they are distinguishable (popcorn, sand, salt, flour, sugar, etc.) One slide should be the crime scene (label c/s). Use the same material for one of the suspects (for example, #4).

To streamline this activity for numerous students in a class, we recommend imaging each slide onto a monitor so that students can look at each image at the same time and guess. If the class is small we recommend letting students use the actual microscope(s); this could be done with just a few at a time by putting the appropriate slides under the microscope.

2. Students decide who committed the crime. Have them mark a sheet of paper with the number of the slide they think is the match. The teacher should then tell them if they are correct or not. If correct, students should move on to Part II.

### Answer Sheet for Teacher:

The data agree and students **suggest** that person #4 was the one “who did it”.

You can change the crime scene if desired. For example:

Who took the baby’s stuffed animal and played with it? Some residue was left behind that allows us to compare people:

**Person A** had been to the beach --- **sand**

**Person B** has recently made a cake --- **flour or baking soda**

**Person C** went to a movie --- **popcorn**

**Person D** helped mother change baby --- **powder**

**Person E** went to dinner and spilled salt on him/herself --- **salt**

**Person F** helped father make lemonade and spilled sugar --- **sugar**

## Part II --- Inks:

Chromatography can separate inks into colors on absorbent paper. Use pens with ink that separate different colors after 5 min on a paper towel or filter paper in 70% isopropanol (note – washable inks usually will not separate in alcohol but may in water). This activity requires 1 liter of 70% isopropanol (rubbing alcohol) and several 500 ml beakers in which to do the chromatography.

1. With a pencil, draw a horizontal line approximately  $\frac{1}{2}$  inch from the bottom of each paper for the students to spot the ink samples on. Number spots 1-5 and the c/s (crime scene). Pre-spot the ink for the crime scene on the c/s spot. One ink pen is used as the c/s; that ink pen should also be used as one of the suspects (i.e. number 4). Students can label their own paper at the top with their names, and then draw a small circle of ink on the line at the appropriate number.
2. Make sure the solution in the beaker is below the penciled line and put the paper into the beaker (pencil-mark toward the bottom of the beaker). In ~5 min the inks will separate enough to compare the crime scene ink with a suspect. NOTE: If you are running both experiments, make sure the slide suspects agree with the ink suspects (i.e. make #4 match in both cases).

### Expected Results:

We compared the crumbs and pen inks found in several suspects pockets.

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### Evidence sheet:

#### Microscope analysis

Circle the sample that matches the crime scene:

Suspect number            1        2        3        4        5

Why did you pick that one?

#### Chromatography analysis

Whose ink matches the note left at the crime scene?

Suspect number            1        2        3        4        5

Do your results from the microscope analysis and ink analysis agree?

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