

Lesson 5

Investigation details on Genialy: <https://view.genially.com/62b98e3019c10300188bf136>

Threat letter analysis



Mission 1: The threat letter ink analysis

The Facts

A threat letter has been found on the crime scene.

You will compare this ink with different ink pens found at the suspect's houses.

Forensic science, a branch of science that helps criminal investigations by collecting and analyzing evidence from crime scenes

Ink analysis

Chromatography is a method for analysing mixtures by separating them into the chemicals from which they are made. It can be used to separate mixtures like ink, blood, gasoline, and lipstick. In that case, you are separating the coloured pigments that make up the colour of the pen. Even though a pen will only write in one colour, the ink is generally made from a mixture of different coloured pigments.

To perform ink chromatography, you put a small dot of ink at one end of a strip of filter paper. This end of the paper strip is placed in a solvent, in a beaker or a graduated cylinder. The solvent rises up the paper by capillary action. When the solvent reaches the "spot", it dissolves the mixture of colored substances (pigments).

The chemicals that dissolve best in the solvent will move up the paper strip further than chemicals that do not dissolve as well, effectively separating the pigments: each pigment will produce a different coloured line on the paper. What is produced is a chromatogram. Forensic scientists are able to use ink chromatography to solve crimes by matching documents or stains found at a crime scene to the marker or pen that belongs to a suspect. Forensic scientists analyse the unknown ink and compare it with writing utensils collected from possible suspects.

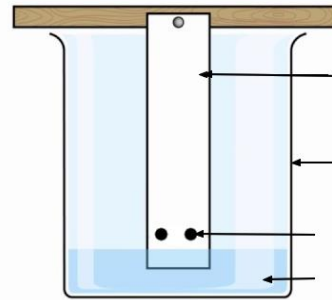
Instructions

1. Use the text to complete the caption of the drawing
2. You have the chromatography of the ink extracted from the threat letter (Available on Genialy) and four pens belong each one to a suspect
3. When the experiment is over, add your results to the drawing:

4. Do you find one of those pens match the one used in the threatening message?

Procedure:

- ⇒ On your filter paper, draw a line with a paper pencil at 2 cm from the edge.
- ⇒ On this line, make small dots using the 4 pencils belonging to the suspects
- ⇒ Put all the solvent into the beaker
- ⇒ Place the paper into the solvent but the solvent needs to be below the ink stains
- ⇒ Wait until the solvent rises up



Dyes: colorants

Mission 2: Search for fingerprints

Fingerprints are the most commonly-collected type of evidence. Because fingerprint patterns are unique to a specific person, they are a very reliable way of identifying a suspect.

There are different types of fingerprints that can be left behind: 1) a fingerprint imprint in a soft surface, such as wax or soap; 2) a patent fingerprint, visible to the naked eye, such as fingerprints resulting from dirty hands; and 3) latent fingerprints, which are invisible, but still present.

These invisible latent fingerprints are made of water, fatty acids, amino acids, and triglycerides—in other words, they result from the oil and sweat that your skin produces naturally. To make them visible, you have to find a way to detect one of these substances present in the invisible fingerprint. The easiest method is called dusting, in which you use a very fine powder that can stick to the oil in the fingerprint. Once the fingerprint becomes visible, you can lift it from the surface with clear tape and transfer it to another surface to then take into the laboratory to analyze further.

Instructions

1. **Dip your brush carefully into the powder. Only the tips of the bristles should be covered with powder. Then, tap the brush to remove any excess powder.**
2. **Sweep the brush carefully all over the letter. Make sure to not apply too much pressure so that you do not wipe the print away. If necessary, add more powder to the brush, but be careful not to add too much. *What happens if you apply the powder to the surface? Can you see a fingerprint developing?***
3. **Wash your hands thoroughly with warm water and soap.**
4. **Take a picture of the fingerprints and compare them to those of the suspects and the victim**

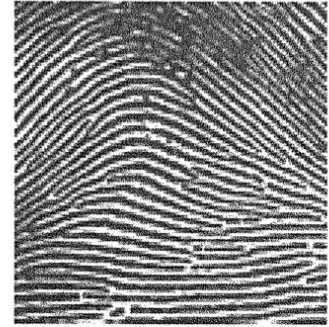
In order to identify and match a fingerprint to an individual, several characteristics must be compared. Like most methods of identification, you start with very general properties and continue to work toward more specific characteristics. When first examining a fingerprint, the three major categories of classification are loop (boucle), whorl (verticelle) and arch (arc). Examples are pictured below:



Loop



Whorl



Arch

However, considering approximatively 60% of the population has loops, 35% has whorls and 5% has arches, this is hardly a reliable means of identifying an individual. So these major categories have been subclassified on further difference among each type.



Radial Loop (right hand)



Ulnar Loop (right hand)

In the loop pattern, ridges enter from one side of the fingerprint, curve around, and exit toward the same side. A loop pattern that opens toward the thumb is called a radial loop and a loop pattern that opens toward the little finger is called an ulnar loop. Loops have type lines, a core, and only contains one delta.



Plain Whorl



Central Pocket Whorl

In both the plain and central pocket whorls, at least one ridge on the fingerprint must form a complete circuit. All whorl patterns have type lines and at least two deltas. In order to differentiate between a plain and a central pocket whorl, a line may be drawn between two deltas (pictured above): if the line touches any part of the complete circuit, it is a plain whorl, if not, it is a central pocket whorl.

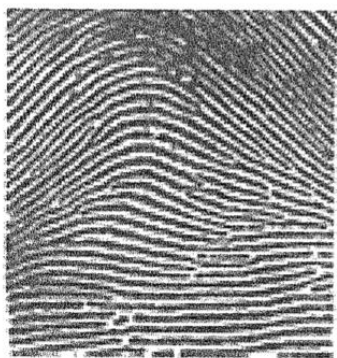
Here are other examples of whorls and arches:



Double Loop Whorl



Accidental Whorl



Plain arch



Tented arch