

The image shows a spiral-bound notebook with a light-colored, textured cover. The spiral binding is on the left side. The text is centered on the cover.

# Forensics and Science Crime Busters—October 2007

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# Objectives

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- Students will perform a series of tests on evidence obtained from a crime scene
- Analysis of the evidence will be used to solve a crime.

# Qualitative Analysis

- Identification of white powders using solubility, pH, indicators, and for Forensics—flame tests and conductivity tests



# QA

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- Have students perform all tests on each chemical to see how they react during practice, but...
- Create and practice with a flow chart so that every test does not need to be performed to identify a chemical.

**A Sample Flow Chart for Forensics**

Solubility (--) → Iodine test (--) → HCl (--) → CaSO<sub>4</sub>  
Test for starch reaction  
(+) (+) blue-black (+) bubble  
=Cornstarch =CaCO<sub>3</sub>

NaOH test  
on the solution (+) → milky solution=Ca(NO<sub>3</sub>)<sub>2</sub>  
(--) precipitate=MgSO<sub>4</sub>

NaOH test  
On a dry sample (+) → ammonia smell=NH<sub>4</sub>Cl  
(--)

(See complete Flow Chart on Website)

Phenolphthalein  
Test (on dry sample) (+) → pink=Na<sub>2</sub>CO<sub>3</sub>  
(--)

HCl test  
(On dry sample) (+) → bubbles=NaHCO<sub>3</sub>  
(--)

Alcohol solubility (+) Flame test green=Boric acid

# Helpful Hints for QA

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- When testing solubility, add only a tiny amount on the end of a toothpick. Adding too much may give the impression of insolubility, when the solution is just super-saturated.
- Some substances are slow to dissolve. Stir for a sufficient amount of time.

# Helpful Hints for QA

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- Some tests work best by starting with a little of the dry sample.
  - NaOH test for ammonia smell
  - HCl test
  - Phenolphthalein test
  - Flame tests

# Helpful Hints for QA

- Division C can bring in a “cheat sheet”—include your flow chart on it!
- Students should record the tests performed and the results to provide support for their conclusions.
- Practice for speed and efficiency—need time to analyze other evidence

# QA for Science Crime Busters

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- \*-ed items on the list may be presented as mixtures of 2 substances.
- Use the appearance and shape of crystals in the powders as an identifying characteristic
- B Division also has to identify metals and liquids. See the National event site for worksheets and flowcharts for these.

# Polymers

- Plastics can be identified by their density, by burn tests, and by their recycling symbols.
- Cool website showing how to do density tests--  
<http://chemmovies.unl.edu/chemistry/smallscale/SS069c.html>
- Students will not perform burn tests on plastics, but should be able to recognize a picture or description of the results of a burn test.
- **Sample kit** of polymer pellets for \$14.50 from  
<http://www.polymers.eezway.com/> Use to compare to plastics from household items.

# Fibers

- Microscopic analysis and burn tests on natural and man-made fibers, and cat, dog and human hair.
- Teach proper slide-making and microscope techniques. Get students to look at the little details in the microscopic structures of the fibers
- Search the following website for microscopic images of different fibers:  
<http://micro.magnet.fsu.edu/index.html>

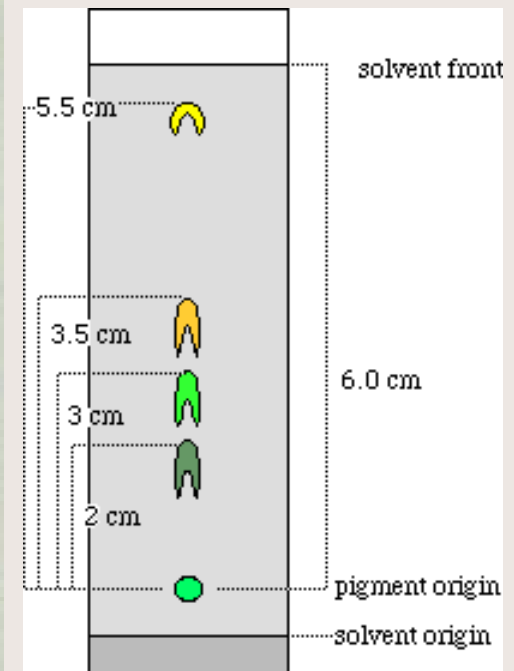
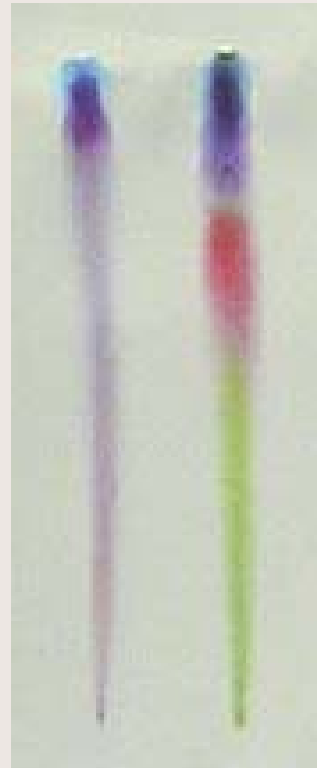
# Fibers

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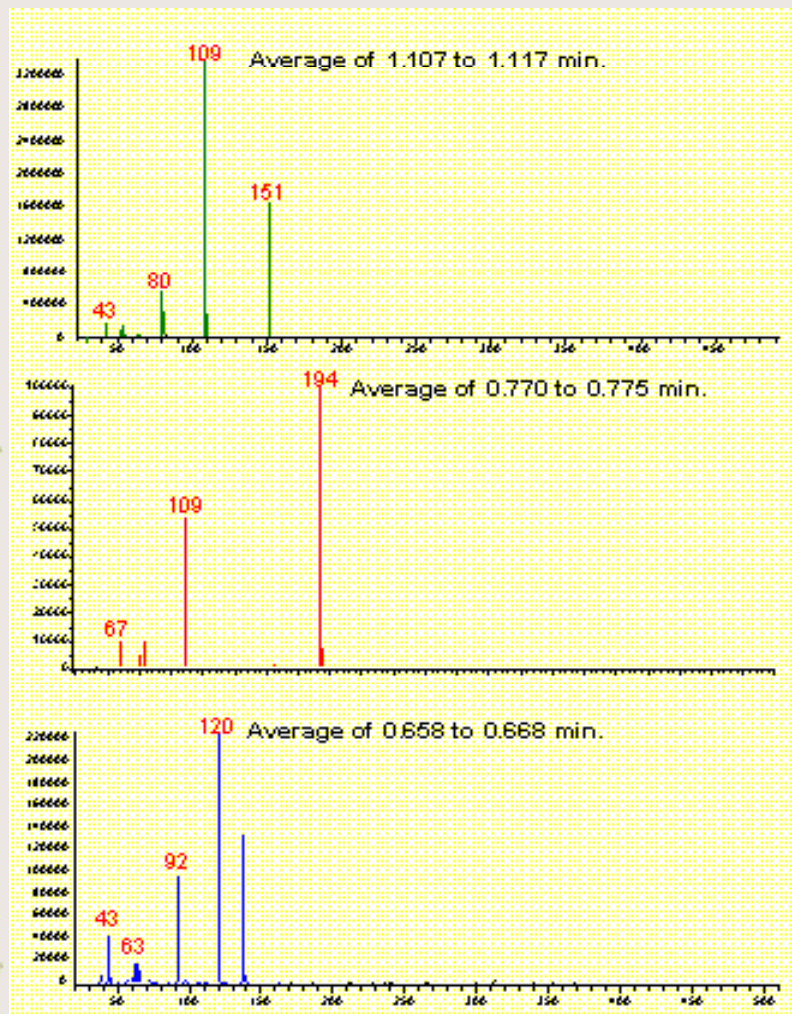
- Burn tests—
  - Use only a very small amount of the fiber and slowly bring it close to the flame, not straight into it using forceps.
  - Watch for melting, charring, speed of ignition.
  - Note the smell produced.

# Chromatography

- Students should be expected to do paper chromatography.
- C Division should be able to determine the Rf value of a pigment
- $R_f = (\text{dist. moved by solute}) / (\text{dist moved by solvent})$ .



# Mass Spectra



- C Division may also analyze mass spectra
- Find a variety of these online and have students practice with them.

# Other Physical Evidence

- Crime Busters also have to be able to analyze fingerprints, shoe prints, tire prints and DNA evidence.
- In addition to QA, polymers, and chromatography, Division C will be given 2 (3 at state) types of evidence from finger, shoe and tire prints, DNA, glass, entomology, blood, seeds and pollen, soil, and bullet striations.

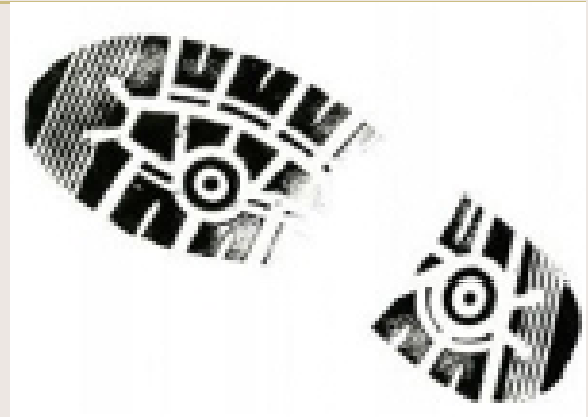
# Fingerprints

- Fingerprints—identify patterns and compare prints from the
- crime scene to the prints of suspects.
- C Division also must know:
  - how fingerprints are formed
  - the techniques used for lifting prints on various surfaces, and the chemistry of those processes.

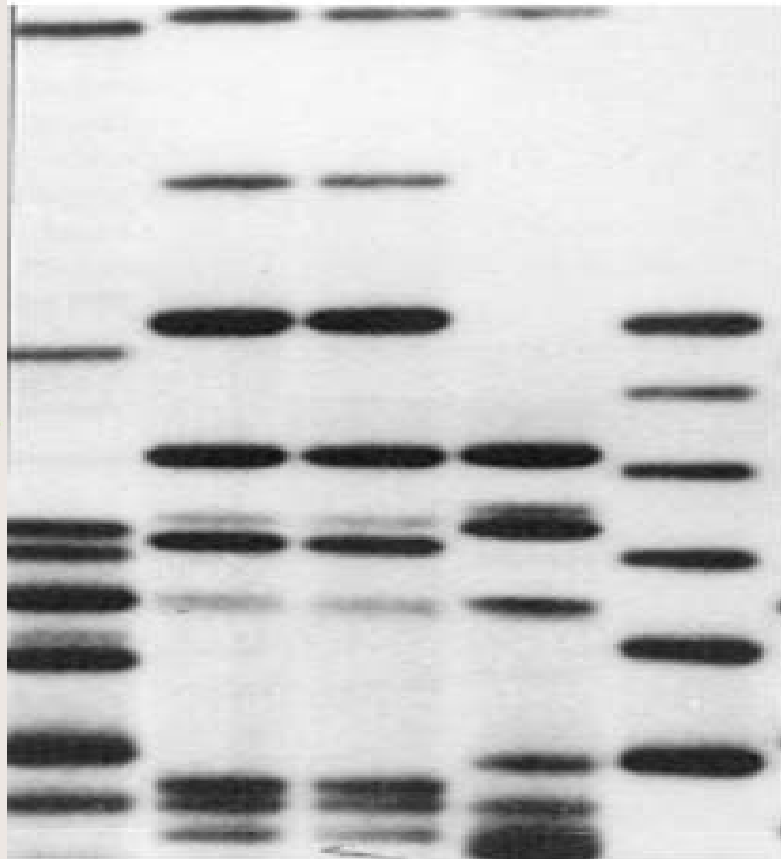


# Tire and Shoe Prints

- Students should practice • interpreting prints— looking for the variations in the prints.
- Look at methods of obtaining foot prints and tire tracks.
- C Division may also have to analyze the soil found in shoes and tires and match it to a site.



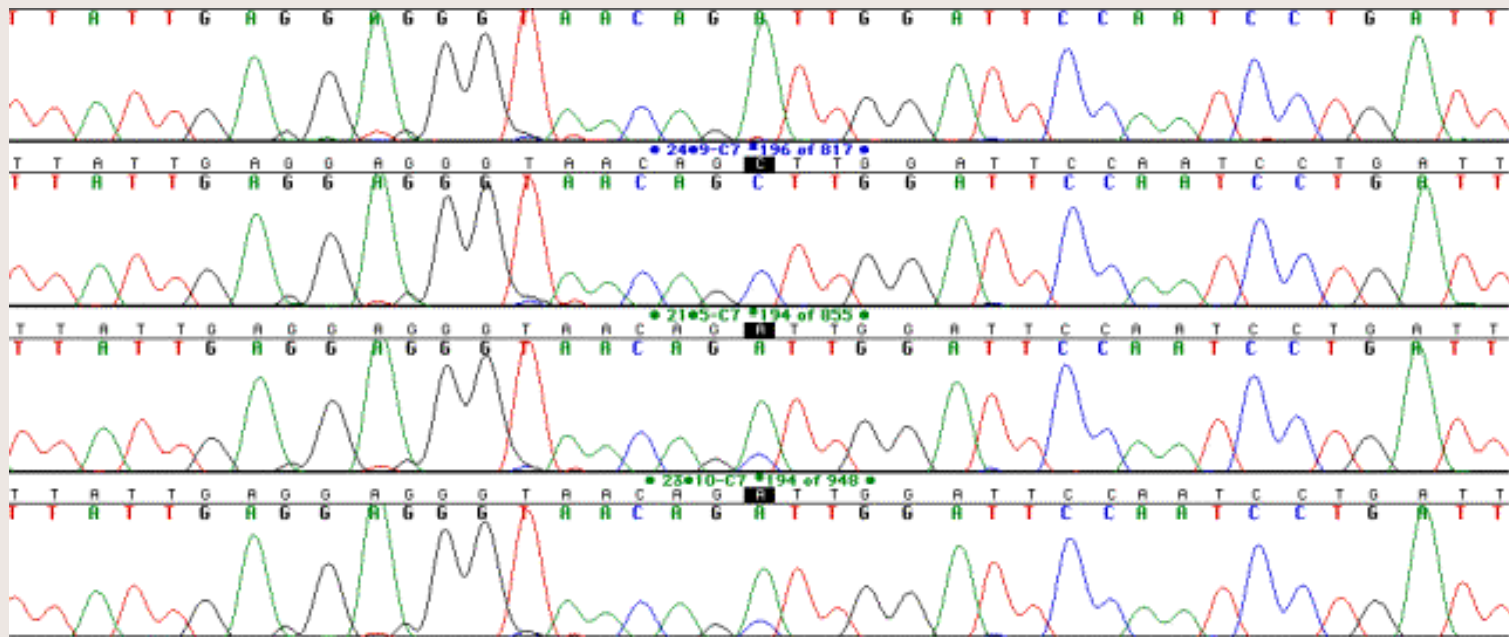
# DNA Evidence



- Students should be familiar with how DNA fingerprinting gels are made and how to interpret them.

# Division C--DNA electropherograms

- There is a good tutorial on these at <http://www.udel.edu/dnasequence/UDSGC/Interpreting%20Electropherograms.html> Basically, it is like the sequence of a DNA fingerprint.





# Evidence for Forensics Only:

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- Glass analysis—analyze fracture patterns to determine the sequence of fractures, as well as the composition of the glass.
- Seeds and Pollen—comparison of seeds and pollen found at a crime scene to those found on suspects. Have students observe types of seeds and look at different types of pollen under a microscope.

# Entomological Evidence

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- Students need to understand the succession of insects that occurs on a dead body and how that info can be used to determine time of death.
- Try out your own “Body Farm” (*ala* the University of Tennessee) using chicken quarters staked out in an inconspicuous area.

# Blood Evidence

- **Blood Spatters**— students must determine directionality and velocity. Practice with old clothes and lots of dropcloths!

– See

<http://www.bloodspatter.com/BPATutorial.htm>



- **Blood Typing**— Students must understand about the inheritance of blood types and how typing is done. Invest in a blood typing kit to practice with.

# Bullet Striations

- You've seen it on CSI—Match the striations on a bullet from a crime scene, to one fired from a gun taken into evidence.



# Analysis of the Crime

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- This counts as 30% of the score ! Remind students that investigating the evidence is only part of the event. Without an interpretation of that evidence, the crime is not solved.
- Analysis and conclusions about various suspects must be backed up with data collected from the evidence.
- Additional general questions may be asked about forensics by the event leader.