

Using Science to Solve Crimes

Reading Preview

Key Concepts

- What skills do people who investigate crimes use?
- How does working as a team help solve crimes?
- How do the methods used to solve crimes today compare with those used in the past?

Key Terms

- burglary
- forensic science
- observing
- evidence
- inferring
- predicting
- hypothesis
- crime scene investigator
- medical examiner
- autopsy
- density

Target Reading Skill

Building Vocabulary After you read this lesson, use what you have learned to write a definition of each Key Term in your own words. Define a term by telling its most important feature or function.

Discover Activity

What Do You Know About Solving Crimes?

Which of these statements about solving crimes do you think are true and which do you think are false?

1. Every crime that is reported to the police gets solved.
2. It takes just a few hours to solve most crimes.
3. Crime scene investigators work only on murder cases.
4. One task of crime scene investigators is to track down and arrest suspects.

Think It Over

Making Judgments Where do you think most people get their information about how crimes are solved? Do you think this source gives people true or false ideas about how crimes are investigated? Give an example to support your answer.



A 9-1-1 call comes in to a police station. Someone broke into a ground-floor apartment. A valuable stamp collection that was kept in a locked desk drawer is missing. Breaking into a building to steal an object is a **burglary**.

The first officers to arrive see a broken window. Inside, there are shoe prints on the carpet. One officer says, "Those shoe prints come from two different shoes. There was more than one burglar." Then she looks at the desk. "Here are marks left by a tool. They must have pried open the drawer."

The other officer sniffs the air. "That smells like a perfume my wife wears," he says. "One of the burglars may be a woman." In the bedroom he finds a parrot who keeps saying, "Hurry up, Pat!" Could one burglar be named Pat?

This investigation shows science in action. From the time that investigators arrive at a crime scene, they use skills that scientists use. They observe details. They interpret what they see. They ask questions. They draw conclusions about what happened.

Science at a Crime Scene

The use of scientific knowledge and methods to answer legal questions is called **forensic science**. People sometimes call this field just “forensics.” However, the complete term helps stress the connection between science and law.

Some members of an investigative team are scientists. Some are not. But all of them approach the situation with the same questions: What happened? When did it happen? Who could have done it? To find out, each investigator must think like a scientist. **The investigative team uses inquiry skills to help solve crimes. These skills include observing, inferring, predicting, and developing a hypothesis.**

Observing What were the officers at the burglary scene doing when they saw shoe prints, smelled perfume, and listened to a parrot? They were observing the crime scene. **Observing** is using one or more of your senses to gather information. People who investigate crime scenes rely on their senses of sight, smell, and hearing. They rarely use taste or touch.

Observing is a skill used to find evidence. In the legal system, **evidence** is something that can be presented in court to make a point during a trial. The evidence can be a statement from a witness. Evidence can also be an item collected at a crime scene or the results of tests done on that item. The place where an item is found can also be evidence. All the observations made at a crime scene can be used as clues to help solve a crime. But not every clue can be used as evidence, as shown in Figure 1.



**Reading
Checkpoint**

Which senses do people who investigate crimes use most often?

FIGURE 1

Clues vs. Evidence

Shoe prints on a carpet and words spoken by a parrot can both be clues. But only the shoe prints could be used as evidence in a trial.



“Hurry up,
Pat!”

Skills Activity

Observing

Your teacher will give you a list of five items to find in your classroom. When you find an item, record its location on the list. After you finish the task, answer these questions: Were some items harder to find than others? If so, what made these items harder to find?

What happened here?



Inferring Some things the officers said at the burglary scene were not observations. One officer said there was more than one burglar. The other said that one burglar might be a woman. These officers were inferring when they made these statements. **Inferring** is offering a reasoned opinion based on observations and experience. A statement made by a person who is inferring is called an *inference*. When you are inferring, you are using your ability to reason, not your senses.

It is possible to make more than one inference from one observation. For example, you see a moving van parked in front of a house. You could infer that someone is moving into the house or you could infer that someone is moving out. There is only one way to tell which inference is correct. You need to investigate further.

Predicting At the burglary scene, the officers used their observations to infer what had happened in the past. But observations can also help you infer what will happen next. **Predicting** is stating an opinion about what will happen in the future. Inferences about the future are called *predictions*. People who solve crimes use observations and past experience to make predictions.

You can use predictions to help you decide what to do next. For example, experience says that people who steal stamp collections may try to sell the stamps to a stamp dealer. So the police could contact dealers and give them a description of the stamps. You can use Figure 2 to practice making inferences and predictions.

FIGURE 2

Inferring and Predicting

You observe a paper bag and spilled groceries on a sidewalk. No one is near the groceries.

Inferring What are two inferences you could make? Predict what might happen next.

What might happen next?

Inquiry Skills

Description

Forensic Science Examples

Interpreting Data

Analyzing data to look for patterns or trends

Deciding if a suspect's fingerprints match those at a crime scene; mapping locations of similar crimes

Classifying

Grouping together objects that are alike in some way

Typing blood; distinguishing cat hair from human hair

Making Models

Using a drawing, diagram, or a 3-D structure to represent a complex object or process

Making sketches or 3-D models of a crime scene; making a computer simulation of a crime

Communicating

Sharing ideas and information with other people

Taking notes at a crime scene; interviewing witnesses

Measuring

Making quantitative observations about the properties of an object or of a set of objects

Measuring the length of skid marks; using body temperature to determine time of death

Posing Questions

Asking questions that can be answered by gathering evidence

Which automobile models have this type of paint? Is the person who lost this contact lens nearsighted or farsighted?

Developing a Hypothesis Sometimes what happened at a crime scene is obvious from the beginning. Sometimes the people who solve crimes must dig deeper to find an explanation. Scientists call a possible explanation for a set of observations a **hypothesis**.

There may be more than one reasonable hypothesis for a given set of facts. Think again about the case of the stolen stamps. Here are three possible hypotheses.

- ▶ One of the burglars knew about the collection and where it was stored.
- ▶ The burglars didn't know that the owner had a valuable stamp collection. They chose the apartment at random.
- ▶ The owner hid the stamps and staged the burglary to collect the insurance money.

The third hypothesis seems least likely. The first and second hypotheses fit the known facts. As of now, there is not enough evidence to support one hypothesis and reject the other.

Other Inquiry Skills Figure 3 lists some other inquiry skills that can be used to solve crimes. You will learn more about these skills in later lessons. In Lesson 2, for example, you will see why it is important to communicate and to make measurements at a crime scene.

FIGURE 3

Other Inquiry Skills

An investigator uses many inquiry skills to solve a crime.

Interpreting Data Which skill is used to interview a witness?

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Forensic Science Video
Clues From a Murder



Reading
Checkpoint

What do people who solve crimes base their predictions on?

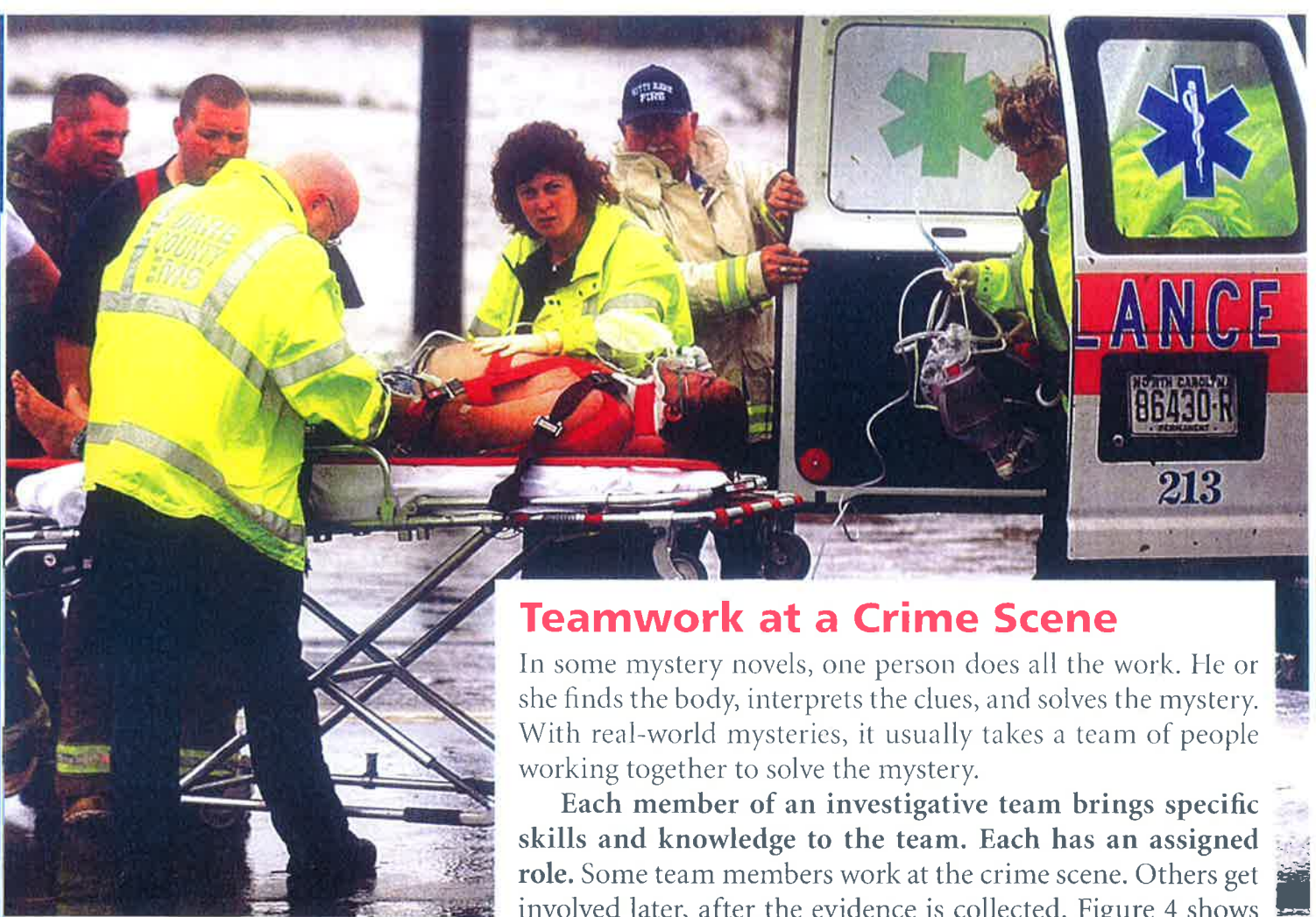


FIGURE 4

Roles at a Crime Scene

These North Carolina emergency medical technicians are trying to save a life. They may treat victims at a crime scene. They may also treat an injured suspect.

Teamwork at a Crime Scene

In some mystery novels, one person does all the work. He or she finds the body, interprets the clues, and solves the mystery. With real-world mysteries, it usually takes a team of people working together to solve the mystery.

Each member of an investigative team brings specific skills and knowledge to the team. Each has an assigned role. Some team members work at the crime scene. Others get involved later, after the evidence is collected. Figure 4 shows one task that might take place at a crime scene.

First on the Scene The person who answers a 9-1-1 call has an important task. He or she must decide who should respond to the call. Uniformed police officers almost always respond first. Fire and ambulance crews may also be sent.

This group's first responsibility is to save lives. They rescue people who are trapped inside burning buildings. They pull people from wrecked cars. They provide emergency medical treatment as they rush seriously injured people to a hospital.

Crime Scene Investigators What happens next? It depends on what the first people on the scene find when they respond. If a crime has taken place, someone needs to record and collect the evidence. For some crimes, a uniformed officer may do this task. At major crime scenes, crime scene investigators do this task. A **crime scene investigator (CSI)** is trained to record, collect, and test evidence from a crime scene. In later lessons, you will learn much more about this process.

A detective may come to view the scene before the evidence is collected. Detectives are experienced police officers whose only job is to solve crimes. They usually must pass a test before they can become a detective.

Medical Examiners When there is a sudden or suspicious death, a medical doctor will come to observe the body. These doctors are called **medical examiners**. By law, they need to confirm that the person is dead. They also do a few simple tests at the crime scene. For example, they may measure air and body temperature to help estimate the time of death.

If there is evidence of “foul play,” the doctor will later do an autopsy. An **autopsy** (AW tahp see) is a detailed exam of a dead body. It includes cutting the body open to look inside.

Police use a different type of examiner when a victim has been dead for years. They use people who know how to find clues in bones, like the bones in Figure 5.



Reading Checkpoint

What does the person who answers a 9-1-1 call have to decide?

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Forensic Science Video
The Mysterious Ice Man



FIGURE 5

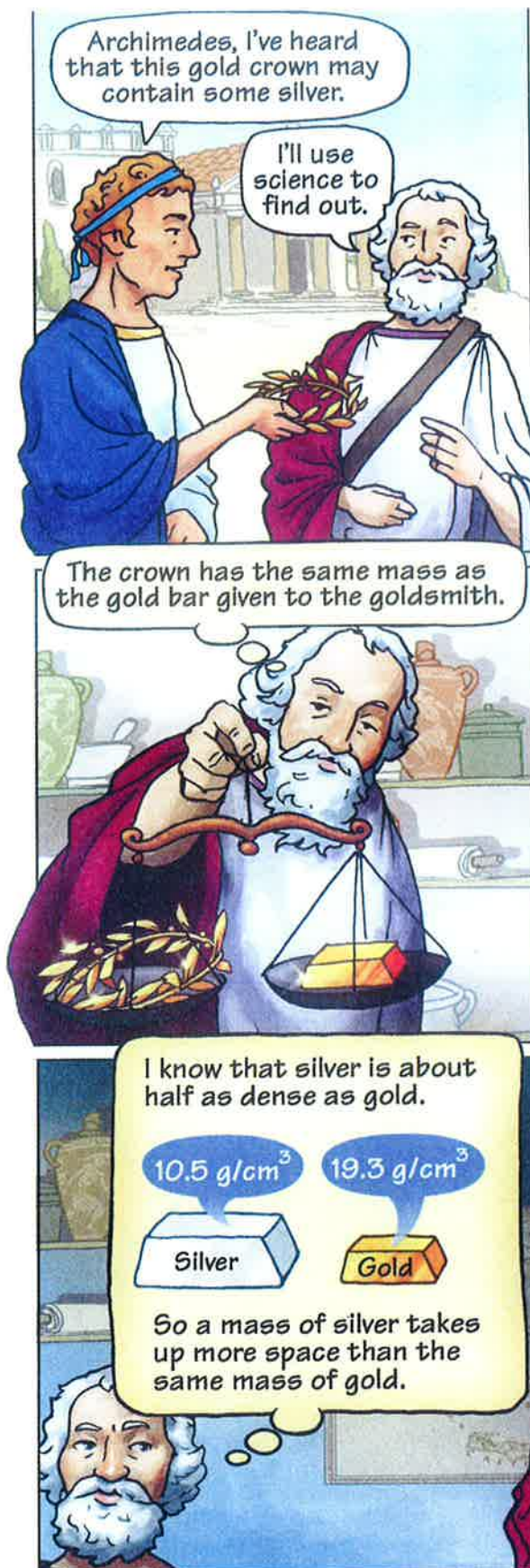
Forensic Anthropologists

Forensic anthropologists are experts on human bones. They use the bones they collect to figure out who a victim was and how he or she died.

Making Judgments Why might an anthropologist use a soft brush to uncover bones?



FIGURE 6
Telling Gold From Silver



Forensic Science Methods

Do today's crime solvers use the same methods used by earlier crime solvers? This story of an investigation that took place long ago is a good place to start to answer this question.

The Case of the Golden Crown About 2,300 years ago, King Hiero II gave a goldsmith enough gold to make a crown like the one in Figure 6. Later, the king heard a troubling rumor. The goldsmith had replaced some of the gold with an equal mass of silver. If so, the goldsmith was guilty of fraud, which is telling a lie to obtain money or other property.

The king asked the Greek scientist Archimedes to investigate. The challenge for Archimedes was finding a test that would not damage the crown.

Archimedes used what he knew about a property of matter called density to solve the crime. **Density** is the ratio of the mass of a substance to its volume. Pure silver is about half as dense as pure gold. Thus a crown made from a mixture of silver and gold should have a greater volume than a crown of the same mass made from pure gold.

So Archimedes designed an experiment. He placed a gold bar of equal mass to the crown into a bowl and filled the bowl with water to the brim. When he removed the gold bar and placed the crown in the bowl, water flowed out of the bowl. Archimedes concluded that the crown had a greater volume than the bar of gold. Thus, the crown was not pure gold. The goldsmith was guilty of fraud!



Reading
Checkpoint

Which property of matter did Archimedes use to solve a crime?

The Case of the Fake Painting What if forensic scientists today were faced with the problem Archimedes faced? They would still have to design an experiment. But they would have some advantages. **Scientists still design tests to solve crimes. But now they have better technology for doing the tests.**

Consider a fraud that could happen in the art world. The value of a painting depends on the identity of the painter. Some artists' paintings sell for millions of dollars. With this much money at stake, a talented crook might make a fake that looked like a painting by a well-known artist. The crook would copy the style of the artist and forge the artist's signature. On the surface, the fake would look real.

What could an art dealer do to detect a fake? The dealer could ask a forensic scientist to run some tests on the painting without damaging it. One way is to use the equipment shown in Figure 7 to analyze the paint the artist used. The equipment bombards a painting with X-rays. In response, elements in the paint give off energy. Each element gives off distinctive wavelengths of energy that can be used to identify the element.

The chemical makeup of paints has changed over time. Some elements that were used long ago are not used now. So analyzing paint can help a scientist tell if a painting is a fake.



FIGURE 7

Using Paint to Detect Fake Art

This equipment bombards a painting with X-rays. It also measures the energy that is given off by elements in the paint.

Applying Concepts Why doesn't the scientist take a sample of paint from the painting to test?

Lesson 1 Assessment

Target Reading Skill Building Vocabulary
Use your definitions to help you answer the questions below.

Reviewing Key Concepts

- Listing** Name four skills that people use in investigating a crime.
 - Comparing and Contrasting** How are inferences different from predictions?
- Identifying** What is the role of a crime scene investigator?
 - Sequencing** Which task happens first at a crime scene: a CSI collects evidence or a victim receives medical treatment? Give a reason for your answer.
 - Applying Concepts** At a crime scene, which tasks require an understanding of human biology? Explain your choices.

- Reviewing** What objects did Archimedes use to test the density of the gold crown? How can a modern investigator identify the elements in paint?
 - Summarizing** What advantage does a modern crime investigator have over earlier crime solvers like Archimedes?
 - Developing Hypotheses** What is the hypothesis that Archimedes was testing?

In the Community

9-1-1 People don't call 9-1-1 just to report a crime. They may call to report a fire or a heart attack. Young children can save lives if they know about 9-1-1. Design a poster that teaches young children when to call 9-1-1.