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Curriculum Unit Overview

Participating students (primarily designed for 3rd-5th grade but applicable for middle school as well) will use forensic science techniques to preserve physical evidence and solve a fictional crime. Students will also be given the opportunity to learn from forensic science professionals and put their newly-acquired forensic science skills to work in simulated lessons.

<table>
<thead>
<tr>
<th>Instructional Period</th>
<th>Topic</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Forensic Introduction/ Forensic 101</td>
<td>Students will observe physical features, requiring them to utilize methods of thinking to investigate and construct solutions.</td>
</tr>
<tr>
<td>Week 2</td>
<td>Microscopic Fiber Analysis</td>
<td>Students will utilize the microscope to analyze different types of fibers by using a microscope to identify a suspect.</td>
</tr>
<tr>
<td>Week 3</td>
<td>Powder Properties/ Powder Analysis</td>
<td>Students will learn to preserve physical evidence by observing physical properties and chemical reactions.</td>
</tr>
<tr>
<td>Week 4</td>
<td>The Parting of the Pen/ Ink Analysis</td>
<td>Students will understand chromatography a process used in crime investigations to separate a material from a mixture.</td>
</tr>
<tr>
<td>Week 5</td>
<td>Stepping Up To the Suspects/ Foot Print Analysis</td>
<td>Students will focus on collecting data.</td>
</tr>
<tr>
<td>Week 6</td>
<td>Lipstick Fusion/ Lip Print Analysis</td>
<td>Students will learn to classify and analyze lip prints to find a suspect in a crime investigation.</td>
</tr>
<tr>
<td>Week 7</td>
<td>Hair Do or Don’t/ Hair Analysis</td>
<td>Students will utilize hair strands to identify forensic analysts.</td>
</tr>
<tr>
<td>Week 8</td>
<td>It All Points to “Guilty”</td>
<td>Students will rely on fingerprinting to compare possible suspects.</td>
</tr>
</tbody>
</table>
Lesson One: Forensic Introduction/Crime Overview

**Lesson 1 Topic:** Forensic 101

**Lesson Objective:** Students will learn about the study of forensic investigation and begin to evaluate the details of the community crime they will assist in evaluating. Students will learn what it means to write a hypothesis and draw inferences from available details.

**Targeted Grade Level:** 3-5th, Middle School

**Anticipated Time:** 60-75 minutes

<table>
<thead>
<tr>
<th>Description</th>
<th>Modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standards</strong></td>
<td>Output: Adapt how the student can respond to written responses such as allowing verbal responses, or use a journal book to allow students to show knowledge with diagrams.</td>
</tr>
<tr>
<td>TEKS: Science 3.2 - 5.2</td>
<td></td>
</tr>
<tr>
<td>(A) plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world;</td>
<td></td>
</tr>
<tr>
<td>(B) collect data by observing and measuring using the metric system and recognize differences between observed and measured data;</td>
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<tr>
<td>(C) construct maps, graphic organizers, simple tables, charts, and bar graphs using tools and current technology to organize, examine, and evaluate measured data;</td>
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<tr>
<td>(D) analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Paper</td>
<td>Seeing the Evidence: Forensic Scientists at Work is an informational book about the science of analyzing types of evidence found at crime scenes. The book provides a historical overview of the first</td>
</tr>
<tr>
<td>➢ pen/pencil</td>
<td></td>
</tr>
<tr>
<td>➢ class set of Books- Seeing the Evidence: Forensic Scientists at Work (if possible) Teachers can register at <a href="http://www.readinga-z.com">www.readinga-z.com</a> for a free trial and search the book title to print class set of books.</td>
<td></td>
</tr>
</tbody>
</table>

| SET-UP | |
| Grouping: | |
| Divide the class into 4 groups (these groups will remain over the course of the curriculum) | |
| ➢ Arrange classroom so students may sit in group setting | |
| ➢ Make sure all students are seated so they can see the instructor | |
| ➢ Place materials for the day on a table where the teacher and student can easily access them | |

| OPENING | |
| Begin the class by introducing yourself and explain to students that over the next 8 weeks they will work with the police department to determine if the presented individuals are indeed responsible suspects for in the community park crime. | |
| Explain to students that they will learn about Forensic Science and gain important skills needed to be a Forensic investigator. | |

| LESSON INTRODUCTION | |
| Begin lesson by asking students if any of them have ever thought about | |
becoming a police officer or working for the FBI? (allow for no more than a minute response)

- Explain that over the next 8 weeks they will learn skills needed to become an investigative police officer or Forensic FBI agent. Provide each student with an Investigative Notebook.
- Instruct students to immediately write their name on the cover and turn to the Community Crime Profile. Teacher will read the profile (page 7 of this manual) to the students and inform them that by supporting the police department in their investigation they will also learn important forensic skills.
- Teacher should explain that it is important for students to pay close attention over the next 8 weeks because at the end of the program they will work in groups to solve another crime on their own and will need to know how to conduct a proper investigation. (this is referring to the culminating event)
- Icebreaker (view supplemental sheet lesson 1A): Since students will be working very closely over the next 8 weeks it is important for them to get to know one another. As the teacher, if you are not yet familiar with students or if they are not familiar with each other, use “Two Facts and A Falsehood” (supplement p. 6 of this manual). This activity will support and encourage students ability to analyze details and make sound conclusions.

Extensions: Critical Thinking Warm Up
Teacher should read the critical extension scenario below to encourage the students to think critically and practice analyzing information. (Extension can be placed on the board)

There was nothing Leon, the driver passing by the park could do about the group of teens trashing the park. He’d left his cell phone at home and it was very dark. Leon knew the popular community park had been totally demolished. After he arrived home, he called the police and reported the little bit he had seen. What questions would the police need to ask Leon to begin investigating the community park crime?

- Allow students a few minutes to discuss the potential questions in a small group setting.
- Teacher should then lead group discussion and write the group responses on the board.
- Explain that over the course of this program students will learn how to investigate details like this.
- Introduce them to a few of the following guiding questions that students or professionals may use to guide investigations.

Guiding Questions: (teacher may use all or some of these questions)

- How many individuals were involved?
- What did the individuals look like?
- What were they wearing?
- What color was their hair?

Vocabulary Terms-

- Review the vocabulary terms below and have students add to their investigation vocabulary notebook section.

Observation- fact collected using the 5 senses
Inference- explanation based on an observation
Hypotheses- possible solutions to a problem from analyzing data
ENGAGE
- Begin a discussion to explore what students already know about forensic scientists and crime scene investigators. Explain that though they will be helping to solve a case they must learn new skills in order for them to be successful investigators, so it is important to understand what they already know.
- Create a 3 column KWL chart on the board. Review or explain that the K stands for knowledge we know, the W stands for questions we want to have answered, and the L stands for the knowledge we learned. Fill in the first column (K) with information students already know about forensic science and the (W) with questions they would like answered.

EXPLAIN
- Explain that not all information presented in the case will be directly stated. Sometimes investigators will need to make inferences by using details from the scene including suspect interviews and witness interviews to understand what happened.

ELABORATE
- Teacher should have students turn back to the Community Crime Profile page in the Investigative Notebook.
- Students should now read both the crime and suspects’ profiles and discuss in their assigned small group. This is important because these groups will work together throughout the entire 8 week period.
- Once the groups have completed their reading, students should be instructed to complete the Investigation Ideas Sheet (p. 8 in this manual).
- Explain that over the next 8 weeks they will work through the notebook to help the Police solve the Community Park Crime.

WRAP-UP
- Have students complete the “L column to include what they learned during the lesson today.

CAREER AND COLLEGE READINESS:
Allow students to research one of the following careers and have them design a poster or digital presentation and share with class.
- Clinical biochemist
- Clinical molecular geneticist
- Microbiologist
- Research scientist (life sciences)
- Research scientist (physical sciences)
- Scientific laboratory technician
- Toxicologist

PARENT ENGAGEMENT
Family Reading: Encourage students to visit the library and read the following book. Students should be encouraged to write a summary of the book or draw a digital summary map.

This summer I went to Alaska.*

I have 5 little brothers.

My favorite food is asparagus.

References:

Two Truths and a Lie

Two Truths and a Lie - Family and Group Games

Two Truths and a Lie - Party Ice Breaker

Next, have your class sit in a circle if possible. Each person (including the teacher) gets a chance to share their three sentences. Then the rest of the class takes turns guessing which one is the falsehood*. Obviously, the more realistic your falsehood, the harder time people will have figuring out the truth.
At 9:30 pm yesterday, the police were called to a secluded, community park where the park had been demolished and city equipment had been stolen. At the scene, police investigators determined that the popular park had been demolished by several suspects. Based on a large amount of trash, soda bottles, candy wrappers, food, pieces of clothing, paint cans and other evidence the officers are confident that the park was demolished by the same group who demolished a park on the other side of town last month.

Items used to operate the park were missing from the main office including: park basketballs, jump ropes, after school snacks, rugby gear, football equipment, jump ropes, and over $500 in petty cash from the directors drawer.

After thoroughly investigating the scene, the investigators found evidence to be sent to the crime lab for further research. The chief of police has demanded that before any arrest are made; investigators must prove that the suspects were indeed at the park. To achieve this, police investigators would like to work with the CASE student investigators to analyze the evidence and determine if they have enough evidence to make the arrest.

The suspects have all been identified and profiles have been included in the profile packet. Please read the profiles now for a brief introduction. You will refer back to these profiles frequently throughout the unit.
Investigation Ideas: Lesson 1

Here are three hypotheses (educated guesses) about what happened to the equipment at the popular Community Park:

1. ____________________________ demolished the park and stole the equipment because
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

2. ____________________________ demolished the park and stole the equipment because
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

3. ____________________________ demolished the park and stole the equipment because
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

Complete the chart below indicating three things you’d like to know more and how you might go about finding the information you seek. This information can relate to the actual crime or the study of Forensics.

<table>
<thead>
<tr>
<th>I’d Like to Know More About</th>
<th>I Could Learn More About This By</th>
</tr>
</thead>
<tbody>
<tr>
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Forensic Science 9
Lesson Two: Microscopic Fiber Analysis

**Lesson 2 Topic:** Collecting Data Using a Microscope

**Lesson Objective:** The microscope is a valuable tool used by forensic scientists. Students are introduced to the care and safety measures that should be taken when using a microscope. Students will analyze fibers for evidence by using a microscope to identify suspected individuals in the crime.

**Targeted Grade Level:** 3-5th

**Anticipated Time:** 60-75 minutes

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<table>
<thead>
<tr>
<th>Standards</th>
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</thead>
<tbody>
<tr>
<td><strong>TEKS: Science 3.2 -5.2</strong></td>
</tr>
<tr>
<td>(A) plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world;</td>
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<tr>
<td>(B) collect data by observing and measuring using the metric system and recognize differences between observed and measured data;</td>
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<tr>
<td>(C) construct maps, graphic organizers, simple tables, charts, and bar graphs using tools and current technology to organize, examine, and evaluate measured data;</td>
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<tr>
<td>(F) communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion</td>
</tr>
</tbody>
</table>

**Science 3.3 -5.3**

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

| **Science 3.4 -5.4**  |
| (A) collect, record, and analyze information using tools, including microscopes, cameras, computers, hand lenses, metric rulers, Celsius thermometers, pan balances, graduated cylinders, beakers, meter sticks, and notebooks  |

| **MATERIALS/EQUIPMENT**  |
| Paper  |
| pen/pencil  |
| microscope per group  |
| Activity sheet per student  |
| Evidence baggies marked A, B, C, D, E- samples of fabric made of wool, rayon, polyester, silk and cotton in the same color. Choose whatever fiber you wish to be the one found at the park, by staining the fabric with a small trace of soda, paint or food crumbs. (Each group will need a set of baggies)  |

| **SET-UP**  |
| **Grouping:** Providing each group of students with microscopes, place them around the room so students may use them during the engage activity.  |
| Arrange classroom so students may sit in group setting  |
| Make sure all students are seated so they can see the instructor  |
| Place materials for the day on a table where the teacher and student can easily |
```
BRIDGE AND REVIEW

- Have students describe the case they are prepared to solve over the next few weeks.

Vocabulary Terms: Definition of terms provided in Lesson 2 explore supplement section (p.12)

- Review the vocabulary terms provided by having students create vocabulary cards

Ocular or eyepiece

Objectives

Adjustment knob

Diagram

INTRODUCTION

- Teacher should explain that today’s lesson much like investigating a crime lab will require them to evaluate different fabrics using a microscope.

Extensions: Critical Thinking Warm Up

Teacher should read the critical extension scenario below to encourage the students to think critically and practice analyzing information. (Extension can be placed on the board)

- Fibers can be divided into two large groups: natural and man-made. The earliest people wore natural animal skins and furs for clothing. From these same plant and animal products, people learned to form individual threads that could be woven into large pieces of cloth (man-made cloth). Eventually weaving became a mechanical process that produced plenty of fabric for a growing population and its needs. These same fibers or pieces of clothing are often used to solve crimes. Why are the pieces of clothing found at the park important to solving the Community Crime Case and how might the police collect more evidence from them?

Guiding Questions: (teacher may use all or some of these questions)

- What are fibers?
- Why do police use fibers in investigating a crime scene?
- Why would a Forensics Scientist be interested in fabrics?
- Why are microscopes used?

EXPLORE

- In a whole group setting, teacher should introduce and identify the parts of the microscope, and their respective functions.
- If technology access is available teacher may utilize the following interactive website by clicking on the parts of the microscope:
  
http://www.biologycorner.com/microquiz/

- During this time, students should complete their “What’s A Microscope” (p.13 of this manual) worksheet included in their investigative notebook. Though this is not directly related to the crime, explain to students that the use of a microscope is paramount in investigations.

EXPLAIN

- Refer students to their “Identifying the parts of the Microscope” sheet (p. 12) and review the functions by pointing to a part of the microscope. Have students name and share the function of each part.
- Have students demonstrate to their group members the steps in using the microscope. Teacher should monitor this small group demonstration.
<table>
<thead>
<tr>
<th>ENGAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Teacher should provide the Lesson 2 supplemental engage activity (p. 15 of this manual) to the students and have them sequence the steps in order that they should follow to view the specimen.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELABORATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Teacher should verbally present the scenario:</td>
</tr>
<tr>
<td>“The police are investigating the Community Park crime scene and have interviewed several suspects to determine what each suspect was wearing at the time of the crime”.</td>
</tr>
<tr>
<td>➢ Six pieces of clothing were found at the Community Park and collected as evidence. The police investigators are asking student investigators to determine if any of the items found at the scene were potentially worn by any of the suspects. Remember to refer back to the Community Profile to infer potential details regarding the pieces of clothing found at the scene.</td>
</tr>
<tr>
<td>➢ Teacher should then challenge students to match a suspect or the “unknown”. Once student investigators have determined what fabric/clothing pieces was worn by a suspect, they will be able to use their knowledge to confirm that at least one of the individuals suspected by the police is correct.</td>
</tr>
<tr>
<td>➢ Students should examine each fiber sample under low, medium and high magnification/resolution with their microscope and record their observations of the crime scene clothing by sketching on their sheet, noting any stains etc. on the fiber.</td>
</tr>
<tr>
<td>➢ In the “NOTES” section of the Evidence Lab sheet students can write which fabric was void of stains, what type of fabrics were in each baggie (this may be important in matching suspects) and what type of stains do they suspect was found on the designated fabric.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WARP UP</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ If time permits and technology is accessible, students can engage in the following online science experiment games.</td>
</tr>
<tr>
<td>➢ On an exit index card or post it note students in their own words should detail why microscopes are important or the “coolest” thing that they learned about using microscopes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>College and Career Readiness:</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Utilizing the following website <a href="http://occupations.careers.org/19-4092.00/forensic-science-technicians-criminalist">http://occupations.careers.org/19-4092.00/forensic-science-technicians-criminalist</a></td>
</tr>
<tr>
<td>➢ Students should select a career of interest and complete a poster, electronic or written presentation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PARENT ENGAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Provide students with the “A Day in the Life of a T-shirt” supplement sheet to complete at home with parents. Encourage students to bring their final product to the next class section to share with the class.</td>
</tr>
</tbody>
</table>
IDENTIFYING THE PARTS OF THE MICROSCOPE
Lesson 2 Explore Resource Sheet
Part I

Obtain a microscope to guide you as you locate its various parts.
Read about the function of each part of the microscope.
Use this information to label on your Microscope Lab page.

*Ocular or eyepiece* – Contains lenses to increase magnification, usually 10×

*Arm* – Connects the body tube to the base, where stage and adjustment knobs are located

*Revolving nosepiece* – Allows changing of various objectives

*Objectives* – Contains lenses of different magnifications, usually 4×, 10×, and 40×

*Stage* – Holds microscope slides and has an opening to allow light to pass through

*Stage clips* – Hold the slide in place

*Adjustment knobs* – Can be found as one knob with two parts or as two separate knobs. The outer knob or the larger knob is the coarse adjustment and is used to bring the slide into focus. The fine adjustment is the inner knob or the smaller knob and is used to sharpen the focus.

*Diaphragm* – Regulates the amount of light passing through the stage

*Light source* – Directs light upward through the diaphragm

*Base* – Supports the microscope
What’s a Microscope?
Using the Microscope
Explain Activity
Part II

1. Plug in the microscope.
2. Turn on the lamp to allow light to pass through the specimen.
3. Most microscopes are equipped with a diaphragm for regulating light. Some materials are best viewed in dim light, others in bright light.
4. Rotate the nosepiece to bring the low-power objective into place.
5. The low-power objective will be the shortest and will have the smallest magnifying power, as indicated by the number stamped on its side. When changing from one objective to another, you will hear a click as the objective snaps into position.
6. When focusing, start with the objective with the lowest magnification. Make sure that both the coarse and fine adjustment knobs are lowered as far as possible. Do not allow the objectives to touch the cover slip.
7. Look through the ocular and slowly turn the coarse adjustment knob to raise the nosepiece until the specimen comes into rough focus. Use the fine adjustment knob to sharply focus the specimen.
8. Slowly move the slide to the right.
9. Slowly move the slide away from you.
10. Sketch a drawing of the image. Record the magnification.
11. Remove the slide and return to the low-power objective.
An unknown specimen is placed on the stage of the microscope to be viewed under high-power magnification. Place the steps in the order that one should proceed to view the specimen using #1-7.

1. Focus the specimen using the course adjustment knob.
2. Focus the specimen using the fine adjustment knob.
3. Place the slide on the stage.
4. Remove the slide from the stage.
5. Return the objective to low power.
6. Turn the objective to high power.
7. Turn the objective to its lowest magnification.
Microscope Lab

Name: ___________________________ Date: ___________________________

Item Observed: ___________________________

Notes:

Draw your observations at 2 different magnifications.

Use colored pencils if appropriate.

Magnification _____ X  

Magnification _____ X

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Forensic Science 17
A Day in the Life of a T-shirt

Parent Engagement Sheet

Directions: Send this sheet home with students and encourage them to participate in an investigation with their parents, neighbors or mentor. This is an optional activity but will further encourage students to learn about investigative techniques.

Activity:

Perform a real-world forensic fiber analysis with a new t-shirt. Unwrap the t-shirt and wear it all day long. Take notes throughout the day of the places you visit, the people and animals you encounter, and so on.

At the end of the day, remove the t-shirt and place it on a clean surface. (A trash bag fresh from the box provides an uncontaminated work surface.) Under a strong light, use a magnifying lens to examine the entire surface of the t-shirt, front and back. Use tweezers to remove any hairs or fibers you find, and transfer them to a collection envelope.

Examine all of the fiber specimens and try to determine where they originated. Perhaps you will find fibers from your sofa, car seats, and other people.
Lesson Three: Powerful Powders

Lesson 3 Topic: Powder Properties/Analysis
Lesson Objective: In order to preserve physical evidence in its original state, the crime scene must be protected and preserved as soon as possible. Evidence is then taken to a lab where physical properties and chemical reactions are observed. Students will investigate characteristics of powders to identify a powder from a crime scene to determine if the powder is connected to any of the suspects.
Targeted Grade Level: 3-5th
Anticipated Time: 60-75 minutes

<table>
<thead>
<tr>
<th>STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TEKS: Science 3.1-5.1</strong></td>
</tr>
<tr>
<td>(A) demonstrate safe practices during laboratory and field investigations as outlined in the Texas Safety Standards</td>
</tr>
<tr>
<td><strong>Science 3.2 -5.2</strong></td>
</tr>
<tr>
<td>(A) plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world;</td>
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<tr>
<td>(B) collect data by observing and measuring using the metric system and recognize differences between observed and measured data;</td>
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<td>(C) construct maps, graphic organizers, simple tables, charts, and bar graphs using tools and current technology to organize, examine, and evaluate measured data;</td>
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<tr>
<td>(D) analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations</td>
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<tr>
<td>(E) demonstrate that repeated investigations may increase the reliability of results.</td>
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<tr>
<td>(F) communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>MATERIALS/EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ paper</td>
</tr>
<tr>
<td>➢ pen/pencil</td>
</tr>
<tr>
<td>➢ deck of cards</td>
</tr>
<tr>
<td>➢ Hand lenses – one hand lens per three to four students</td>
</tr>
<tr>
<td>➢ Measuring spoons – one set per class</td>
</tr>
<tr>
<td>➢ Paper plates or bowls</td>
</tr>
<tr>
<td>➢ Baggies- set per group: 5 labeled baggies each with ½ cup of A-baking soda, B-sugar, C-salt, D-cornstarch,</td>
</tr>
<tr>
<td>➢ 1 “unknown” baggie from crime scene (baking soda + sugar) 1 tbsp</td>
</tr>
<tr>
<td>➢ Eye dropper – one dropper per three to four students</td>
</tr>
<tr>
<td>➢ Water- half cup full per group</td>
</tr>
<tr>
<td>➢ Iodine- one dropper full per group (or place sample amount in cup or bowl)</td>
</tr>
<tr>
<td>➢ Vinegar – one dropper full per group (or place sample amount in cup or bowl)</td>
</tr>
<tr>
<td>➢ Safety goggles – one pair per student and per teacher</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SET-UP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grouping:</strong> Provide each group of students with a deck of cards.</td>
</tr>
<tr>
<td>➢ Arrange classroom so students may sit in group setting</td>
</tr>
<tr>
<td>➢ Make sure all students are seated so they can see the instructor</td>
</tr>
</tbody>
</table>
Place materials for the day on a table where the teacher and student can easily access them.

**BRIDGE and REVIEW**

- Explain to students that in the previous lesson microscopes were utilized to analyze fabrics. Today they will use a hand lens to observe substances.
- Teacher should propose the following question to students: Is utilizing a hand lens to observe powdery substance better than utilizing a microscope? Why?
- Instruct students to use the provided hand lens to observe each of the baggies of powders and record their observations on an index card.
- Review vocabulary terms related to this lesson provided by having students write definitions in vocabulary notebook section of their Investigators Notebook.

**Vocabulary Terms**

**Solubility** - mixing a substance with water

**Wafting** - a person takes an open hand with the palm towards the body and moves their arm in a rapid circular manner over the substance so as to lift vapors of the substance towards the nose.

**Physical Change** - a reversible change in a substance that does not change the identity of the substance

**Chemical Change** - when 1 or more substances are mixed together and changed into a different substance.

**INTRODUCTIONS**

- Teacher should explain that in this lesson students will investigate characteristics of powders by identifying a powder from the crime scene.

**Extensions: Critical Thinking Warm Up**

Teacher should read the critical extension scenario below to encourage the students to think critically and practice analyzing information. (Extension can be placed on the board)

Forensic labs are often called in a crime investigation to identify unknown powders, liquids and pills that may be illegal substances. There are basically two categories of forensic tests used to analyze drugs and other unknown substances: A **Presumptive test** give only an indication of which type of substance is present -- but they can’t specifically identify the substance. **Confirmatory test** are more specific and can determine the precise identity of the substance. Which test do you think is more useful in a police investigation? What techniques do you think would be helpful in conducting these test.

**Guiding Questions:** (teacher may use all or some of these questions)

- Why is hand lenses used?
- Why is the wafting technique a safe method to observe substances?
- Why are repeated trials/investigations performed by scientists?
- What evidence supports a physical change has taken place?
- What evidence supports a chemical change has take place?

**GROUPING**

- The class should be divided into their groups of four. Using a deck of cards assign a role to each member to test the powders:
- use a deck of cards—if you are not able to use a deck of cards develop another alternative to randomly assign a role to each student
**Jack**- odor (remind to use the wafting): Student will be responsible for smelling the substance and recording his/her observation.

**Queen**- water solubility: Student will be responsible for testing a tsp. of each substance from each baggie by dropping the solution in the substance and recording his/her observation.

**King**- vinegar test: Student will be responsible for testing a tsp. of each substance from each baggie by dropping the solution in the substance and recording his/her observation.

**Ace**- iodine test: Student will be responsible for testing a tsp. of each substance from each baggie by dropping the solution in the substance and recording his/her observation.

**ENGAGE:**

- Provide the following scenario to the student investigators:
  
  The police have additional evidence from the Community Park Crime scene and need your help to analyze it in order to obtain a search warrant to search each of the suspects’ businesses or homes. A small amount of a powdery white substance was found on the broken lock of the parks basketball cage. It will be your job to record how four commonly known powdery substances respond to different tests and then compare those observations with the results of the powder found at the Community Crime scene (in the unknown baggie).

**EXPLORE**

- Students should be reminded of the following safety precautions: wear goggles, do not taste any powders, use the wafting method- have students demonstrate, safety procedures for powders in the eye.
- Each group member should be provided a playing card in the group. Remind group members of the expectation of each role as discussed previously.
- Have each student collect their assigned solution and a paper bowl to test their substance. The student assigned to observe the odor via the wafting technique does not need to collect anything.
- Each student should test the substance in each of the baggies by collecting a tsp from the baggie and either smelling the odor of the substance and recording his/her observation on the Lesson 3 Forensic Observation form (p. 23 of this manual).
- Teacher should remind students to observe for **physical changes** and **chemical changes** (definitions included in vocabulary section). Below are some questions to consider when observing:
  
  * Did the color of the substance change once the solution was added?
  * Did the texture of the substance change once the solution was added?
  * Did any of the substance remain the same?
  * Did any of substances appear to be the same?
- Teacher should monitor to ensure that each student complete their testing for each of the baggies A-D and record their observations.
- **NOTE:** if time permits, teacher may allow each student to perform each of the test and record their own observation.

**EXPLAIN**
- Groups should share their observations as teacher writes them on the board.
- Teacher should drive decisions to ensure students fully observe and understand both chemical and physical changes.

**ELABORATE**
- Now, groups should determine which substance matches the one found at the crime scene. After testing the 5 labeled baggies, the teacher should reveal the substances in baggies A-D (A-baking soda, B-sugar, C-salt, D-cornstarch)
- Since limited evidence was collected and investigators MUST preserve the quality of the sample, teacher should now test the “unknown” substances at the front of the classroom. Use the same testing procedures utilized on the other powdery substances.
- Once complete and observations discussed and compared to other labeled baggies teacher should reveal that the “unknown” substance from the crime scene is baking soda + sugar.
- **As a challenge**, have each group investigate where the suspected teens might work. This is important because the “unknown” substance could potentially be connected to the teen’s job. List the following company details on a board at the front of the classroom. Do not reveal the names presented as this is provided to the teacher.
  - **Kids Candy Company** (Aaron) – manufactures sugar-free chewy candy using starch;
  - **Anderson Pretzel Company** (Kesha) – manufactures pretzels covered with salt;
  - **Fritz’s Soda Company** (Maria) – manufactures sugar-containing beverages;
  - **Liberty Statues** (Chrissie) – manufactures garden statues using plaster;
  - **Burpy Company** (Tran) – manufactures antacids using baking soda.
- Utilizing clues from the suspect profiles allow students an opportunity to infer from the provided details where each suspect works or potentially works.

**WRAP UP**
- Teacher should remind students that Forensic professionals must develop specific skills:
  1. Analyze a situation to identify a problem to be solved.
  2. Develop and apply multiple strategies to solve a problem.
  3. Collect evidence and data systematically and directly relate to solving a problem.
- On an exit card, ask students to write 2 important reminders for forensic investigators to remember when analyzing substances.

**PARENT ENGAGEMENT**
This week’s parent Engagement Activity will require students to create a news-paper clipping detailing a current event that has impacted the city of Houston or within the students’ local community. Student is encouraged to work with family to create the design. The clipping should provide details about the current event and should also include an idea of how to prevent future events from occurring.
SERVICE LEARNING

- Hanging with the wrong crowd can lead to serious trouble for youth, including trouble with police officers.
- As a group of student investigators, work with your team to create a training workshop that will teach students the importance of staying out of trouble with police, parents and school administrators.
- Create a brochure, flier or worksheet that would remind students about bad choices. Ultimately your goal is to encourage others to maintain a safe, Crime-Free community.
- Work with students to share this workshop with classes in the school, at your school culminating event or with other groups in the after school program.
**LESSON 3: POWERFUL POWEDERS**

**FORENSIC OBSERVATION**

**Directions:** Student investigators must assist Police Officers with determining a powdery substance found at the Community Park Crime Scene. After using a series of test, on the line under the labeled baggie, students should provide a guess of the substances. Before testing the “unknown” teacher will reveal the substances in Baggies A-D.

<table>
<thead>
<tr>
<th></th>
<th>Water Solution</th>
<th>Iodine Solution</th>
<th>Vinegar Solution</th>
<th>Odor</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAGGIE A</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>BAGGIE B</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>BAGGIE C</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>BAGGIE D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“UNKNOWN” Evidence from Crime Scene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lesson Four: The Parting of the Pen

**Lesson 4 Topic:** Chromatography/Ink Analysis  
**Lesson Objective:** Chromatography is used in crime investigations to separate a material from a mixture. A blackmail note is often collected as evidence and the ink is analyzed. Students will test several pens and signatures and then match the pattern with the one found at the crime scene.

**Targeted Grade Level:** 3-5th  
**Anticipated Time:** 60-75 minutes

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td><strong>STANDARDS</strong></td>
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<tr>
<td><strong>TEKS: Science 3.1-5.1</strong></td>
</tr>
<tr>
<td>(A) demonstrate safe practices during laboratory and field investigations as outlined in the Texas Safety Standards</td>
</tr>
<tr>
<td><strong>Science 3.2 - 5.2</strong></td>
</tr>
<tr>
<td>(A) plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world;</td>
</tr>
<tr>
<td><strong>Science 3.3 - 5.3</strong></td>
</tr>
</tbody>
</table>
| (A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;  
D) connect grade-level appropriate science concepts with the history of science, science careers, and contributions of scientists. |
| **Science 3.5** |
| (E) identify the formation of a new substance by using the evidence of a possible chemical change such as production of a gas, change in temperature, production of a precipitate, or color change. |
| **Science 5.5** |
| A) classify matter based on physical properties including solubility in water. |

<table>
<thead>
<tr>
<th><strong>MATERIALS AND EQUIPMENT</strong></th>
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<tbody>
<tr>
<td>paper</td>
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<tr>
<td>pen/pencil</td>
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<tr>
<td>tape</td>
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<td>timer/clock</td>
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<tr>
<td>tweezers</td>
</tr>
<tr>
<td>Black water soluble marker (BRAND: Expo, Vis A Vis)</td>
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<tr>
<td>Black permanent marker (BRAND: Sharpie)</td>
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<tr>
<td>Hand lenses – one hand lens per three to four students</td>
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<tr>
<td>(4) Coffee filter strips per group each 1 inch wide— (signature coffee strips must be complete before class)</td>
</tr>
<tr>
<td>Signed or labeled by “Kesha”; “Aaron”; “Tran”, “Chrissie” in the water soluble marker and “Maria” in permanent.</td>
</tr>
<tr>
<td>1 inch wide strip signed - “Meet at Park”- written in permanent marker and posted at the front of the classroom for students to observe</td>
</tr>
<tr>
<td>beaker/cup – 1per team</td>
</tr>
<tr>
<td>Water- ¼ full in a beaker-label</td>
</tr>
<tr>
<td>Rubbing Alcohol- ¼ full in a beaker-label</td>
</tr>
</tbody>
</table>
- Safety goggles – one pair per student and per teacher

### Classroom Set Up
- Arrange classroom so students may sit in group setting
- Make sure all students are seated so they can see the instructor
- Place materials for the day on a table where the teacher and student can easily access them

### Grouping:
Divide the class groups into two; half the groups will test the samples with water and the other groups will test with alcohol. Each lab team will have their original 4 members and will need to organize their responsibilities.

### BRIDGE and REVIEW
- Review Safety concerns when testing liquids- wear goggles, do not drink any liquids and eye caution should be taken when using the rubbing alcohol

### Vocabulary Terms
- Review vocabulary terms related to this lesson provided by having students write definitions in vocabulary notebook section of their Investigators Notebook.

**Solubility** - mixing a substance with water

**Constant Variable** - factor in an investigation held steady

### INTRODUCTION:
- Teacher should explain that students will test pen solutions and then match the pattern produced with the one found at the crime scene.

### Extensions: Critical Thinking Warm Up
Teacher should read the critical extension scenario below to encourage the students to think critically and practice analyzing information. (Extension can be placed on the board)

In forensics, **chromatography** can be used to determine what is in a mixture. Chromatography analyzes mixtures like ink by separating the mixtures into the chemicals from which they are made. The piece of paper found in the park can be tested with chromatography to see if there is any match for the piece of paper found at the crime scene.

**Guiding Questions:** (teacher may use all or some of these questions)
- Why is solubility used?
- How is water soluble ink removable?
- Explain how a permanent ink could be removed?
- Why are constant variables needed in an investigation?

### EXPLORE
- Teacher should provide the engage scenario to the students (p. 27 of this manual).
- The scenarios should first be read aloud as a class and teacher should monitor for understanding.
- Teacher should allow additional time for scenario review if necessary.

### ENGAGE
- Discuss what factors need to be kept the same by all lab teams in the investigation to make it a fair test.
- Teacher should provide each group with a zip lock bag which includes the 5 pack of signatures. Have students use the hand lens to observe each of the signatures before testing in solutions. Record observations on index card.
- Students should tape the blank end of a signature sample to the middle of a pencil and lower it in the liquid.
- Students should test each of their signature samples either in water or alcohol based on their assignment.
- Students should leave each sample in the liquid for one minute.
- Students should allow time to dry and tape their artifact to the board in a T-chart marked water and alcohol.

**EXPLAIN**

- Students will use the strategy of gallery walk to observe trends and patterns in the posted T-chart.
- Students should discuss trends and patterns in the T-chart amongst one another as they walk and observe. Student observations can be written on “The Parting of The Pen Lesson 4 Forensic Observation” sheet in the Investigators Notebook. (p. 29 of this manual)
- Teacher and students should discuss the observations in whole group.

**ELABORATE**

- Since the evidence was checked out from the police department to the teacher, the teacher should explain that she will now test the “evidence” found at the crime scene labeled “Meet Me at the Park”
- Teacher should explain that she/he is being careful to maintain clean evidence by holding it with tweezers.
- Based on their observation of the t-chart samples ask the students to justify which liquid would be better to test...the water or alcohol.
- Test the evidence in the suggested liquid and allow students to observe and record their observation on the form

**WRAP-UP**

- On an exit card have students write their final observation of the evidence.
- Have students decide if any of their signatures tested from the suspects “Kesha-A”, “Aaron-B”, “Tran-C”, Chrissie-E or “Maria-D” would be reasonable suspect in the case.
- Their answer should be circled on the observation form.
- Collect Notebooks from students as they exit the room.

**SERVICE LEARNING-ongoing project**

- Hanging with the wrong crowd can lead to serious trouble for youth, including trouble with police officers.
- As a group of student investigators, work with your team to create a training workshop that will teach students the importance of staying out of trouble with police, parents and school administrators.
- Create a brochure, flier or worksheet that would remind students about bad choices. Ultimately your goal is to encourage others to maintain a safe, Crime-Free community.
- Work with students to share this workshop with classes in the school, at your school culminating event or with other groups in the after school program.

**Middle and High School Modifications:**

Have students read the “Separation Science” article found at the following link. Students should then answer the 2 questions at the end of the article: [http://www.propertiesofmatter.si.edu/fbiscience.html](http://www.propertiesofmatter.si.edu/fbiscience.html)
Lesson 4: The Parting of Pen

Scenario

Engage Activity

The Community Park Crime remains open. This morning the police recovered a small piece of paper with the words “Meet Me at the Park” written on it. The paper was found in the grass at the park. Though the police have performed various tests on the paper, they have not been able to identify who wrote it. The police just dropped off this piece of evidence and it will be posted on the board. Do not touch the evidence paper as this will contaminate the evidence. Keeping contamination of evidence to a minimum is especially critical while investigating a homicide. Homicide crime scenes are ripe for potential DNA transfer from one crime scene to another through tools.

The police also dropped off signatures of suspects and would like us to test these samples to determine which if any suspect’s pen was used to write the note. You will be using a process called chromatography to analyze the ink from pens collected from the suspects. Chromatography analyzes mixtures like ink by separating the mixtures into the chemicals from which they are made. Your job will be to work in small groups to perform chromatography on a variety of ink samples to see if any match the piece of paper found at the crime scene.

EXPLANATORY QUESTIONS

1. Did you determine if the water or alcohol was better to use?________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

2. What happened to the signatures tested in alcohol?______________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

3. What happened to the signatures tested in water?________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

4. Did any of the signatures after being tested appear similar to the crime scene evidence?
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
# T-Chart Sample

<table>
<thead>
<tr>
<th>Water</th>
<th>Alcohol</th>
</tr>
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<tbody>
<tr>
<td></td>
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</tbody>
</table>
# The PARTING OF THE PEN
## FORENSIC OBSERVATION

<table>
<thead>
<tr>
<th>Suspects Pens</th>
<th>Signature Observation</th>
<th>WATER</th>
<th>ALCOHOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
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<td>C</td>
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<td></td>
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<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crime Scene Evidence</td>
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</tbody>
</table>
Lesson Five: Stepping Up to the Suspects

Lesson Topic: Foot/Height Analysis

Lesson Objective: Data collection in any investigation helps investigators recognize the relationship between factors and strengthen a conclusion. Students will collect data of their own feet size and height to determine a relationship between height and weight. Students will analyze a footprint found at the scene to determine the height of one of the suspects.

Targeted Grade Level: 3-5th

Anticipated Time: 60-75 minutes

<table>
<thead>
<tr>
<th>Standards</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science 3.2 - 5.2</td>
<td>(A) plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world; (B) collect data by observing and measuring using the metric system and recognize differences between observed and measured data; (C) construct maps, graphic organizers, simple tables, charts, and bar graphs using tools and current technology to organize, examine, and evaluate measured data; (D) analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations (F) communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion</td>
</tr>
<tr>
<td>Science 3.3 - 5.3</td>
<td>(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student; (D) connect grade-level appropriate science concepts with the history of science, science careers, and contributions of scientists.</td>
</tr>
<tr>
<td>Science 3.4 - 5.4</td>
<td>(A) collect, record, and analyze information using tools, including microscopes, cameras, computers, hand lenses, metric rulers, Celsius thermometers, pan balances, graduated cylinders, beakers, meter sticks, and notebooks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials and Equipment</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>*paper</td>
<td></td>
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<tr>
<td>*pen/pencil</td>
<td></td>
</tr>
<tr>
<td>* Rulers or yard sticks – 2 rulers or yard sticks per group</td>
<td></td>
</tr>
<tr>
<td>* Scratch paper – one piece per partner</td>
<td></td>
</tr>
<tr>
<td>* colored circle stickers</td>
<td></td>
</tr>
<tr>
<td>* Calculators – one calculator per partner</td>
<td></td>
</tr>
<tr>
<td>* overhead transparency of “evidence” footprint</td>
<td></td>
</tr>
<tr>
<td>* Poster board or butcher paper size graph paper with graph included (graph sample included in supplement section)</td>
<td></td>
</tr>
</tbody>
</table>

Classroom-Set up

Grouping: Students work with a partner.
Arrange classroom so students may sit in group setting
Make sure all students are seated so they can see the instructor
Place materials for the day on a table where the teacher and student can easily access them

BRIDGE AND REVIEW
Review vocabulary terms related to this lesson by having students write definitions in vocabulary notebook section of their Investigators Notebook.

Vocabulary Terms

**Dependent variable:** the part that the experimenter changes in order to conduct the experiment
**Independent variable:** the part that changes when the dependent variable changes
**Proportional:** a constant relationship, when one variable changes the other changes in a constant proportion.

INTRODUCTION
Teacher should explain that in this lesson students will be collecting data of their own shoe/feet size and height to determine a relationship.
The student investigators will determine if the mathematical relationship between shoe size and height commonly used by investigators is accurate. Students will then estimate the height of the suspect based on the footprint collected from the Community Park Crime Scene.
See the following link to understand the common mathematical relationship used by investigators

Extensions: Critical Thinking Warm Up
Teacher should read the critical extension scenario below to encourage the students to think critically and practice analyzing information. (Extension can be placed on the board)

Footprints are found at around 40% of crime scenes. In the United Kingdom, there has been a National Footwear Intelligence and Reference Database established. It reports that 60% of the shoeprints are Nike with the most commonly style shoe being the Nike Air Max 95. If the United States had a database similar to the United Kingdom how would you as investigators be able to use it to solve the Community Park Crime?

**Guiding Questions: (teacher may use all or some of these questions)**

- What is the advantage of using a data base?
- What are the units for length in the metric system?
- What is a dependent variable in an investigation?
- What is an independent variable in an investigation?
- What is meant by proportional?

Engage:
Refer students to the lesson 5 “Stepping Up to the Suspect” scenario in the student investigators handbook. (p. 33 in this manual)
Teacher should also show the footprint evidence transparency from the Community Park Crime Scene. If not, this can be shown by printing the footprint on paper and hanging at the front of the classroom on larger paper.
Set up the class graph on the poster.

Explore:
Teacher should explain that students are to trace their shoeprint with a pencil on the scratch paper.
Students should then measure the length of their shoeprint from heel to toe to the nearest cm and record in T-chart for shoeprint.
Partners help each other measure their height to the nearest cm and record in
### T-chart for height.
- This information can first be charted in a t-chart (sample included in supplement section)

### Explain:
- Each student will place their colored circle sticker on the class graph poster.
- Students should discuss the pattern that is observed once all students have communicated their data on the graph.
- Discuss the visual relationship between these two variables by drawing a line of best fit. (sample shown in supplement section)
- Calculate the average of all students’ shoeprint and then the heights. Discuss the mathematical relationship between these two variables.

### Elaborate/Challenge:
- Using the mathematical relationship the class discovered (Height is 15% of an individual’s foot length), calculate the height of the suspect from the evidence shoeprint.
- Student should complete questions on the Stepping Up to the Suspect Scenario sheet.

### WRAP-UP
- On an index card teacher should request that students list 2 reasons why collecting data is important during an investigation.
- As students leave the classroom they should turn their cards in to the teacher.

### SERVICE LEARNING
- Hanging with the wrong crowd can lead to serious trouble for youth, including trouble with police officers.
- As a group of student investigators, work with your team to create a training workshop that will teach students the importance of staying out of trouble with police, parents and school administrators.
- Create a brochure, flier or worksheet that would remind students about bad choices. Ultimately your goal is to encourage others to maintain a safe, Crime-Free community.
- Work with students to share this workshop with classes in the school, at your school culminating event or with other groups in the after school program.

### Parent Connection
- Provide students with a second copy of the graphing sheet to take home or encourage students to draw their own graph on construction paper
- Encourage students to demonstrate their family’s relationship between height and foot size.
- Illustrate a “family” line of best fit or trend line

### Middle and High School Modifications:
Have students read the attached article at the link included: [http://www.crime-scene-investigator.net/footwear.html](http://www.crime-scene-investigator.net/footwear.html) Middle and High School Students can extend their lesson to include the making of a footprint craft.
LESSON 5 STEPPING UP TO THE SUSPECT
FORENSIC ACTIVITY

TEACHER EDITION (Refer to notebook for Student Investigators Edition)

The case of Mr. Kyle Fielding has had a great turn of events this morning. The crime scene investigators have been able to retrieve a shoeprint that was found on the ground near where his body was found. Here is a transparency of the photograph of this footprint the police sent over for us to analyze.

What can be learned from this footprint?

The crime scene investigators already know that historically a shoe print indicates the approximate height of the person whose foot made the print. There is a mathematical relationship between the two variables.

You and your lab partner are asked to collect data to support or reject this ascertain. You will be measuring your shoe length and height and record the data into a data table. Since the class will have recorded data from each lab team, the varying data can be communicated on a class graph on the poster by placing a colored circle sticker for each participant. The graph will display foot length along the x-axis and height along the y-axis. What other information will be needed to be include on this class graph?
Lesson 5 T-Chart Data Sample

**Directions:** Teacher should allow students to complete this classroom size t-chart before completing the classroom graph below.

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Height (inches)</th>
<th>Shoe length (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</table>

Forensic Science 35
LESSON 5 STEPPING UP TO THE SUSPECT

GRAPHING ACTIVITY

Line of Best Fit/ Trend Line

**DIRECTIONS:** After students measure their foot length and height, they should place a marker dot or sticker on the graph at the intersection of their foot length and height. Once every student has documented their foot size and height the teacher can draw a line of BEST FIT to fully illustrate the range of the student investigators.

---

A **line of best fit** is a straight line that best represents the data on a scatter plot. This line may pass through some of the points, none of the points, or all of the points.

Try to have the line as close as possible to all points, and **as many points above the line as below**. Line of best fit may vary according to individuals.
Lesson Six: Lipstick Fusion

Lesson 6 Topic: Lip Print Analysis
Lesson Objective: Every person has a sort of barcode printed across their mouth. Students will collect lip prints to classify and analyze how to find a suspect in the ongoing crime scene.
Targeted Grade Level: 3-5th
Anticipated Time: 60-75 minutes

Description

**STANDARDS**

**Science 3.2 -5.2**
(A) plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world;
(B) collect data by observing and measuring using the metric system and recognize differences between observed and measured data;
(C) construct maps, graphic organizers, simple tables, charts, and bar graphs using tools and current technology to organize, examine, and evaluate measured data;
(D) analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations
(F) communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion

**Science 3.3 -5.3**
(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;
(D) connect grade-level appropriate science concepts with the history of science, science careers, and contributions of scientists.

**Science 3.4 -5.4**
(A) collect, record, and analyze information using tools, including microscopes, cameras, computers, hand lenses, metric rulers, Celsius thermometers, pan balances, graduated cylinders, beakers, meter sticks, and notebooks

**MATERIALS and EQUIPMENT**
* paper
* pen/pencil
* Rulers – one ruler per student
* Cotton swabs – one swab per student (and a few extras)
* Dark-colored / red lipstick – one to two inexpensive tubes per group
* Suspects’ Lip Prints chart – one
* Lip Print Evidence cards – one set per lab group
* White index card

**Classroom-Set up**
- Arrange classroom so students may sit in group setting
- Make sure all students are seated so they can see the instructor
- Place materials for the day on a table where the teacher and student can easily
Grouping:
Students should be arranged in their original groups.

BRIDGE AND REVIEW
- Review the mathematical relationship between shoe size and height

Vocabulary Terms
- Review vocabulary terms related to this lesson provided by having students write definitions in vocabulary notebook section of their Investigators Notebook.

Classifying: to arrange or organize in similar groups, classes or classifications
Cheiloscopy: technique that identifies humans based on lip traces

INTRODUCTION
- Teacher should explain that in today’s lesson students will collect lip prints to classify and analyze how to find a suspect in the ongoing crime scene.

Extensions: Critical Thinking Warm Up
Teacher should read the critical extension scenario below to encourage the students to think critically and practice analyzing information. (Extension can be placed on the board)
- The skin cells lining the mouth create their own miniature patterns which crime scene investigators process through cheiloscopy as a formal method of suspect identification especially in cases which lack fingerprints. How might an investigator collect lip stick prints from a crime scene?

Guiding Questions: (teacher may use all or some of these questions)
- Where might an investigator inspect for lip prints?
- How can investigators classify lipstick prints? Explain.

Engage:
- Refer students to the Lesson 6 Lipstick Fusion scenario in the students’ investigation notebook. (p. 39 of this manual)
- Scenario may be read in a whole group setting, individually or in small group setting. At this point in the program, the teacher should determine what is best for the students participating in the program.

Explore:
- Once the directions are read, teacher should pass around the lipstick or provide one red lipstick per group.
- She should explain that before the class analyzes the lipstick evidence and suspect prints they are going to practice by evaluating their personal lipstick prints.
- Students should wipe the cotton swap on the lipstick and pass to next student.
- Students should rub their lipstick-covered cotton swab on their lips so entire surface of their lips is covered in lipstick.
- Students should make their lip impression by firmly pressing their lips to the index card and quickly release.
- Students should measure the width and length of their lip print and record their dimensions next to their print.
- Students should also list features of their lip print on the same paper.
- Students should share their lip print within their lab group and observe common features if any between group members.

Explain:
- Teacher should guide the groups in discussing trends in gender, age, features
present in all lip prints collected by the class.

**Elaborate:**
- Teacher should now direct students to analyze the lip prints from the suspects and compare it to the evidence collected by the crime scene investigators.
- Students should be instructed to discuss in their small groups the comparisons and write the suspects id next to the evidence prints collected from the Community Park Crime Scene.

**WRAP UP:**
- On an exit card have students write the id of the suspects they believe are involved in the Community Park Crime.

**CAREER AND VOCATIONAL CONNECTION**
- Teacher should provide an opportunity to discuss the following site with the class.
- In either a group setting or individual basis teacher should allow time for students to watch the video on the Forensic site attached. [http://ccr.mcgraw-hill.com/2011/07/26/forensic-expert/](http://ccr.mcgraw-hill.com/2011/07/26/forensic-expert/)
- In a group setting discuss the importance of proper education and training as a forensic expert.
LESSON 6: LIPSTICK FUSION
FORENSIC Scenario

The crime scene investigation of the Community Park demolition is still in flux. The investigators have lip prints that were lifted off of napkins taken from the trash can in the park. They have determined from video surveillance from the store across the street that one of the suspects wiped his or her mouth and then threw that item into the trash can while hanging out and eventually demolishing the park.

The agents from the crime scene investigation unit need help with their cheiloscopy. Every person has a sort of barcode printed across their mouth so this process of crime scene investigation involves looking for distinct patterns in lip creases.

This morning an inspector dropped off the collected items from the trash can that had lip prints on them and also collected lip prints from the suspects. Remember our goal is to collect as much evidence about the suspects to prove that they are indeed guilty of the crime. Your task today will be to observe patterns to match the lip prints on the items extracted from the trash with the lip prints collected from the suspects. But first, as young investigators you must learn how to effectively evaluate lip prints.
LESSON 6: Suspects Lip Prints

Suspect A

Suspect B

Suspect C

Suspect D

Suspect E
Lesson 6: CRIME SCIENCE EVIDENCE COLLECTED

Your job is to analyze the lip prints collected from the crime scene and determine if any of the prints match at least one or all the suspects listed above. Simply write the suspect id next to the picture based on your observations. If any of lip prints do not match a suspect simply leave it blank.
Lesson Seven: Hair Do or Don’t?

Lesson 7 Topic: Hair Analysis

Lesson Objective: Hair has value as physical evidence in a variety of crimes. While the characteristics of hair samples that students will examine typically can’t be used to identify an individual, they do provide forensic analysts with important and useful information. Students will learn how to analyze hair samples and will evaluate hair samples from the suspects.

Targeted Grade Level: 3-5th

Anticipated Time: 60-75 minutes

### Standards

**Science 3.2 -5.2**

(A) plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world;
(B) collect data by observing and measuring using the metric system and recognize differences between observed and measured data;
(C) construct maps, graphic organizers, simple tables, charts, and bar graphs using tools and current technology to organize, examine, and evaluate measured data;
(D) analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations
(F) communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion

**Science 3.3 -5.3**

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;  
(D) connect grade-level appropriate science concepts with the history of science, science careers, and contributions of scientists.

**Science 3.4 -5.4**

(A) collect, record, and analyze information using tools, including microscopes, cameras, computers, hand lenses, metric rulers, Celsius thermometers, pan balances, graduated cylinders, beakers, meter sticks, and notebooks

### Materials and Equipment

- paper
- pen/pencil
- White construction paper
- Microscopes- one per group
- Blank microscope slides – one blank slide per student
- Microscope slide cover slips – one cover slip per student
- Eyedroppers – one eyedropper per two to three students
- Small cups – one cup per two to three students
- Water – enough to fill the small cups given to every two to three students
- Hair microscope slides for A, B, C, D – one of each per group
- Hair Evidence on scenario

### Classroom-Set up

Grouping:
Students work in a lab group of four students.
- Arrange classroom so students may sit in group setting
- Make sure all students are seated so they can see the instructor
- Place materials for the day on a table where the teacher and student can easily access them

**BRIDGE AND REVIEW**

- On a small post-it note have students write the importance of investigating foot and lip prints. Have them predict the similarities between analyzing fibers and hair strands.

**Vocabulary Terms**

- Review vocabulary terms related to this lesson provided by having students write definitions in vocabulary notebook section of their Investigators Notebook.
- **Trichology** - the scientific study of hair
- **Medulla** - the central hollow core of a hair sample
- Review Microscope Vocabulary from Lesson 2

**INTRODUCTION**

- Teacher should explain that in today’s lesson students will study their hair sample and analyze the hair samples of the suspects to determine if all or any matches additional evidence from the community park crime scene.

**Extensions: Critical Thinking Warm Up**

Teacher should read the critical extension scenario below to encourage the students to think critically and practice analyzing information. (Extension can be placed on the board)

The scientific study of hair is called trichology and this field dates to the mid-1800s. Forensic scientists perform three major types of hair analysis. Chemical analysis, DNA analysis and microscopic comparison. Results from hair composition analysis are somewhat controversial. Hairs were found in various places by the crime scene investigators at the Community Park Crime. Agents are confident that the hairs found came from individuals who were at the crime scene on the day of the crime.

**Guiding Questions:** (teacher may use all or some of these questions)

- What factors may impact the results?
- What physical properties will be important to record about the hair samples?
- How do similarities and differences help identify hair samples?

**Engage:**

- Provide the lesson 7 Forensic Engage scenario to the students (p.45 in this manual).
- Scenario should be read in a whole group setting, as individuals or in small group setting.

**Explore:**

- Teacher should instruct students to remove one hair from their own heads and place it on a paper towel.
- Students should prepare wet slides by placing a single drop of water on a blank microscope slide then place their hair on the drop of water and place cover slip on top of the hair so as to create a seal between the slide and the cover slip.
- Teacher should instruct students to take turns using the microscope to view their microscope slides and record their observations by sketching their hair image on the lesson 7 scenario page.

**Explain:**

- Teacher should instruct students to share their sketches in their lab groups and
discuss trends in gender, age, and features present in all samples.

**Elaborate:**

- Students will compare the hair samples from the suspects with the evidence collected by the crime scene investigators.
- Students should determine which if any of the hair samples from the suspects is the same as the evidence.
- After discussion, students should tally number of votes per suspect to arrive at their collective conclusion.

**WRAP UP**

- Teacher should remind students of the importance of hair analysis. Have students circle if any of the suspects hair samples collected match that found at the crime scene.
- Before exiting the class, have students write on an exit index their understanding about the importance of hair analysis.

**Middle and High School Modification:**

Utilizing the websites below middle and high school students should create a brief skit 2-5 minutes. The skit theme should reflect an investigation of hair follicles in a crime lab. Students should create a basis for the investigation and demonstrate that they understand the importance of conducting hair analysis.

Lesson 7: Hair Do or Don’t Scenario

We have an update on the Community Park Crime Case. Hairs were found in various places near where the lip prints were found by the crime scene investigators. Agents are confident that the hairs found came from individuals who were at the crime scene on the day of the crime. These are the two magnified hair samples retrieved:

![Magnified Hair Samples]

The crime scene investigators have dropped off hair samples of the suspects today and are asking for your help to match the hair characteristics to the evidence sample. One of the samples has been determined to be that of animal hair. This hair sample (on the left) is thin with a coarse thick medulla (the central hollow core of a hair sample). What characteristics of the hairs would you examine to look for differences and similarities?

Before observing hair from the crime scene, let’s observe your hair for practice. After viewing your hair under the microscope draw your observation sample in the box below.

Your Hair Sample
Lesson 7 Forensic Samples

Suspect A

Suspect B

Suspect C

Suspect D

Suspect E
Lesson Eight: It All Points to Guilty

Lesson 8 Topic: Fingerprint Analysis
Lesson Objective: Even with all the new technology we have to analyze a crime scene, one of the most important pieces of evidence is still a person’s fingerprints. Students will dust for fingerprints and observe patterns and characteristic among all people. Students will analyze collected fingerprint samples from a crime scene and compare to possible suspects.
Targeted Grade Level: 3-5th
Anticipated Time: 60-75 minutes

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<tr>
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</tr>
<tr>
<td>Small soft camelhair or fiberglass paintbrushes – one paintbrush per two students</td>
</tr>
<tr>
<td>Transparent tape – approximately two inches per student</td>
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<tr>
<td>Completed Fingerprint Cards– one set per two students</td>
</tr>
<tr>
<td>Fingerprints: Evidence envelopes – one envelope per two students</td>
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</tbody>
</table>

Classroom-Set up
Grouping:
Students work in a lab group of four students.
Arrange classroom so students may sit in group setting
Make sure all students are seated so they can see the instructor
Place materials for the day on a table where the teacher and student can easily access them

**BRIDGE AND REVIEW**
- In whole group discussion teacher should encourage students to express what they’ve learned so far over the course of the program.
- Based on the previous lessons teacher should encourage students to predicate the similarities and differences between fingerprint analysis and footprint analysis? (responses can be written on the board)

**INTRODUCTION**
- Teacher should explain that students will analyze collected fingerprint samples from the Community Crime scene and compare to possible suspects.

**Extensions: Critical Thinking (teacher should read this section aloud)**
The largest criminal fingerprint database in America is the FBI’s Integrated AFIS (IAFIS) in Clarksburg, WV. The database has more than 60 million individual computerized fingerprint records. As student investigators where might fingerprints be at the Community Park Crime Scene?

**Guiding Questions: (teacher may use all or some of these questions)**
- Do identical twins have the same fingerprints?
- How are fingerprints classified into groups?
- What surfaces would fingerprints be more visible?
- What surfaces would fingerprints be less visible?

**ENGAGE**
- Teacher should refer students to “It All Points to Guilty” scenario sheet in their student investigative notebook. (p.50 of this manual)
- The scenarios should first be read aloud as a class and teacher should monitor for understanding.
- Teacher should allow additional time for scenario review if necessary.

**EXPLORE**
- Teacher should explain that students will now conduct a fingerprint analysis.
- One partner should press their thumb on the side of the drinking glass.
- Another partner should lightly shake the cocoa powder over the glass so the fingerprint is coated.
- The original partner uses the brush to gently brush away the excess powder revealing the fingerprint.
- The second partner will place the sticky side of the tape on the dusted fingerprint and then lift the tape (and the print) and place in the designated box on the scenario page.

**Explain:**
- Partners should identify characteristics of the fingerprint and then classify it as having loops, whorls or arches.
- Partners should observe at least three other fingerprints and observe their characteristics.
- Teacher should create a 3 column chart (before class preferably) on the board and have students come to the board and write a tally mark under the correct classification loops, whorls or arches for their fingerprint to recognize a trend within the class.
Does the class trend align with the national trend data as discussed on the Lesson 8 Scenario sheet?

**ELEBORATE**
- Teacher should now explain that students will analyze suspect’s fingerprints on the lesson 8 Fingerprinting Suspect sheet in the Investigators notebook. (p.51 of this manual)
- Students should compare the fingerprint samples from the suspects and compare it to the evidence collected by the crime scene investigators, (evidence included on the lesson eight scenario sheet).
- Teacher should lead the discussion regarding the students’ observations.

**WRAP-UP**
- Remind students that fingerprint analysis play a very important role in solving criminal cases.
- Teacher should provide students an opportunity to discuss if the suspects were indeed confirmed after evaluating all the evidence over the eight week course.
- Have student investigators complete the confirmed profile sheet and issue a warrant for the confirmed suspect’s arrests.

**PARENT CONNECTION**
- Research an alternative method for fingerprinting. Create a fingerprint poster at home with your family members.
- Create a family fingerprint profile poster.
LESSON 8: IT ALL POINTS TO GUILTY
FORENSIC SCENARIO

The agents investigating the open case of the crime scene involving the Community Park Crime have just been handed some startling piece of evidence. A thumb print was lifted from the glass door at the Parks Office. They collected this fingerprint by “dusting” for them. In the dusting process, fingerprints are coated with powder then lifted and taken to a lab to be identified. Here is the print they found: (the fingerprint confirms that Tran or Suspect D was indeed involved in the Community Crime)

As crime scene investigators you will review the thousands of fingerprints recovered from crime scenes throughout the nation, each person in the world has a set of fingerprints unique to them! Even though every print is different, they can be categorized into one of three general types:

- **loops** (found in 65% of the population),
- **whorls** (35%),
- **arches** (5%)

But first, as young investigators you must learn how to effectively evaluate fingerprints by analyzing practicing in the lab.
Lesson 8 Forensic Engage Activity

Suspect Fingerprints

A: Aaron  B: Maria  C: Kesha  D: Tran  E: Chrissie
Final Community Park Crime Report

SUSPECT IDENTIFICATION

Directions: Students should go back through the files (their investigative notebooks) and describe the investigative analysis used to confirm a suspect’s involvement in the Community Park Crime. Police investigators will utilize this information to make an official arrest. Once successfully complete student investigators will earn their badge and move on to a culminating investigation case.

<table>
<thead>
<tr>
<th>Suspect</th>
<th>Crime Confirmation Description</th>
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<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
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<td>C</td>
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<td>D</td>
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<td>E</td>
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</table>
Final Community Park Crime Report

**SUSPECT IDENTIFICATION**

**TEACHER COPY WITH ANSWERS**

**Directions:** Students should go back through the files and describe the investigative analysis used to confirm a suspect’s involvement in the Community Park Crime. Police investigators will utilize this information to make an official arrest. If the suspects were not confirmed through any of the investigative analysis student investigators must make a recommendation to remove the individual from the suspect list. Once successfully complete student investigators will earn their badge and move on their career as an FBI investigator.

<table>
<thead>
<tr>
<th>Suspect</th>
<th>Crime Confirmation Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>The lip analysis shows that suspect A could have thrown the napkin away in the garbage and could have been at the scene of the crime that day.</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>The lip analysis shows that suspect B could have thrown the napkin away in the garbage and could have been at the scene of the crime that day. The unknown powder matches the sugar found on Maria. The hair analysis confirms that suspect B Maria was at the Crime Scene and should be arrested.</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>The lip analysis shows that suspect C could have thrown the napkin away in the garbage and could have been at the scene of the crime that day.</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>The fingerprint analysis confirms that Tran suspect D was at the Crime Scene. The unknown powder matches the sugar found on Tran. The lip analysis shows that suspect D could have thrown the napkin away in the garbage and could have been at the scene of the crime that day.</td>
</tr>
<tr>
<td><strong>E</strong></td>
<td>There is no evidence that this suspect was involved in the crime.</td>
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</table>
# Forensic Supply List

<table>
<thead>
<tr>
<th>Lessons</th>
<th>Materials</th>
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</table>
| **General** | - Teacher CASE Final Forensic Unit  
  - CASE Final Forensic Investigative Notebooks (1 per student)  
  - CASE Final Forensic Profile Packets (1 per student) |
| **LESSON 1** | - paper  
  - pen/pencil  
  - class set of Books- Seeing the Evidence: Forensic -Scientists at Work (if possible)  
  teachers can register at [www.readinga-z.com](http://www.readinga-z.com) for a free trial and search the book title to print class set of books.  
  - poster paper  
  - chalk board  
  - computer projector |
| **LESSON 2** | - paper  
  - pen/pencil  
  - microscope per group  
  - activity sheet per student  
  - evidence baggies marked A, B, C, D, E- with samples of fabric made of wool, rayon, polyester, silk and cotton in the same color. (1 set per group) |
| **LESSON 3** | - paper  
  - pen/pencil  
  - deck of cards  
  - Hand lenses – one hand lens per three to four students  
  - Measuring spoons – one set per class  
  - Paper plates or bowls  
  - Baggies: 5 labeled baggies each with ½ cup of A-baking soda, B-sugar, C-salt, D-cornstarch (1 set per group)  
  - 1 “unknown” baggie from crime scene (baking soda + sugar) 1 cup (1 baggie per class)  
  - Eye dropper – one dropper per three to four students  
  - Water- half cup full per group  
  - Iodine- one dropper full per group (or place sample amount in cup or bowl)  
  - Vinegar – one dropper full per group (or place sample amount in cup or bowl)  
  - Safety goggles – one pair per student and per teacher |
| **LESSON 4** | - paper  
  - pen/pencil  
  - tape  
  - timer/clock  
  - tweezers  
  - Black water soluble marker (BRAND: Expo, Vis A Vis)  
  - Black permanent marker (BRAND: Sharpie)  
  - Hand lenses – one hand lens per three to four students  
  - (4) Coffee filter strips per group each 1 inch wide–  
  (Signed or labeled by “Kesha”; “Aaron”; “Tran”, “Chrissie” in the water soluble marker and “Maria” in
| LESSON 5 | -paper  
| -pen/pencil  
| Rulers or yard sticks – 2 rulers or yard sticks per group  
| Scratch paper – one piece per partner  
| colored circle stickers  
| Calculators – one calculator per partner  
| overhead transparency of “evidence” footprint  
| Poster board or butcher paper size graph paper with graph included (graph sample included in supplement section) |
| LESSON 6 | -paper  
| -pen/pencil  
| Rulers – one ruler per student  
| Cotton swabs – one swab per student (and a few extras)  
| Dark-colored / red lipstick – one to two inexpensive tubes per group  
| Suspects’ Lip Prints chart – one  
| Lip Print Evidence cards – one set per lab group  
| White index card |
| LESSON 7 | -paper  
| -pen/pencil  
| White construction paper  
| Microscopes- one per group  
| Blank microscope slides – one blank slide per student  
| Microscope slide cover slips – one cover slip per student  
| Eyedroppers – one eyedropper per two to three students  
| Small cups – one cup per two to three students  
| Water – enough to fill the small cups given to every two to three students  
| Hair microscope slides for A, B, C, D – one of each per group  
| Hair Evidence on scenario |
| LESSON 8 | -paper  
| -pen/pencil  
| Hand lenses- one per student  
| Clear glass drinking glasses – one glass per two students *Cocoa powder – approximately one teaspoon per two students  
| Small soft camelhair or fiberglass paintbrushes – one paintbrush per two students  
| Transparent tape – approximately two inches per student  
| Completed Fingerprint Cards– one set per two students  
| Fingerprints: Evidence envelopes – one envelope per two students |
Community Crime Profile

To: CASE STUDENT INVESTIGATORS  
From: HARRIS COUNTY CRIME DEPARTMENT  
Date: JANUARY 1, 2014  
Re: COMMUNITY PARK CRIME – Case Number 8523696

At 9:30 pm yesterday, the police were called to a secluded, community park where the park had been demolished and city equipment had been stolen. At the scene, police investigators determined that the popular park had been demolished by several suspects. Based on a large amount of trash, soda bottles, candy wrappers, food, pieces of clothing, paint cans and other evidence the officers are confident that the park was demolished by the same group who demolished a park on the other side of town last month.

Items used to operate the park were missing from the main office including: park basketballs, jump ropes, after school snacks, rugby gear, football equipment, jump ropes, and over $500 in petty cash from the directors drawer.

After thoroughly investigating the scene, the investigators found evidence to be sent to the crime lab for further research. The chief of police has demanded that before any arrest are made; investigators must prove that the suspects were indeed at the park. To achieve this, police investigators would like to work with the CASE student investigators to analyze the evidence and determine if they have enough evidence to make the arrest.

The suspects have all been identified and profiles have been included in the profile packet.
Investigation Ideas: Lesson 1

Here are three hypotheses (educated guesses) about what happened to the equipment at the popular Community Park:

1. ____________________________ demolished the park and stole the equipment because
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

2. ____________________________ demolished the park and stole the equipment because
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

3. ____________________________ demolished the park and stole the equipment because
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Complete the chart below indicating three things about which you’d like to know more and how you might go about finding the information you seek.

<table>
<thead>
<tr>
<th>I’d Like to Know More About</th>
<th>I Could Learn More About This By</th>
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CASE Forensic Investigators Notebook  2
IDENTIFYING THE PARTS OF THE MICROSCOPE

Lesson 2 Explore Resource Sheet
Part I

Obtain a microscope to guide you as you locate its various parts.
Read about the function of each part of the microscope.
Use this information to label on your Microscope Lab page.

**Ocular or eyepiece** – Contains lenses to increase magnification, usually 10×

**Arm** – Connects the body tube to the base, where stage and adjustment knobs are located

**Revolving nosepiece** – Allows changing of various objectives

**Objectives** – Contains lenses of different magnifications, usually 4×, 10×, and 40×

**Stage** – Holds microscope slides and has an opening to allow light to pass through

**Stage clips** – Hold the slide in place

**Adjustment knobs** – Can be found as one knob with two parts or as two separate knobs. The outer knob or the larger knob is the coarse adjustment and is used to bring the slide into focus. The fine adjustment is the inner knob or the smaller knob and is used to sharpen the focus.

**Diaphragm** – Regulates the amount of light passing through the stage

**Light source** – Directs light upward through the diaphragm

**Base** – Supports the microscope
What’s a Microscope?

[Diagram of a microscope with annotations]

CASE Forensic Investigators Notebook 4
Using the Microscope

1. Plug in the microscope.
2. Turn on the lamp to allow light to pass through the specimen.
3. Most microscopes are equipped with a diaphragm for regulating light. Some materials are best viewed in dim light, others in bright light.
4. Rotate the nosepiece to bring the low-power objective into place.
5. The low-power objective will be the shortest and will have the smallest magnifying power, as indicated by the number stamped on its side. When changing from one objective to another, you will hear a click as the objective snaps into position.
6. When focusing, start with the objective with the lowest magnification. Make sure that both the coarse and fine adjustment knobs are lowered as far as possible. Do not allow the objectives to touch the cover slip.
7. Look through the ocular and slowly turn the coarse adjustment knob to raise the nosepiece until the specimen comes into rough focus. Use the fine adjustment knob to sharply focus the specimen.
8. Slowly move the slide to the right.
9. Slowly move the slide away from you.
10. Sketch a drawing of the image. Record the magnification.
11. Remove the slide and return to the low-power objective.
Forensic Science
Lesson 2 Engage Activity

An unknown specimen is placed on the stage of the microscope to be viewed under high-power resolution. Place the steps in the order that one should proceed to view the specimen using #1-7.

_____ Focus the specimen using the fine adjustment knob.
_____ Place the slide on the stage.
_____ Remove the slide from the stage.
_____ Return the objective to low power.
_____ Turn the objective to high power.
_____ Turn the objective to its lowest magnification.

Note: Once you have mastered the use of a microscope it is time to evaluate evidence from the Community Park Crime Scene
Lesson 2 INVESTIGATIONS

Scenario: Six pieces of clothing were found at the Community Park and collected as evidence. The police investigators needs the student investigators to determine if any of the items found were potentially worn by any of the suspects.

Microscope Lab

<table>
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<tr>
<th>Name:</th>
<th>Date:</th>
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<tbody>
<tr>
<td>Item Observed:</td>
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<tr>
<td>Notes:</td>
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</table>

Draw your observations of 2 different magnifications.

Magnification: X

Use colored pencils if appropriate.

Magnification: X
LESSON 3: POWERFUL POWEDERS
FORENSIC OBSERVATION

<table>
<thead>
<tr>
<th></th>
<th>Water Solution</th>
<th>Iodine Solution</th>
<th>Vinegar Solution</th>
<th>Odor</th>
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<tbody>
<tr>
<td>BAGGIE A</td>
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<td>BAGGIE B</td>
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<td>Crime Scene</td>
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Lesson 4: The Parting of the Pen

Scenario

Engage Activity

The Community Park Crime remains open. This morning the police recovered a small piece of paper with the words “Meet Me at the Park” written on it. The paper was found in the grass at the park. Though the police have performed various tests on the paper, they have not been able to identify who wrote it. The police just dropped off this piece of evidence and it will be posted on the board. Do not touch the evidence paper as this will contaminate the evidence. Keeping contamination of evidence to a minimum is especially critical while investigating a homicide. Homicide crime scenes are ripe for potential DNA transfer from one crime scene to another through tools.

The police also dropped off signatures of suspects and would like us to test these samples to determine which if any suspect’s pen was used to write the note. You will be using a process called chromatography to analyze the ink from pens collected from the suspects. Chromatography analyzes mixtures like ink by separating the mixtures into the chemicals from which they are made. Your job will be to work in small groups to perform chromatography on a variety of ink samples to see if any match the piece of paper found at the crime scene.

EXPLORATORY QUESTIONS

1. Did you determine if the water or alcohol was better to use?________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
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2. What happened to the signatures tested in alcohol?_______________________________
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3. What happened to the signatures tested in water?________________________________
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4. Did any of the signatures after being tested appear similar to the crime scene evidence?
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# The PARTING OF THE PEN

## Lesson 4: FORENSIC OBSERVATION

### FORM

<table>
<thead>
<tr>
<th>Suspects Pens</th>
<th>Signature Observation</th>
<th>WATER</th>
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| Crime Scene Evidence |       |       |         |
LESSON 5 STEPPING UP TO THE SUSPECT

FORENSIC SCENARIO

The case of Community Park Crime has had a great turn of events this morning. The crime scene investigators have been able to retrieve a shoeprint that was found on the ground near slide. Here is a transparency of the photograph of this footprint the police sent over for us to analyze.

What can be learned from this footprint? __________________________________________
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The crime scene investigators already know that historically a shoeprint indicates the approximate height of the person whose foot made the print. There is a mathematical relationship between the two variables—the length of the foot is approximately 15% of the person's total height.

In inches, what is the length of the suspect's footprint? ________________________________

What is the anticipated height of the suspect? _________________________________________

Which suspect do you think the footprint belongs to? _________________________________

CASE Forensic Investigators Notebook  11
LESSON 5 STEPPING UP THE SUSPECT

GRAPHING ACTIVITY

Line of Best Fit/ Trend Line

**DIRECTIONS:** After students measure their foot length and height, they should place a marker dot or sticker on the graph at the intersection of their foot length and height. Once every student has documented their foot size and height the teacher can draw a line of BEST FIT to fully illustrate the range of the student investigators.

A line of best fit is a straight line that best represents the data on a scatter plot. This line may pass through some of the points, none of the points, or all of the points.

Try to have the line as close as possible to all points, and **as many points above the line as below**. Line of best fit may vary according to individuals.
LESSON 6: LIPSTICK FUSION
FORENSIC Scenario

The crime scene investigation of the Community Park demolition is still in flux. The investigators have lip prints that were lifted off of napkins taken from the trash can in the park. They have determined from video surveillance from the store across the street that one of the suspects wiped his or her mouth and then threw that item into the trash can while hanging out and eventually demolishing the park.

The agents from the crime scene investigation unit need help with their cheiloscopy. Every person has a sort of barcode printed across their mouth so this process of crime scene investigation involves looking for distinct patterns in lip creases.

This morning an inspector dropped off the collected items from the trash can that had lip prints on them and also collected lip prints from the suspects. Remember our goal is to collect as much evidence about the suspects to prove that they are indeed guilty of the crime. Your task today will be to observe patterns to match the lip prints on the items extracted from the trash with the lip prints collected from the suspects. But first, as young investigators you must learn how to effectively evaluate lip prints.
Lesson 6: Suspects Lip Prints

Suspect A

Suspect B

Suspect C

Suspect D

Suspect E
CRIME SCIENCE EVIDENCE COLLECTED

Your job is to analyze the lip prints collected from the crime scene and determine if any of the prints match at least one or all the suspects listed above. Simply write the suspect id next to the picture based on your observations. If any of lip prints do not match a suspect simply leave it blank.
Lesson 7: Hair Do or Don’t Scenario

We have an update on the Community Park Crime Case. Hairs that were found in various places near where the lip prints were found by the crime scene investigators. Agents are confident that the hairs found came from individuals who were at the crime scene on the day of the crime. These are the two magnified hair samples retrieved:

![Animal Hair](image1.png)  ![Human Hair](image2.png)

Animal Hair. Note the thick medulla (core). Human Hair. Note the absence of a medulla.

The crime scene investigators have dropped off hair samples of the suspects today and are asking for your help to match the hair characteristics to the evidence sample. One of the samples have been determined to be that of animal hair. What characteristics of the hairs would you examine to look for differences and similarities?

Before observing hair from the crime scene, let’s observe your hair for practice. After viewing your hair under the microscope draw your observation sample in the box below.

Your Hair Sample
SUSPECT HAIR SAMPLES
Lesson 7 Forensic Samples
LESSON 8: IT ALL POINTS TO GUILTY
FORENSIC SCENARIO

The agents investigating the open case of the crime scene involving the Community Park Crime have just been handed some startling piece of evidence. A thumb print was lifted from the glass door at the Parks Office. They collected this fingerprint by “dusting” for them. In the dusting process, fingerprints are coated with powder then lifted and taken to a lab to be identified. Here is the print they found: (the fingerprint confirms that Tran or Suspect D was indeed involved in the Community Crime)

As crime scene investigators you will review the thousands of fingerprints recovered from crime scenes throughout the nation, each person in the world has a set of fingerprints unique to them! Even though every print is different, they can be categorized into one of three general types:
loops (found in 65% of the population), whorls (35%), arches (5%)

But first, as young investigators you must learn how to effectively evaluate fingerprints by analyzing practicing in the lab.

Your Thumb Print
Lesson 8 Forensic Engage Activity
Suspect Fingerprints

A: Aaron  B: Maria  C: Kesha  D: Tran  E: Chrissie
Final Community Park Crime Report

SUSPECT IDENTIFICATION

Directions: Students should go back through the files (their investigative notebooks) and describe the investigative analysis used to confirm a suspect’s involvement in the Community Park Crime. Police investigators will utilize this information to make an official arrest. Once successfully complete, student investigators will earn their badge and move on to a culminating investigation case.

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<thead>
<tr>
<th>Suspect</th>
<th>Crime Confirmation Description</th>
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Forensic Vocabulary Terms

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Lincoln High School Theft Profile

To: CASE STUDENT INVESTIGATORS
From: HARRIS COUNTY CRIME DEPARTMENT
Date: April 30, 2014
Re: Stolen Money and Lucky Bracelet

Rachel Morris and her best friend, Nora were getting in additional practice after their basketball practice one afternoon. They both wanted the extra practice time because on Saturday their school would be playing against their archrival, Lincoln High School; the winner would go to the state tournament. Rachel was the team’s top player and she had a lot of pressure to perform well in the game.

After shooting extra baskets, Nora suggested that they should get going if they wanted to make the bus home. The bus would leave at 4:15 pm. Both girls wanted to shower quickly before they headed for the bus. So they left the basketball court and headed to the locker room. Most of the other team members had already showered and dressed and were getting ready to head outside to the bus by the time Rachel and Nora entered the locker room. All of a sudden, Rachel screamed; she realized someone had broken into her locker. She noticed that her backpack was missing. Rachel was extremely sad and frustrated. The backpack not only contained her personal items, but also the money the team has raised for new uniforms for the big game.

After hearing Rachel scream, the team’s coach, Mrs. Roberts came into the locker room to see what was going on and why the girls were so upset. Rachel explained to the coach that her bag was missing and so was the money the team needed to buy their uniforms. She couldn’t figure out why anyone would do this and no one, but her teammates knew the money was even in the bag. Rachel suddenly realized her lucky bracelet she wore during her games was also in the game. Now the money for new uniforms and her lucky bracelet were gone. Who would do this right before the biggest game of the season? And why?

Let’s put together our forensic skills and help Rachel and her team solve this crime!
The Suspects

The only people still in the school when the crime took place were the girls on the team and their coach. It seemed almost impossible, but it looked like one of Rachel’s own teammates stole from her and the entire team. But who would do this and why would they do this? The biggest game of the year was coming up.
Suspect A: Nora

Height: 5’8”

Weight: 120 lbs

Shoe Size: 9

Hair Color: Black

Eye Color: Dark Brown

Nora is Rachel’s best friend and confidant since they were 3 years old. She is Rachel’s biggest fan and supporter and these friends go out of their way to encourage each other. Nora is a great basketball player on her own, but she has always been “second best” to Rachel, but she says it doesn’t bother her. She was wearing a black shirt and black shorts that day.
Suspect B: Rina

**Height:** 5’6”

**Weight:** 115 lbs

**Shoe Size:** 9

**Hair Color:** Brown

**Eye Color:** Blue

Rina is the second best player on the team after Rachel. She is a junior and Rachel is a senior, so they have been teammates for a long time, but the only know each other from the team. They are not friends outside of the team. Rina is definitely looking forward to her senior year and being the top player once Rachel is gone to college. Rina and Coach Roberts are very close. She was wearing a red shirt and black shorts that day.
Suspect C: Mariah

**HEIGHT:** 5’5”

**WEIGHT:** 105 lbs

**SHOE SIZE:** 8

**HAIR COLOR:** Dark Brown

**EYE COLOR:** Dark Brown

Mariah is only a freshman, so she hasn’t been on the team for very long. She is a huge supporter of all of her teammates and is happy to be on the team. The older players look at Mariah as their team’s mascot and biggest fan. She is not the best player yet, but Coach Roberts sees a lot of potential in her young player. She is great at defense and she is desperate to play in the next game. She plays the same position as Rachel. She was wearing a red shirt and red shorts that day.
**Suspect D: Nellie**

**Height:**  5’4”

**Weight:**  113 lbs

**Shoe Size:**  8

**Hair Color:**  Dark Brown

**Eye Color:**  Dark Brown

As the team’s only center player, Nellie tends to practice on the other side of the court and is not as close to her teammates as she would like. She spends most of her time alone and she does not speak to the rest of the team. She has also been known to be jealous of Rachel and all of the praise she receives. She was wearing an orange shirt and blue shorts that day.
Suspect E: Anne

**HEIGHT:** 5’10”

**WEIGHT:** 135 lbs

**SHOE SIZE:** 10.5

**HAIR COLOR:** Blonde

**EYE COLOR:** Blue

She is a foreign exchange student from Russia. She has become friends with most of the players on the team and actually lives with Mariah’s family. She is outgoing and friendly to all of the girls; however, none of the girls know her that well. She was wearing a white shirt and black shorts that day.
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<td><strong>Shoe Size:</strong></td>
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<td><strong>Hair Color:</strong></td>
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She is not a likely suspect, but nonetheless, she was present at the time of the crime and had an opportunity to be the thief. Coach Roberts has been coaching the team for 10 years and is an English teacher for the school as well. She was a top basketball player during high school and college and she loves to coach these girls. Coach Roberts was wearing a black shirt and black shorts that day.
The Clues

4:15 pm: Coach Roberts followed the school’s policy on vandalism and any type of theft by reporting the incident to the police. While the entire team waited for the police to arrive, the girls began to discuss among themselves about who might have stolen Rachel’s bag and the lucky bracelet and team’s money.

Most of the girls did not know where to start, so Rachel and the other teammates need your help! Your job is to act like detectives and solve this crime. Let’s get started and look at the clues.

The Locker: This is where Rachel put her bag. She had a lock on the locker, so someone had to know the locker code or break the lock. There are scrape marks on the locker near where the lock was removed. The blue paint was completely scraped off where the lock was and the lock was also missing. The side of the locker door was dented and there were also pry marks.

Footprints: As you know, footprints can be important to solving a crime. There are footprints just outside the gym door. The custodian cleans the sidewalk leading to the locker room and the locker room every day around 3 pm. The footprints could be the thief’s prints.

Fiber Evidence: There is a scrap of fiber that was stuck to the jagged edge of the metal where the lock had been removed from the locker. This fiber could be used for several key things.

Fingerprints: There are likely fingerprints on the locker where the lock was pried off and also where the bag was hanging in the locker. If additional prints besides Rachel’s are found, they likely belong to the person who stole the bag.
Help the Police

The police are quite busy with other cases, so they have asked your CSI groups to take over the case. However, they have left you some key information that they gathered from interviewing all of the girls and Coach Roberts. Let’s get started on solving the case!

Evidence to be Reviewed:

**Shoeprint:** A shoeprint was found outside of the locker room.

**Fiber Evidence:** The fiber was found snagged on the locker.

**Fingerprints:** Fingerprints were found on the locker and all of the suspects provided fingerprints to the police.

**Tools:** There were several tools found in garbage cans in the locker room that could have assisted in removing the lock from the locker.

**Other Clues:** Other clues found around the locker room may assist in solving this case.
FORENSIC SCIENCE

CULMINATING CASE

LINCOLN HIGH THEFT: INVESTIGATORS NOTEBOOK

2013-2014
Lincoln High School Theft Profile

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Re: Stolen Money and Lucky Bracelet

Rachel Morris and her best friend, Nora were getting in additional practice after their basketball practice one afternoon. They both wanted the extra practice time because on Saturday their school would be playing against their archrival, Lincoln High School; the winner would go to the state tournament. Rachel was the team’s top player and she had a lot of pressure to perform well in the game.

After shooting extra baskets, Nora suggested that they should get going if they wanted to make the bus home. The bus would leave at 4:15 pm. Both girls wanted to shower quickly before they headed for the bus. So they left the basketball court and headed to the locker room. Most of the other team members had already showered and dressed and were getting ready to head outside to the bus by the time Rachel and Nora entered the locker room. All of a sudden, Rachel screamed; she realized someone had broken into her locker. She noticed that her backpack was missing. Rachel was extremely sad and frustrated. The backpack not only contained her personal items, but also the money the team needed to buy their uniforms.

After hearing Rachel scream, the team’s coach, Mrs. Roberts came into the locker room to see what was going on and why the girls were so upset. Rachel explained to the coach that her bag was missing and so was the money the team needed to buy their uniforms. She couldn’t figure out why anyone would do this and no one, but her teammates knew the money was even in the bag. Rachel suddenly realized her lucky bracelet she wore during her games was also in the game. Now the money for new uniforms and her lucky bracelet were gone. Who would do this right before the biggest game of the season? And why?

Let’s showcase our forensic skills and help Rachel and her team solve this crime!
Activity Station #1: Crime Scene

Walk around the crime scene with your group and look for any additional clues. The clues that you already know about are the shoe print, the fiber on the locker, the fingerprints on the locker and the fact that there was a tool used to break the lock. Try to find as many other pieces of evidence as possible to help you solve this case!

Possible Clue: ____________________________________________________________

What it could tell us: ____________________________________________________

_______________________________________________________________________

Draw a picture of the clue:


Possible Clue: ____________________________________________________________

What it could tell us: ____________________________________________________

_______________________________________________________________________

Draw a picture of the clue:


Possible Clue: ________________________________________________________________

What it could tell us: _______________________________________________________

__________________________________________________________________________
__________________________________________________________________________

Draw a picture of the clue:
Activity Station #2: Fingerprints

Step 1: Lift a fingerprint off the locker using cocoa powder, a brush and tape (just like you learned how to do). Place the print here:

Step 2: Review the fingerprints of all of the suspects. The police have provided the fingerprints and they are hanging up on index cards. Write down the features of each fingerprint.

   Suspect A: ____________________________________________________________
   Suspect B: ____________________________________________________________
   Suspect C: ____________________________________________________________
   Suspect D: ____________________________________________________________
   Suspect E: ____________________________________________________________
   Suspect F: ____________________________________________________________

Step 3: Based on the features of each suspects’ fingerprint and the fingerprint you lifted from the locker, figure out who you think committed the crime and write that person’s name below.

   ____________________________________________________________
Activity Station #3: Fiber Analysis

Remove the fiber from the locker door using tweezers so that the fiber is not contaminated. Then, look at the fiber under the microscope. Make note of the color of the fiber, the type of fiber (if you know) and whether or not there are any stains on the fiber. Then, draw a picture of the fiber.

**Microscope Lab**

<table>
<thead>
<tr>
<th>Name:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item Observed:</td>
<td>Notes:</td>
</tr>
<tr>
<td>Magnification X</td>
<td>Magnification X</td>
</tr>
</tbody>
</table>

Draw your observations at 2 different magnifications.

Use colored pencils if appropriate.

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Activity Station #4: Footprints

A shoe print was found outside of the locker room. Use the following formula to determine the height of the perpetrator. Then, look back at the suspect profiles and determine who may be the perpetrator based on her height.

1. Measure the length of the shoeprint from the heel to the tip of the big toe.
2. The length of a person’s foot is approximately 15% of his or her height. Therefore, the fraction $\frac{15}{100}$ represents 15%.
3. To find the person’s height, you will use a fraction that represents the length of the person’s foot over the person’s height. That fraction is $\frac{\text{length of foot}}{x}$.
4. Set up a ratio so that it looks like this:
   \[
   \frac{15}{100} = \frac{\text{length of foot}}{x}
   \]
5. Substitute the length of the foot that you measured in the space that says length of foot.
6. Cross multiply to get $100 \times \text{length of the foot} = 15x$
7. Divide the answer to $100 \times \text{length of the foot}$ by 15.
8. The answer you got is in inches. Divide that answer by 12 to figure out how many feet the suspect is.

Which suspect has a height that matches the height that you have determined the owner of the shoeprint has? ________________________

________________________________________

________________________________________
Activity Station #5: Tool Analysis

Tools have been found at the scene of the crime. Analyze each tool for clues and write your observations down.

Screwdriver Observations: _____________________________________________________
___________________________________________________________________________
___________________________________________________________________________
Could this tool have removed a lock?   Yes    No
Could this tool have made a dent in a locker?   Yes    No

Tweezer Observations: _____________________________________________________
___________________________________________________________________________
___________________________________________________________________________
Could this tool have removed a lock?   Yes    No
Could this tool have made a dent in a locker?   Yes    No

Nail clipper Observations: _____________________________________________________
___________________________________________________________________________
___________________________________________________________________________
Could this tool have removed a lock?   Yes    No
Could this tool have made a dent in a locker?   Yes    No

Hammer Observations: _____________________________________________________
___________________________________________________________________________
___________________________________________________________________________
Could this tool have removed a lock?   Yes    No
Could this tool have made a dent in a locker?   Yes    No
Solving the Crime: Suspect Identification

With your group, review all of the evidence that you have worked with. Based on that evidence, fill in the chart below. Then, identify the suspect you believe committed the crime!

<table>
<thead>
<tr>
<th>Suspect</th>
<th>Crime Confirmation Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
</tbody>
</table>

The person who committed the crime is __________________________________________
Lincoln High School Crime Culminating Event Teacher Guide

Duration: 2 -3 hours depending on number of groups

Age Range: 3rd to 6th Graders

# of Students: 10-30

# of Teachers: One teacher per activity station (at least 5)

Facility Needed: Auditorium or gym for whole group gathering. Gym locker room and gym for activity stations or a space that can be set up as a locker room

Overview:
This culminating event will begin with an introduction and welcome for the students. The students will be told that they are going to be investigating and solving a mystery. The overview of the missing bag should be read to the students. The students will be briefed on the case by reviewing the case information packet that includes: the evidence collected, the list of suspects and clues. The information about each of the suspects should be projected onto a screen for all of the students to see. The teacher should then break the students into groups. There should be five groups.

Time Frame:
Introduction: 20 minutes Whole Group
Activity Station 1: 20 minutes per group
Activity Station 2: 20 minutes per group
Activity Station 3: 20 minutes per group
Activity Station 4: 20 minutes per group
Activity Station 5: 20 minutes per group
Solving the Crime: 15 minutes
Whole Group Conclusion: 15 minutes

Whole Group Introduction (20 minutes)
This Introduction should explain Forensic setup, procedures relating to the culminating event and any general rules established by the organizer. The case can be read to the entire group. The information about each suspect should be reviewed as it is displayed for the students to see. The pre-determined teams should also be given their Investigator’s Notebook and one copy of the Suspect Profiles. The teacher should explain to the students that they will be using their Investigator’s Notebook at each station to take notes about clues found at the crime scene. Students will then leave with their group to rotate through the activity stations.

Materials:
- Investigator’s Notebook for each participant
- Suspect Profiles, Clues and Evidence for each group
- computer, projector and screen for displaying the suspects’ information
Activity Station 1: Crime Scene (20 minutes per group)
At this station, students will have the opportunity to walk around the “crime scene” to look for additional clues. The students will be searching for the tool that broke the lock off the locker and any other clues such as a Band-Aid or blood in a sink. Students will record the clues that they find in their Investigator’s Notebook.

Materials:
- Set up the gym locker room (or, if that is not available, recreate a locker room) so that there is a locker with a “dent”
- different tools (such as a screwdriver, nail clippers, hammer and tweezers) in a garbage can
- a Band-Aid on the floor
- “blood” drops in the sink

Activity Station 2: Fingerprints (20 minutes per group)
At this station, the students will lift fingerprints off the locker for analysis. The students will then compare the fingerprint they lifted from the locker to the samples of fingerprints they got from each of the suspects.

Materials:
- Fingerprints placed on a locker (or something that looks like a locker door) to be “lifted” by the student
- cocoa powder
- brush
- tape
- ink fingerprints of all of the suspects for the students to work with (these must be provided by teachers who are willing to be fingerprinted as one of the suspects ahead of time and placed on index cards that are labeled with the name of the suspect they represent).

(Note: It is recommended that a teacher who is at the culminating event provide the fingerprint of the culprit. That way, the teacher can continuously put fingerprints on the locker if needed.)

Activity Station 3: Fiber Analysis (20 minutes per group)
At this station, the students will collect fibers that were found on the locker. They will then look at the fiber sample under the microscope. The students will analyze the fiber for any notable features (color, type of fiber, any stains). Students will draw their observations on the fiber analysis sheet in their investigator notebooks.

Materials:
- Microscopes
- fiber samples that match the samples from the suspects
- tweezers
- colored pencils

The fiber samples should be placed on a locker door (or something that looks like a locker door) so the students can remove the fibers to be analyzed.

Activity Station 4: Footprints (20 minutes per group)
At this station, the groups will analyze the footprint that was found at the scene of the crime and will compare that footprint to the height of all of the suspects. The students will use the footprint formula to determine the height of each suspect from the shoe print.

Materials:
• A real shoe print (create one by putting paint on the bottom of a shoe and then stepping onto paper) that will be used as the perpetrator’s print. The shoe print must be a size 9.
• Calculators and scrap paper

Activity Station 5: Tool Analysis (20 minutes per group)
At this station, the groups will analyze the tools that were found at the crime scene for evidence of paint. Students will also analyze whether each of the tools could have left a dent and removed a lock.

Materials:
• Screwdriver (with blue paint on it)
• Nail clippers (with blue paint on it)
• Hammer
• Tweezers

Solving the Crime (15 minutes per group)
The groups will get together and review all of the evidence that they collected at each station. After reviewing the evidence, the group needs to make a decision as to which suspect is the guilty one.

Materials:
• Investigator’s notebook

Whole-Group Conclusion (15 minutes)
A brief review of all of the evidence will be provided and then the perpetrator will be identified. Students will receive their diplomas.

Materials:
• Computer, projector and screen for evidence review
• A diploma for each student
# Planning Guide and Sample Schedule

## Several Weeks in Advance:
- Ensure that the venue that you will be using is secured

## One Week Prior to the Event:
- Print Investigator’s Notebooks for each participant
- Prepare materials for each of the activity stations
- Divide students into groups of at least five students each and create a schedule for each teacher

## Day of the Event
- Set up materials for each activity station
- Have materials organized and ready to hand out to each group
- Test projector and sound for the introduction and conclusion
- **NOTE:** Stations 1, 2, and 3 will need to be reset in between each group

## Sample Schedule

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity Station 1: Crime Scene</th>
<th>Activity Station 2: Fingerprints</th>
<th>Activity Station 3: Fiber Analysis</th>
<th>Activity Station 4: Footprints</th>
<th>Activity Station 5: Tool Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:00-00:20</td>
<td><strong>Introduction</strong> in the auditorium with all participants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>00:20-00:40</td>
<td>Group 1</td>
<td>Group 2</td>
<td>Group 3</td>
<td>Group 4</td>
<td>Group 5</td>
</tr>
<tr>
<td>00:40-01:00</td>
<td>Group 5</td>
<td>Group 1</td>
<td>Group 2</td>
<td>Group 3</td>
<td>Group 4</td>
</tr>
<tr>
<td>01:00-01:20</td>
<td>Group 4</td>
<td>Group 5</td>
<td>Group 1</td>
<td>Group 2</td>
<td>Group 3</td>
</tr>
<tr>
<td>01:20-01:40</td>
<td>Group 3</td>
<td>Group 4</td>
<td>Group 5</td>
<td>Group 1</td>
<td>Group 2</td>
</tr>
<tr>
<td>01:40-02:00</td>
<td>Group 2</td>
<td>Group 3</td>
<td>Group 4</td>
<td>Group 5</td>
<td>Group 1</td>
</tr>
<tr>
<td>02:00-02:15</td>
<td><strong>Solving the Crime</strong> - groups working together to solve the crime</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02:15-02:30</td>
<td><strong>Closing</strong> in the auditorium with all participants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Instructor Answers

## Final Locker Room Report

### SUSPECT IDENTIFICATION

<table>
<thead>
<tr>
<th>Suspect</th>
<th>Crime Confirmation Description</th>
</tr>
</thead>
</table>
| A       | Wore only black  
          | Rachel’s best friend  
          | Was with Rachel during the time of the theft  
          | Has a cut on her hand  
          | Wore size 8 shoes |
| B       | Wore red shirt  
          | Jealous of Rachel  
          | Has a cut on her hand  
          | Had access to Coach’s screwdriver  
          | Finger print matched that taken from the locker  
          | Wore size 7 shoes |
| C       | Wore all red clothing  
          | Wore size 9 shoes |
| D       | Wore orange and blue clothing  
          | Had access to Coach’s screwdriver  
          | Wore size 6 shoes |
| E       | Wore white and black clothing  
          | Wore size 8 shoes |
| F       | Wore all black clothes  
          | Has size 10 shoes |
SOLUTION DESCRIPTION

If you guessed Rina, you are right! When confronted with the evidence, Rina broke down and admitted that she did it. She desperately wanted to be better than Rachel just once before she graduated, and she thought Rachel relied on the lucky bracelet enough that without it, she might be better than her. Rina stole the money to try to make it look like someone from outside the team committed the crime.

She apologized to Rachel and the team and explained how bad she felt about the whole thing. Rachel said she hoped that Rina had learned something. Coach Roberts took Sabrina off the team for the rest of the year, and the principal suspended her from school for a week.
Central City Police Department

Case Number: 8523696

Community Park Crime
**Suspect A:** Aaron Garcia

**Height:** 5’8”

**Weight:** 180 lbs.

**Hair Color:** Black

**Eye Color:** Brown

**Unique Features/Medical Conditions:** Tattoo on his right arm

**Occupation:** Student and works part-time

**Hobbies:** Jogging in the park, playing sports, and car racing

**Suspect claims that at the time of the crime, he was:** Hanging out with friends at the local car racing track. When questioned by police, they noticed a starch substance on his shirt.

**Motive:** Michael has wanted to start racing cars for some time, but he has been short on cash and looking for ways to make some quick cash.
Suspect B: Maria White

HEIGHT: 5’9”

WEIGHT: 130 lbs.

HAIR COLOR: Black

EYE COLOR: Brown

UNIQUE FEATURES/ MEDICAL CONDITIONS: Tattoo on ankle, near-sighted

OCCUPATION: Student and works at a used sporting goods store & another part-time job

HOBBIES: Riding bikes, hanging out with friends, and watching TV

Suspect claims that at the time of the crime, she was: working at her part-time job that night. When questioned by police, she had several bottles of pop with her and she had just gotten off work.

Motive: Nina is a hard worker, but lately the store she works at has been low on equipment to sell and Nina has been worried she might lose her job.
Suspect C: Kesha Newman

**Height:** 5’5”

**Weight:** 145 lbs.

**Hair Color:** Blonde

**Eye Color:** Blue

**Unique Features/ Medical Conditions:** Has braces

**Occupation:** Worked at the Community Park and she just got a new job after school

**Hobbies:** Exercising, reading, and talking to friends

Suspect claims that at the time of the crime, she was: getting home from work. She cleaned up the park that night. When questioned by police, she was eating pretzels and had salt all over her hands.

**Motive:** Melissa was losing her job at the park. The community did not have enough money to pay for her services.
Suspect D: Tran Gerr

**Height:** 5’2”

**Weight:** 98 lbs.

**Hair Color:** Dark Brown

**Eye Color:** Brown

**Unique Features/Medical Conditions:** Allergic to grass

**Occupation:** 9th grade student at Central High School and has a part-time job

**Hobbies:** shopping, dancing, playing soccer, hanging out with friends

**Suspect Claims that at the Time of the Crime, She Was:** working at her part-time job. When questioned by police, she had baking soda on her face.

**Motive:** Ms. Gerr has been hanging out with a bad crowd. She has been getting into trouble and taking dares by her friends to steal items from public places.
### Suspect E: Chrissie Jones

<table>
<thead>
<tr>
<th><strong>Height:</strong></th>
<th>5’10”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight:</strong></td>
<td>135 lbs.</td>
</tr>
<tr>
<td><strong>Hair Color:</strong></td>
<td>Light Brown</td>
</tr>
<tr>
<td><strong>Eye Color:</strong></td>
<td>Brown</td>
</tr>
</tbody>
</table>

**Unique Features/Medical Conditions:** Has a scar on his right knee from playing sports

**Occupation:** Student with a part-time job.

**Hobbies:** Playing basketball and being with friends

**Suspect Claims that at the Time of the Crime, She Was:** Leaving the playground with his friends. She was playing basketball. The courts are near the park. When questioned by police, she had plaster under her fingernails.

**Motive:** Chrissie is a great basketball player; however, she hasn’t been able to afford new shoes and equipment.