



High School Science Virtual Learning

Forensic Science
Role of Chemistry

May 13, 2020



High School Forensic Science
Lesson: May 13, 2020

Objective/Learning Target:

**Students will be able to identify the various roles of
Chemistry in Forensic Science.**

1. Classify the following types of matter as either homogeneous or heterogeneous:
Soil
Rubbing alcohol
2. Classify the following as pure substances or mixtures:
Blood
Iron



1. Soil is heterogeneous and rubbing alcohol is homogeneous.
2. Blood is a mixture and iron is a pure substance.



Lesson Activity:

Directions: Watch the video below and read through the information provided on the next few slides.

Link(s): [Chemistry in Forensics](#)

Role of Chemistry In:

Fingerprint Development
Gunshot Residue Analysis

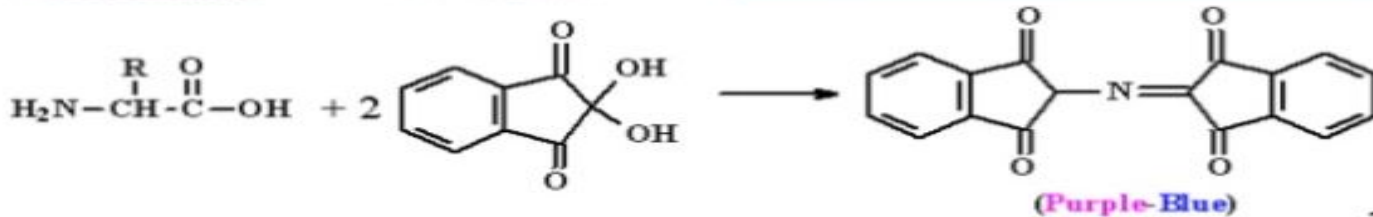


Fingerprint Development Techniques:

Ninhydrin Reaction



Ninhydrin reacts with **α -amino acids** and produce a **purple-colored** product called, **Rhuemann's purple**



Silver Nitrate Reaction



When silver nitrate reacts with **any soluble chloride salt**, the insoluble silver chloride is produced.

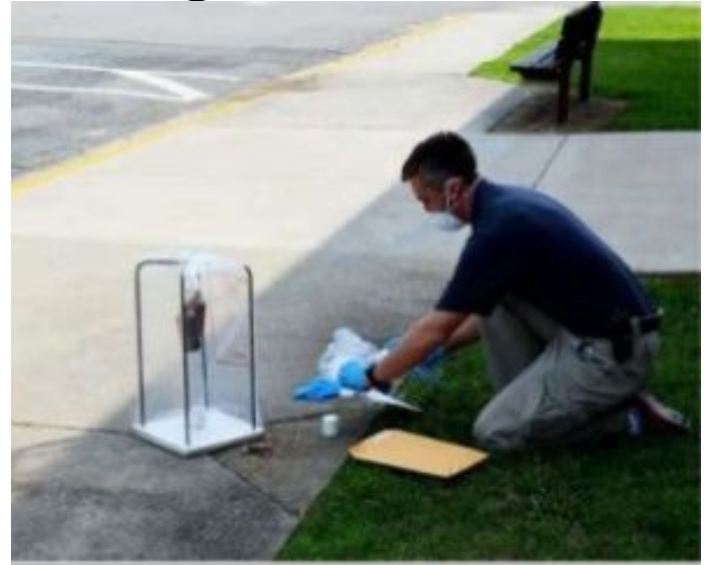
The silver chloride produced is a **white solid** that does not offer much contrast for fingerprint development.

However, as the silver chloride remains exposed to ultraviolet light, it decomposes producing silver and chlorine gas which produces a **purple-black product**.



Superglue Fuming

- Superglue fumes, composed of cyanoacrylate monomers, selectively polymerize on fingerprint residue.
- The polymerization process is typically initiated by negatively charged water-soluble species, which are found in fingerprint residue.
- This allows for the white-gray polymer.



Gunshot Residue Analysis



Gunshot Residue Tests

- Paraffin Test
- Harrison-Gilroy Test
- Atomic absorption spectroscopy (AAS)
- Scanning Electron Microscopy (SEM)

Limitations:

- The residues can be removed by washing the hands.
- It can associate an individual with a firearm but not successful in identifying that person as the shooter.
- It is also possible, but very unlikely, that residue would be deposited on hands by other means.

Paraffin Test

- This test is used to detect the presence of **nitrate residues**.
- These substances are residues from smokeless powder, the propellant used in modern cartridges.
- Paraffin test starts with removing the residues from the hands. After removal, the cast is tested with a reagent (**diphenylamine**). Dark blue spots indicates the presence of nitrate residues.

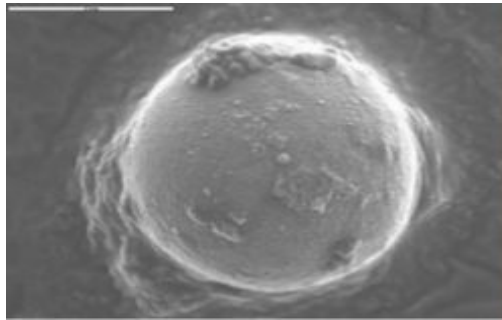


Principal problem :

- Nonspecificity - the test detects nitrate residues, but the source of residues cannot be determined.

Scanning Electron Microscopy

- SEM uses a high-energy electron beam to produce magnification significantly greater than an optical microscope.
- This increased magnification permits the identification of gunshot particles by their characteristic morphology.
- In addition, scanning with an electron beam causes the emission of X rays. Since each element produces characteristic X rays, an elemental analysis of the substances is also possible. Barium, antimony, and lead are the elements that are indicative of firearm discharge.



- Disadvantages:**
- Cigarette lighter flint mimic GSR in morphology
 - Cost of the instruments
 - Time-consuming nature
 - Variation between laboratories in determining the number of particles.

Conclusions

- **Chemistry is an integral part of forensic science** as chemists have made a number of important contributions to forensic sciences over past 2 centuries.
- Forensic scientist must understand chemistry principles, concepts and techniques. They, therefore, look at matter from the chemist's point of view to glean greater information about a substance, person, or crime, for a variety of reasons.
- **Thanks to the chemistry of crime scene investigations, more guilty people get caught and more innocent people are freed.**
- It is definitely one of the most important advances when it comes to criminal justice and **as our technology and knowledge increase, it will only become more reliable.**⁵⁰



Practice

You will use the information from the activity to answer the following questions.



Questions:

1. Identify 3 different types of fingerprint development techniques.
2. What is the product of the silver nitrate reaction?
3. What are some limitations of gunshot residue tests?
4. What might be a problem with using the paraffin test to analyze gunshot residue?
5. What are some disadvantages of using SEM to test for gunshot residues?

Once you have completed the practice questions check with the **answer** key.

1. Ninhydrin reaction, silver nitrate reaction, superglue fuming.
2. Silver chloride
3. The residues can be removed by washing the hands. It can associate an individual with a firearm but not successful in identifying that person as the shooter. It is also possible, but very unlikely, that residue would be deposited on hands by other means.
4. The test detects nitrate residues, but the source of the residues cannot be determined.
5. Cigarette lighter flint mimic GSR in morphology. Cost of the instruments are expensive and the test is time consuming. There are variations between laboratories in determining the number of particles.



Additional Practice

1. [Role of Chemistry in Processing Crime Scenes](#)
2. [FBI Careers: Chemist](#)