

Forensic Detectives: Mysteries and Solutions: Teacher's Guide

Grade Level: 6-8

Curriculum Focus: Forensic Science

Lesson Duration: Three class periods

Program Description

Students work alongside real-life forensic investigators, who glean amazing information from physical evidence. Segments cover the study of archaeological finds, site evidence, DNA, and the human body. In each intriguing case, students learn the value of analytical thinking as they discover clues and formulate how the pieces fit together. This program includes one feature segment and three short segments.

Onscreen Questions

- How were forensic scientists able to reconstruct the story of Napoleon's invasion of Russia?
 - How can buildings provide clues to the past?
 - How do forensic scientists collect, preserve, and present evidence?
 - How does your body provide clues to your health?
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Lesson Plan

Student Objectives

- Discuss forensic science, including evidence, techniques, and tools.
- Research forensic tools and techniques.
- Write a report about a fictional crime scene.

Materials

- *Forensic Detectives: Mysteries and Solutions* video and VCR, or DVD and DVD player
- Computer with Internet access
- Empty manila folders (one for each team)
- Paper and pencils

Procedures

1. After watching *Forensic Detectives: Mysteries and Solutions*, ask students the following questions: What is forensic science? (The study of evidence discovered at a crime scene and used in a court of law) Are forensic techniques used only to solve crimes? (The program illustrated these non-crime examples: to identify skeletons in mass graves of Napoleon's army and to try to authenticate an alleged Leonardo da Vinci painting.)
2. Tell students they will explore the use of forensic science in the murder cases featured in the program. The detectives collected evidence, or clues they hope will solve the crime; trace materials are very small pieces of evidence. What evidence did investigators use to solve the crime? (blood, hair, fibers, tire tracks) How was this evidence helpful? (The hair, fibers, and tire tracks linked the crime to the suspect's dog and to his girlfriend's home and car.) Which evidence was not helpful in identifying a suspect, and why? (The blood, because it belonged to the victim.)
3. Explain that forensic scientists use special tools, techniques, and resources to collect, document, and analyze evidence. Ask students to brainstorm a list of the tools used in the investigation and how each tool was used. Create a chart of their answers.

Tool	How it was used
Luma Light	Revealed fibers, hair, and blood
Orange goggles	Made evidence lit by Luma Light stand out sharply; helped investigators spot evidence
Dental cement	Used to make castings of tire tracks
Microscope	Helped forensic chemist find and identify carpet fibers and dog hairs
Cameras	Supplied photographs of crime scene and evidence, such as tire tracks
Tire company database	Investigators used to find recent purchases of that specific tire.
Ink prints	Made prints of tread patterns of suspect's tires.
Criminal files	Background check revealed the suspect's previous criminal activity and prison sentence.

4. Ask students to identify experts who helped in the investigation. (forensic science unit investigators, forensic chemist, tire track identification expert) How were they valuable? (They helped identify and analyze evidence.)
5. Have the class brainstorm other tools or techniques used by forensic experts. (Answers may include fingerprinting, DNA and handwriting analysis, lie detectors, chemical tests, and soil analysis.)



6. Tell students that they will explore additional forensic tools and techniques that are featured in the Discovery Channel Web site: "You're on the Case" (<http://dsc.discovery.com/fansites/onthecase/onthecase.html>). Students should focus on the following three sections:
 - Photo Gallery: close-up images of evidence seen with high-power microscopes, including human and animal hair, blood, skin, fiber, dust, and more
<http://dsc.discovery.com/fansites/onthecase/photo/photo.html>
 - The Investigators Toolbox: articles about forensic tools and techniques, from psychological analysis to the blood detector luminol
<http://dsc.discovery.com/fansites/onthecase/toolbox/toolbox.html>
 - Ask the Expert: interviews, including with a forensic scientist and a forensic artist
<http://dsc.discovery.com/fansites/onthecase/qa/qa.html>
7. Divide the class into teams of four or five. Explain that teams will investigate a fictitious crime. Using what they learned from viewing the program and the Web site sections above, each team will reconstruct a crime scene with one piece of evidence for each team member. Teams will develop a crime folder that includes all the evidence. Students should work together to decide the pieces of evidence that will be found and the tools and techniques they will use to detect them. One person will record information about the crime scene, including location, time of discovery, description of scene, and evidence found. Then, each team member will write an individual report about a tool or technique, describing in detail the following:
 - the evidence
 - the tool or technique that was used
 - the analysis (include at least one picture or sketch, if applicable)
 - the conclusion
8. Each team will place the individual reports into its crime-report folder and then exchange it with another team.

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- **3 points:** Students actively participated in class discussions about forensics, recalling several tools and techniques and their uses; wrote a well-organized, complete crime report that included a clear description of how a tool analyzed evidence.
- **2 points:** Students participated in class discussions about forensics, recalling a few tools and techniques and their uses; wrote an organized, satisfactory crime report that included an adequate description of how a tool analyzed evidence.
- **1 point:** Students did not participate in class discussions about forensics, recalling few or no tools and techniques and their uses; wrote a disorganized, incomplete crime report that included an unclear description of how a tool analyzed evidence.

Vocabulary

crime scene

Definition: The location of a robbery, murder, or other criminal activity

Context: The suspect left a tire print at the crime scene.

evidence

Definition: An object or information used to reach a conclusion

Context: The evidence from a crime scene included tire tracks, fibers, hair, and blood.

forensic science

Definition: The study of evidence discovered at a crime scene and used in a court of law

Context: Forensic science is used to investigate details of a crime, first by locating and collecting physical evidence at the scene.

Luma Light

Definition: A high-powered light with wavelengths that cause blood or other materials to fluoresce or glow

Context: Investigators often rely on a Luma Light to reveal evidence blood at a crime scene that has been cleaned.

trace materials

Definition: Small pieces of evidence at a crime scene, such as fibers, hair, and blood

Context: Searching the ground for trace evidence, investigators found tiny fibers.

Academic Standards

National Academy of Sciences

The National Science Education Standards provide guidelines for teaching science as well as a coherent vision of what it means to be scientifically literate for students in grades K-12. To view the standards, visit <http://books.nap.edu>.

This lesson plan addresses the following science standards:

- Science as Inquiry: Understandings about scientific inquiry
- Physical Science: Properties and changes of properties in matter
- Science in Personal and Social Perspectives: Science and technology in society
- History and Nature of Science: Science as a human endeavor

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit <http://www.mcrel.org/>.



This lesson plan addresses the following national standards:

- Science – Nature of Science: Understands the nature of scientific inquiry, Understands the scientific enterprise
 - Language Arts – Viewing: Uses viewing skills and strategies to understand and interpret visual media
 - Life Skills – Thinking and Reasoning: Effectively uses mental processes that are based on identifying similarities and differences, Understands and applies basic principles of hypothesis testing and scientific inquiry
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Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the [Discoveryschool.com](http://www.discoveryschool.com) Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- <http://school.discovery.com/teachingtools/teachingtools.html>
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DVD Content

This program is available in an interactive DVD format. The following information and activities are specific to the DVD version.

How To Use the DVD

The DVD starting screen has the following options:

Play Video – This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

Video Index – Here the video is divided into four parts (see below), indicated by video thumbnail icons. Watching all parts in sequence is similar to watching the video from start to finish. Brief descriptions and total running times are noted for each part. To play a particular segment, press Enter on the remote for TV playback; on a computer, click once to highlight a thumbnail and read the accompanying text description and click again to start the video.

Curriculum Units – These are specially edited video segments pulled from different sections of the video (see below). These nonlinear segments align with key ideas in the unit of instruction. They include onscreen pre- and post-viewing questions, reproduced below in this Teacher's Guide. Total running times for these segments are noted. To play a particular segment, press Enter on the TV remote or click once on the Curriculum Unit title on a computer.

Standards Link—Selecting this option displays a single screen that lists the national academic standards the video addresses.

Teacher Resources—This screen gives the technical support number and Web site address.

Video Index

I. A Puzzle From the Past (6 min.)

Join forensic scientists studying a mass grave outside Moscow to gain new insight into Napoleon's disastrous invasion of Russia.

II. Clues to a Culture (4 min.)

Great Zimbabwe, once considered the work of a vanished white culture, stands as a testament to the achievements of an ancient African civilization.

III. The Value of Evidence (31 min.)

From uncovering forgeries to tracking serial killers to identifying wrongful imprisonments, witness the crime-solving power of forensic science.

IV. Hints About Your Health (5 min.)

Your diet can make or break your health. Assess the eating habits of a typical American family, and explore how your body provides clues to your wellbeing.

Curriculum Units

1. Napoleon's Conquest Attempt

Pre-viewing question

Q: What do you know about Napoleon Bonaparte?

A: Answers will vary.

Post-viewing question

Q: Why did Napoleon need to defeat the czar before winter?

A: Answers will vary.

2. A Devastating Toll

Pre-viewing question

Q: What makes warring armies decide to retreat?

A: Answers will vary.

Post-viewing question

Q: If Napoleon had conceded defeat in Russia, would it have changed later events?

A: Answers will vary.



3. Stone Houses of Africa

Pre-viewing question

Q: What ancient culture had the most advanced architecture?

A: Answers will vary.

Post-viewing question

Q: What made Great Zimbabwe problematic for 19th-century European scholars?

A: While they admired African art, these scholars believed Africans were primitive and incapable of building complex structures. If native Africans had, in fact, built this great city with granite walls and towers, it would serve as proof that they were not inferior, after all.

4. Protections and Proof

Pre-viewing question

Q: Have you ever tried to make somebody believe something you knew was false?

A: Answers will vary.

Post-viewing question

Q: Why did the Rhodesian government reject the findings about Great Zimbabwe?

A: Accepting the findings that Great Zimbabwe had been a thriving culture during the Middle Ages would have destroyed the 19th-century colonial view that Africans were uncivilized.

5. The Crime Scene

Pre-viewing question

Q: What is the best way to capture a criminal?

A: Answers will vary.

Post-viewing question

Q: What was the most important clue found at the crime scene?

A: Answers will vary.

6. A Needle in a Haystack

Pre-viewing question

Q: As an investigator, what would you look for when examining a crime scene?

A: Answers will vary.

Post-viewing question

Q: Why are carpet fibers valuable clues in a criminal investigation?

A: Because they can link suspects to a specific location.

7. New Leads

Pre-viewing question

Q: How much evidence should police need to arrest a murder suspect?

A: Answers will vary.



Post-viewing question

Q: How did investigators link the tire track to Terry Jo Howard's truck?

A: They didn't have enough evidence for a search warrant, so they got her to give up her tires voluntarily by telling her that they'd been recalled. Then, a tire tracker identification expert matched the size of the pitches, or geometric shapes, found on the tire tread with those found on the print from the crime scene. Using the sequence of pitches, he was able to determine the exact part of the tire that he believed made the print. He then used the tiny cuts on the surface of Howard's tires to find a match point, or a place on the tire print taken from the crime scene that could only have been made by Howard's tires.

8. Manhunt

Pre-viewing question

Q: Should police be unrestricted when investigating a murder suspect?

A: Answers will vary.

Post-viewing question

Q: What would you have done to capture James Randall?

A: Answers will vary.

9. Misused Justice

Pre-viewing question

Q: If you were wrongly accused of a crime, what would you do?

A: Answers will vary.

Post-viewing question

Q: What testimony did Kate Germond find troubling, and why?

A: The forensic examiner who testified at Honaker's case said that hairs found on the victim closely matched Honaker's. However, hairs aren't distinct enough to be linked to an individual.

10. DNA Evidence

Pre-viewing question

Q: What characteristics are used to describe hair?

A: Answers will vary.

Post-viewing question

Q: Why is DNA such an important clue in criminal cases?

A: No two people have the exact same DNA. Scientists can remove DNA from body tissues and fluids and then make key pieces of it visible on x-ray film. The patterns displayed can positively link a suspect to a crime scene.

11. A New Masterpiece

Pre-viewing question

Q: Could you discern a forged painting from the real one?

A: Answers will vary.



Post-viewing question

Q: What can studying a painting's pigments tell us about its origin?

A: Pigments can be used to date a painting. Modern paint, with minerals and substances ground for days by machine, is consistent and even. In earlier paints, these materials were ground by hand; their pigments are grainier and rougher. Pigment color can also date a painting – for example, Prussian blue has not used until 1704.

12. Food for Health

Pre-viewing question

Q: What are the healthiest foods to eat?

A: Answers will vary.

Post-viewing question

Q: What does the food pyramid suggest for a healthy daily diet?

A: According to the pyramid, each day a person should eat six to 11 servings of complex carbohydrates; two to three servings of meat/poultry/fish/beans; at least three to five servings of fruits and vegetables; and only a sparing amount of fats and sweets.