Mock Crime Scene (Final)

Target Audience: 9 - 12

Background: Forensic Science is the application of science to those criminal and civil laws that are enforced by police agencies in a criminal justice system. The focus of Forensic Science is the Crime Lab, which uses the principles and techniques of Biology, Chemistry, Physics, Geology, Anthropology and many other sciences in order to place physical evidence into a professional discipline. Based on previous laboratory experiences, students will solve a crime using their laboratory skills and knowledge.

Knowledge and Skills

- Students should be able to observe and draw a crime scene, labeling the evidence.
- Students should be able to apply their previous course laboratory activities to solve a crime.

Fundamental Understanding

- A crime scene investigation is a systematic scientific endeavor.
- The scientific method is required to solve a crime using chemical and biological analyses.

Essential Questions

- What evidence is present at the scene?
- How can the evidence be analyzed?
- What laboratory tests can be performed in order to determine which suspect is guilty?

National Standards (grades 5-8) content:

- Students should develop the abilities to do scientific inquiry.
- Students should develop an understanding of scientific inquiry.

National Standards (grades 9-12) content standard A:

- Students should develop the abilities to do scientific inquiry.
- Students should develop an understanding of scientific inquiry.

North Carolina Standard Course of Study for Chemistry objectives:

1.01 Design, conduct and analyze investigations to answer questions related to chemistry.

- Identify questions and suggest hypotheses.
- Identify variables.
- Use a control when appropriate.
- Select and use appropriate measurement tools.
- Collect and organize data in tables, charts and graphs.
- Analyze and interpret data.
- Explain observations.
- Make inferences and predictions.
- Explain the relationship between evidence and explanation.
- Identify how scientists share findings.

1.03 Analyze experimental designs with regard to safety and use safe procedures in laboratory investigations:

- Identify any avoid potential safety hazards given a particular scenario.
- Differentiate between safe and unsafe procedures.
- Use information from the MSDS (Material Safety Data Sheets) to assess chemical hazards.

Purpose: To solve a crime based on a crime scenario ("The Murder of Victor Connor", a fictional story by a former student) using chemical and biological laboratory analyses. The Mock Trial accusing Mitchell Ray Duncan follows the crime scene analysis.

Procedure:

1. Students will analyze the crime scene and determine which biological and chemical tests need to be performed in order to solve a crime.
2. Students use sticky notes to number the evidence at the scene and draw the crime scene including the numbered pieces of evidence.
3. Student teams will use their well-documented lab books in order to design experiments to independently analyze the crime scene evidence.

Questions and conclusions:

1. What, Who, Where, When, and Why are the basic questions.
2. What were the important pieces of evidence?
3. What evidence indicated the guilty person?

Materials:

1. Large (~8.0 feet long) piece of bulletin board paper with outline of a body.
2. Male Skull and Pelvis
3. Red Food Dye
4. Soil (~500 ml)
5. Citric Acid
6. Calcium carbonate
7. White powders (e.g. baking powder, aspirin, baking powder, benzoic acid)
8. Fibers (White cotton and white nylon fibers)
9. Hair (Black Caucasian, Black Asian, and Black African-American)
10. Note with a Blackmail or Extortion statement (Ex: You owe me over $20,000 for your gambling debts to me. Pay now or else.)
11. Post-It Notes
12. Microscopes (2-3)
13. Blood Analysis Supplies from Flinn Blood Kit
14. Black Vis a Vis pens and black waterproof pens
15. Sets of Fingerprints (at least 2 from each person, I use 3 different people)

Procedure:
Set up final crime scene:

1. Place a large (~8.0 feet long) piece of bulletin board paper on the floor. Outline

the body of a student (or any volunteer) on the paper.
2. Place a skull and pelvis appropriately on the outline.
3. Sprinkle some red food dye (blood) near the skull indicating cranial damage (or by chest or torso for a knifing).
4. Sprinkle some soil, white powder, fibers, hair and glass shards around the outlined body. Be creative.
5. Place an ink pen at the crime scene (or white a note at the scene, e.g. ransom or blackmail note).
6. Provide post-it notes for students to number the evidence at the scene. Students will draw the crime scene including the numbered pieces of evidence in their drawing.
    - Evidence in Crime Locker
    - Fingerprints
    - White Powder
    - Soil
    - Fibers
    - Hair
    - Blood
    - Pen / Ink

Set up a crime scene locker as follows: I set up one container for the entire class, the students work on different analyses at the same time.

1. Fingerprints from:
    a. Crime Scene
    b. Suspect 1
    c. Suspect 2
    d. Suspect 3
   Note: I try to keep 2 sets of fingerprints from 2 or 3 individuals, so that I can change which ones match each year.
2. Set up three white substances in the locker
    a. Aspirin (from the crime scene)
    b. Aspirin (from suspect 1, the guilty suspect)
    c. Baking powder (related to suspect 2)
    d. Benzoic Acid (related to suspect 3)
   After analyzing all of the white substances, students can determine that the unknown white powder at the crime scene is acidic. Then, students can compare spectral data reference sheets in order to identify the drug found on suspect 1 and at the crime scene. These spectra can be obtained from your local Bureau of Investigation. My choice would be cocaine hydrogen chloride if the spectra were available since aspirin and cocaine hydrogen chloride would have a pH that is acidic.
3. Label three small vials of soil (Use the same original source of soil for all three)
    a. Crime Scene (Add calcium carbonate to soil mixture until pH of water with the soil is basic)
    b. Suspect 1 (Use same mix as found at crime scene i.e. pH basic)
    c. Suspect 2 (Add citric acid until pH of water with the soil is acidic)
    d. Suspect 3 (leave soil as originally found)

4. Label three small vials containing fibers:
    a. Crime Scene (White cotton fibers)
    b. Suspect 1 (White cotton fibers)
    c. Suspect 2 (White nylon fibers)
    d. Suspect 3 (White rayon fibers)
5. Label three small vitals containing hair:
    a. Crime Scene (Black hair, Caucasian)
    b. Suspect 1 (Black hair, Caucasian)
    c. Suspect 2 (Black hair, African American)
6. Label three pens (paper chromatography):
    a. Crime Scene (Black Vis-à-vis, a water-based ink)
    b. Suspect 1 (Black Vis-à-vis, a water based ink)
    c. Suspect 2 (Black waterproof pen)
7. Label three microcentrifuge tube containing synthetic blood from Flinn Blood kit (~500 ml, 100 ml to be used per team):
    a. Blood from the knife (Blood type A, Rh+, use person Y from Flinn Blood kit)
    b. Victim Victor Connor's Blood (Blood type A, Rh+, use person Y from Flinn Blood kit)
    Note blood types from Flinn Blood kit; Person W was AB+, Person X was O-, Person Y was A+, Person Z was B-

Set up crime scene analysis kits (one or more to be shared by the class)

1. FINGERPRINTS: Use reference cards from the Fingerprint Discovery Kit or from the website: http://www.fbi.gov/hq/cjisd/takingfps.html
2. WHITE SUBSTANCE analysis:
    a. A dropper bottle of distilled water
    b. A dropper bottle of methanol
    c. A dropper bottle of 01. M Iron (III) Nitrate
    d. A dropper bottle of 3.0 M Hydrochloric acid
    e. A dropper bottle of Iodine (dissolved in isopropyl alcohol)
    f. pH paper
    g. Microwell plate
3. SPECTRAL DATA (images from your local law enforcement agency): Set up three 3-ring binders with infrared, NMR, and Mass-spectrographs of each of the following drugs:
    a. Heroine
    b. Ecstacy
    c. Methemphetamine
    d. Amphetamine
    e. Cocaine HCl
    f. Cocaine base
    g. Tetra-hydro Cannibol (Marijuana)
4. SOIL ANAYSIS:
    a. A squirt bottle of distilled water
    b. pH paper
    c. 3 small beakers

d. Three 10 ml graduated cylinders for sedimentation rates
e. A UV light (Black Light) in order to determine fluorescence (optional to add fluorescent chalk to one of the soil samples.)
f. Glass stirring rods

5. TRACE ANALYSIS: (for the analysis of hair and fibers)
   a. Microscopes
   b. Microscope slides and covers
   c. A dropper bottle of distilled water.

6. BLOOD TYPE ANALYSIS: (from the Flinn Scientific blood typing kit)
   a. A plastic tray (from Flinn Blood kit) and tooth picks
   b. Anti-A serum (~200 ?l in microcentrifuge tube)
   c. Anti-B serum (~200 ?l in microcentrifuge tube)
   d. Anti-Rh serum (~200 ?l in microcentrifuge tube)

7. PAPER CHROMATOGRAPHY: Have the following materials available:
   a. Chromatography paper (~10 cm long)
   b. 200 ml beakers
   c. Glass rods
   d. Scotch tape
   e. Distilled water (10-20 ml per team)
   f. Isopropyl alcohol (10-20 ml per team)

Crime Scene Teacher Notes

General information

I recommend that this activity be set up with just two suspects and just four white powders, but it is possible to add more suspects, more white powders and more types of evidence to analyze as experience and time allows. The murder story is in the student crime scene handouts.

Portfolio Organization
(each page is valued as 10 points)

1. Title Page with the team name and the names of the team members.
2. Introduction to include the crime and the evidence to be analyzed.
3. Crime Scene Photo or Drawing, listing and numbering the different types of evidence found at the crime scene.
4. Fingerprinting Evidence Sheet
5. White Powder Evidence Sheet
6. Soil Evidence Sheet
7. Fibers Evidence Sheet
8. Hair Evidence Sheet
9. Victim Blood Evidence Sheet
10. Pen/Ink Evidence Sheet
11. Skull and Pelvis of Victim Evidence Sheet
12. Truth Table
13. (20 points) Conclusion stating the crime and naming the suspect that qualifies as the guilty person based on the evidence found at the crime scene. The conclusion should include the Who, What, Where, When, and Why of the crime. It should list all of the forensic evidence indicating who will be charged with the crime.
14. Introduction and Conclusion need to be typed or take off 10 points for the entire portfolio.

Assessment for the Crime Scene Portfolio:
Sample Grading Scheme:

Depending on the number of evidence sheets (10 points for each required page and 20 points for the conclusion), take total points earned divide by the number of possible points, times 100 for a portfolio grade.

For example: 12 evidence sheets plus Conclusion x 10 pts each = 140 total possible points; divide the total earned by total possible x 100 = % grade.

Earn 120 points out of 140
(100/120) x 100 = 86%