UNIT 6

Solving Crimes with Science

In this unit, you will

- read about the use of science to solve crimes.
- review identifying examples.
- increase your understanding of the target academic words for this unit.

READING SKILL Identifying Time and Sequence Words

Self-Assessment

Think about how well you know each target word, and check (✓) the appropriate column. I have...

TARGET WORDS	never seen the word before	seen the word but am not sure what it means	seen the word and understand what it means	used the word, but am not sure if correctly	used the word confidently in *either* speaking *or* writing	used the word confidently in *both* speaking *and* writing
AWL						
authority						
conclude						
consult						
contrary						
detect						
establish						
instance						
logic						
motive						
panel						
site						
specific						
tape						
technical						

Outside the Reading What do you know about science?
Watch the video on the student website to find out more.

Oxford 3000™ keywords

Before You Read

Read these questions. Discuss your answers in a small group.

1. Do you ever watch crime stories on television? If so, which one is your favorite?
2. Why do you think people like movies, TV programs, or books about solving crimes?
3. What are some ways that science can help the police solve crimes?

Read

This chapter from a book of true crime stories tells how the police solved a case of theft.

Solving a Crime with Science: A True Story

It was 7:30 in the evening. Millionaire Eduard Arellano and his wife Susan were late. They had tickets for a play at a nearby theater, so they were rushing to leave the house. They set the security alarm, locked the front door of their 16-room mansion, and sped away in their BMW.

A tall man watched them drive off. He removed a key from a red cloth bag that he carried and used it to unlock the front door. Once inside, he turned off the security alarm.

The tall man knew that Eduard and Susan would be gone for hours. He would have plenty of time to do his job. He went directly to an upstairs bedroom. He pushed open a wall **panel** and used a code to open a hidden safe. Inside the safe were trays of sparkling rings, necklaces, and earrings.

As soon as Eduard and Susan arrived at the theater, they realized that they had forgotten the tickets. Susan insisted that they return home to get them. When they arrived home, she was surprised to find the front door unlocked and the alarm system turned off. "Someone has been in here," Susan **concluded**. "I'm calling the police." She was told that a police **detective** would be at the **site** in a few minutes.

When the tall man heard voices downstairs, he knew he had to leave at once. He quickly stuffed the jewelry into the red bag. Then he opened a window and climbed down to a flat roof. From there he jumped to the grass and ran off.

Minutes later, the police **detective** and a team of crime scene investigators (CSI) arrived. The **detective** searched the house. Only one room showed signs of a crime. In an upstairs bedroom he found an open window and an empty safe, but no thief. He **consulted** Eduard and Susan, but only the jewelry seemed to be missing.

The **detective** was puzzled. At other **sites,** a thief opened nearly every drawer in the house searching for valuables. To the **contrary**, this thief seemed to know exactly where to find valuables. He also knew how to unlock the front door and open the safe. It seemed **logical** that the thief knew the house. The **detective** asked Eduard and Susan many questions. He asked about their servant. He wanted to know the **specific** time they had returned home. Could Eduard and Susan be lying? What **motive** would they have for faking a theft? Could the servant be guilty?

Meanwhile, the CSIs were upstairs checking the bedroom for fingerprints and searching for evidence—signs that might help solve the crime. They found a button by the open window, and they **detected** a tiny red thread near the safe. They put these pieces of evidence into envelopes and **taped** them shut. Then they searched the garden.

The next day, the **detective** drove to the home of the servant. There in a trash bin the **detective** found a grass-stained shirt with a button missing. In a closet he found a red cloth bag—but no jewelry. The servant was arrested and taken to the police station, where he was fingerprinted.

Subsequent tests done at a police laboratory **established** that the grass stains on the shirt matched the type of grass at the mansion. The button came from the same shirt. Lab tests further **established** that the red thread matched the cloth of the red bag. And the servant's fingerprints matched fingerprints from the crime **site.** In each **instance**, the evidence pointed to the servant's guilt.

Authorities accused the servant of theft, and he confessed to the crime. He described where he had hidden the jewelry. He said that he was **motivated** to steal because he needed money. He added, however, that Mr. Arellano had told him how to do it. Mr. Arellano said they could both make money. The servant could sell the jewelry and Eduard could be paid for his losses by his insurance company.

At a court trial, the servant was found guilty and sentenced to five years in prison. **Technically**, Eduard was guilty, too, and he was sentenced to prison for his role in the crime. Good **detective** work and modern science helped solve a crime. ■

Reading Comprehension

Mark each sentence as *T* (True) or *F* (False) according to the information in Reading 1. Use your dictionary to check the meaning of new words.

___ 1. Contrary to what Susan expected, the front door was unlocked and the alarm was turned off. She concluded that someone was inside.

___ 2. A detective asked Eduard and Susan many questions. For instance, he asked about the specific time they left the house.

___ 3. It seemed logical to the detective that the thief knew the house.

___ 4. Technically, Eduard and the servant were both guilty of a crime.

___ 5. The thief found money in a hidden wall panel.

___ 6. CSIs put the jewelry in an envelope and taped it shut.

___ 7. The detective consulted with Susan and Eduard about the shirt that the CSIs found at the crime site.

___ 8. The crime lab established that the red thread matched the cloth of the red bag.

___ 9. Authorities accused the servant of theft. His motive was to make money.

READING SKILL Identifying Time and Sequence Words

LEARN

Understanding the *order of events* in a story is often essential for understanding the story, especially a mystery such as Reading 1. The order of events can be shown in several ways:

1. Sentences in a paragraph usually describe actions in the order that they happened.
2. Time words such as *Monday, March, summer,* or *1989* tell when actions took place.
3. Words such as *before, after, soon, first, next, meanwhile, then, finally,* and *subsequently* can show the order of events.
4. Phrases such as *three days later, the next year,* and *at the same time* also show time order.

APPLY

A. With a partner, use time clues and logic to figure out the order in which these events in Reading 1 took place. Number them from 1 to 9.

___ A detective arrives.

___ The tall man hears voices downstairs.

___ Susan calls the police.

___ Susan realizes they have forgotten their tickets.

___ The tall man watches Susan and Eduard drive off.

___ Eduard tells the servant how to open the safe.

___ The tall man stuffs the jewelry into the red bag.

___ Susan concludes that someone is inside.

___ The tall man climbs out of the window.

B. **For each sentence, decide which action happened first and which happened second. Mark them 1 and 2.**

___ They realized that they had forgotten the tickets
___ as soon as they arrived at the theater.

___ They were surprised to find the front door unlocked
___ when they arrived home.

___ He knew he had to leave
___ when he heard voices downstairs.

___ He climbed out of the window
___ after emptying the safe.

___ He waited for them to drive away
___ before unlocking the door.

Vocabulary Activities STEP I: Word Level

The verb *consult* means "to ask somebody for information" or "to seek information in a book or other reference."

*The police **consulted** a doctor to learn about the effects of the drug.*

*I **consulted** my calendar to see when my dentist appointment was.*

CORPUS

A. **With a partner, decide whom or what you would consult for information about each of these things.**

1. the meaning of a word
2. a recipe for chicken soup
3. the price of an airplane ticket to London
4. the telephone number of a restaurant

B. **Use the target vocabulary in the box to complete this story. Use the words in parentheses to help you.**

conclude	detect	logic
consult	establish	site
contrary	instance	specific

Sherlock Holmes is a fictional detective, created by Sir Arthur Conan Doyle about a hundred years ago. Readers learn that Holmes is known for using _____ (1. *reasoning*) and observation to solve crimes. As a result, the police _____ (2. *ask advice from*) him when they have a difficult case. In each _____ (3. *event*), Holmes carefully examines the crime _____ (4. *location*) for evidence. He might _____ (5. *notice*) faint footprints that the police overlooked. He might find a broken clock that can _____ (6. *tell*) the

_____ (7. exact) time the crime was committed. He often discusses the evidence with his friend, Dr. Watson. Usually Watson reasons incorrectly. He might say, "Then I must _____ (8. decide) that the husband did it." "On the _____ (9. opposite), my dear Watson," Holmes might reply. "It was her jealous sister."

A *site* is a location or a place where an event has happened or will happen.

*Police were called to the **site** of the accident.*

A *website* is a location on the Internet.

*The university's **website** listed all of the faculty members.*

*The **site** didn't list their office hours, though.*

CORPUS

C. **With a partner, match the sites on the left with the people who might go to that site on the right. Discuss the reasons why the people go to the sites.**

___ 1. accident site	a. a rock band
___ 2. construction site	b. a bride and groom
___ 3. battle site	c. an emergency medical team
___ 4. wedding site	d. students
___ 5. concert site	e. carpenters
___ 6. graduation site	f. soldiers

The word *contrary* is most commonly used in an expression that shows disagreement.

Nayef: It's too hot today.

*Ahmed: On the **contrary**, it's just right.*

It is also used to show an opposite action.

***Contrary** to my parents' advice, I decided to become a lawyer.*

CORPUS

D. **Imagine that two people witnessed a man stealing a cell phone. They disagree when they talk to the police about what happened. With a partner, complete this conversation. Use *on the contrary*.**

First Person	Second Person
1. The robber was really tall.	On the contrary, he was short.
2. He was wearing a black coat.	On the contrary, . . .
3. He looked very young to me.	
4. He was with a friend.	
5. He said, "I need a cell phone."	
6. He looked scared.	
7. He got on a bus at the corner.	

Vocabulary Activities STEP II: Sentence Level

A *motive* is a reason for an action. The word is often used, as it is in this unit, to refer to the reason someone commits a crime.

*Jim needed money fast. That was his **motive** for robbing the store.*

There are other, equally common usages of *motive* and its forms. The verb *motivate* means "to cause someone to act in a particular way," or "to make someone want to do something."

*Desire to attend the music academy **motivated** her to practice every day.*

*The promise of a raise can **motivate** employees to work harder.*

The noun form is *motivation*. It refers to the reason for doing something, or a positive feeling about doing something.

*The employees showed a lot of **motivation** and finished the project quickly.*

Someone who feels eager to do something is *motivated*. Someone who does not feel eager to do something is *unmotivated*.

*Despite interesting lessons and good teachers, some kids remain **unmotivated**.*

CORPUS

E. **Write one or more sentences in your notebook according to the directions. Share your sentences with a small group.**

1. Teachers can motivate their students in many ways. Describe how a teacher once motivated you.
2. Describe how advertisements can motivate people to do something.
3. Some people seem to always act kind (or mean). Describe what their motive might be for acting kind (or mean).

Establish is commonly used to mean "to start something," like "establish a new school." In the context of this unit, however, *establish* is used to mean "to learn facts that prove something is true."

*Detectives **established** that the murdered man owed money to many people.*

CORPUS

F. **In your notebook, write sentences that answer the questions. Use a form of *establish* in each sentence. Refer to Reading 1 for information.**

1. What did the detective find out when he searched the house?
2. What did the tall man learn when he watched Eduard and Susan drive away?
3. What did Susan learn when she tried to open the door to get the tickets?
4. What did the laboratory tests show about the servant's fingerprints?

The adjective *specific* means "detailed" or "exact." It can also be used to refer to something particular rather than general. The adverb form is *specifically*. The verb form is *specify*. *The specifics* is a phrase that means "facts" or "details."

The newspaper reporter wanted to know the ***specifics*** *of the crime.*

G. **Read these sentences about what the police do after a crime has occurred. Rewrite the sentences in your notebook, using the form of *specific* in parentheses.**

1. The police ask many definite questions, like the victim's name and age. (*specific*)
2. They need to know what happened. (*specifics*)
3. They want to know the details about when the crime happened. (*specifically*)
4. They want witnesses to tell exactly what they saw. (*specify*)
5. They hope witnesses can give them particular information about the crime. (*specific*)

The noun *logic* refers to the use of reasoning to decide if something is possible or correct.

Instead of using ***logic*** *to solve the puzzle, he tried guessing.*

A *logical* decision or idea is reasonable and sensible. A decision that is based on guessing, feelings, or unreasonable conclusions is *illogical*.

It did not seem ***logical*** *that a man would buy a car and then sell it the next day.*

It seemed ***illogical*** *for him to buy a car one day and sell it the next.*

H. **Read this story. Then, in your notebook, write five sentences about the facts in the story. Use forms of *establish*, *logical*, and *motive*. Be prepared to read aloud or discuss your sentences in a small group.**

Mr. Able, a jewelry store owner, claims he was robbed of $1 million in jewels. He sued his insurance company when the company refused to pay him for the loss. Mr. Able said that one rainy winter day, a robber ran into the store carrying a gun and an umbrella. The robber kept the gun pointed at Mr. Able as he tied up his hands. Then the robber opened the safe in the back room and took all 536 pieces of jewelry. He stuffed them into a suitcase and ran out the door.

The insurance company's lawyer had a contrary point of view. He concluded that the details of Mr. Able's story are technically impossible. The lawyer said that the tape in the store's surveillance camera would show what really happened and prove that Mr. Able was lying. The tape shows the robber entering the store wearing a raincoat and carrying an umbrella—but they are not wet. He is not carrying a suitcase. The tape shows Mr. Able helping the robber tie his hands. The robber disappears into a back room for just 14 seconds, and then leaves the store carrying a suitcase. The suitcase is too small to hold 536 pieces of jewelry. The robber leaves nearly $20,000 cash in the safe. The lawyer claimed that a friend pretended to rob Mr. Able for a share of the insurance money. His reason—he wanted to get rich quick.

Before You Read

Read these questions. Discuss your answers in a small group.

1. What does a detective do?
2. How can a science laboratory be used to help solve a crime?
3. Is it possible for someone to commit a "perfect" crime that leaves no clues? Why or why not?

Read

This online magazine article discusses the role of scientific laboratory analysis in helping the police solve crimes.

FORENSIC SCIENCE

Sherlock Holmes, a fictional **detective** of a century ago, was one of the first to use forensic science—the scientific analysis of physical evidence to solve crimes. Holding a big magnifying glass, Holmes inspected crime scenes for footprints, broken glass, hair—anything that might help identify the person who committed the crime. In today's world, Holmes might be a CSI, or crime scene investigator.

Actor Basil Rathbone as Sherlock Holmes

Today, when a crime is reported—a murder, for **instance**—the police immediately send a medical examiner (ME) and a CSI team to the crime **site**. The ME and CSIs will be part of a **panel** of **technical** experts in the investigation.

MES AND CSIS

At the crime scene, the ME examines the body of the victim and looks for wounds or marks that might be related to the crime. The ME also takes many photographs of the body. The body is subsequently taken away for a detailed examination that will **establish** the cause and time of the victim's death.

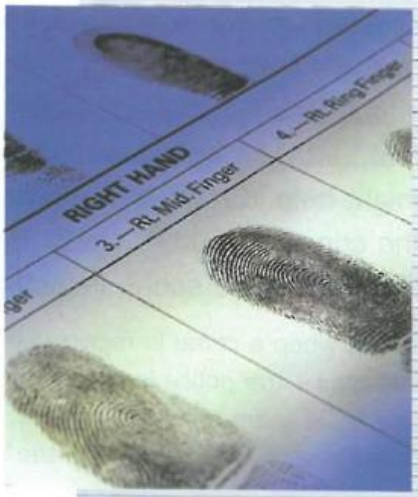
Meanwhile, CSIs first take hundreds of photographs of the crime **site**. Next they check the **site** for fingerprints. Most fingerprints form when sweat or another oily substance on a fingertip leaves an invisible imprint on a glass, tabletop, or other object. CSIs dust a black powder on objects at the crime **site** to make these prints visible. The CSIs then look for drops of blood, strands of hair, pieces of ripped cloth, or other evidence that might link someone to the crime **site**.

FINDING TRACE EVIDENCE

"Every contact leaves a trace," according to an **authority** in forensics. This means that whenever a crime involves physical contact, the criminal either leaves something at the **site**, takes something from the **site,** or both. This might be any number of substances, including hair, animal fur, sand, grass, and fibers from clothing or carpeting. Such trace evidence is usually difficult to **detect**, so, like Sherlock Holmes, CSIs rely on handheld magnifying glasses to examine the crime scene. CSIs might even vacuum the entire area to collect tiny samples. They carefully label each piece of evidence as they collect it.

THE FORENSICS LABORATORY

The collected evidence is then sent to a forensics laboratory. There, forensic scientists will analyze it to **establish** how and when the murder took place, where it took place, and who did it. Sometimes the evidence will even show *why* it took place; that is, the **motive** for the killing.



Among all the evidence found at the **site**, fingerprints are **conclusive.** This is because no two people have the same fingerprints. Fingerprints from a crime scene are analyzed by computer to determine if they match the prints of a known criminal or crime suspect—a person who might be guilty of a crime.

DNA is another **conclusive** means of identification because each person's DNA is unique. DNA is contained in cells of the body, so that evidence of hair, blood, tears, sweat, or other bodily fluids found at a crime scene can be used to link a **specific** person to the crime. Like fingerprints, DNA samples are analyzed by computer to determine if they match the DNA of a known criminal or a suspect.

Voices, too, are unique. Samples of voices from security camera **tapes**, telephone answering machines, or other recording devices can be scanned electronically. A printout of the scan will show patterns of highs and lows, rhythm, and volume that can be compared to patterns of a suspect's voice. However, **authorities** have **contrary** opinions about using voiceprints for identification.

Some argue that voices can change over time as people age or suffer illnesses, so old voiceprints are not always reliable.

In the laboratory, forensic scientists use an electron microscope to scan samples of the substances that were collected at the crime scene. Then they enlarge the samples (up to 150,000×) on a visual display unit. This allows them to easily compare those samples with samples found at another location or on a suspect's clothing.

Forensic laboratories have on file the shoe print patterns of thousands of kinds of shoes. These can be compared to shoeprints found at a crime scene to **establish** the size and kind of shoes worn by a suspect. If the shoeprint was made in a soft material, like mud, the lab may be able to tell the height and weight of the person by the depth of each step and the distance between steps.

After all of the evidence has been analyzed, the police chief **consults** with **panel** members. Based on the evidence, they determine if it is **logical** to accuse and arrest a crime suspect. If it is, members of the **panel** may later be asked to present their forensic evidence in a court of law as proof of a suspect's guilt.

Reading Comprehension

Mark each sentence as *T* (True) or *F* (False) according to the information in Reading 2. Use your dictionary to check the meaning of new words.

___ 1. Holmes inspected a crime site for anything related to the crime; for instance, footprints, broken glass, or hair.

___ 2. CSIs are part of a panel of technical experts in a forensic investigation.

___ 3. Forensic laboratories establish when and where a murder took place by taking hundreds of photographs.

___ 4. To identify footprints, forensic laboratories consult files of footprints of known criminals.

___ 5. CSIs use handheld magnifying glasses to detect trace evidence at crime scenes.

___ 6. Authorities have contrary opinions about using fingerprints for identification.

___ 7. DNA analysis can conclusively establish the motive for a crime.

___ 8. Samples of a suspect's voice can be compared to voice samples from surveillance tapes or telephone answering machines.

___ 9. A suspect will be arrested if, based on the evidence, it seems logical that he or she committed the crime.

___ 10. Fingerprints found at a crime scene can be linked to a specific individual if they match the individual's fingerprints.

READING SKILL Identifying Time and Sequence Words

APPLY

A. **Scan the first four paragraphs of Reading 2. Answer the questions in complete sentences. Include the time words or phrases used in the Reading.**

1. When did Sherlock Holmes do his detective work?

_____

2. When do the police send an ME and a CSI team?

_____

3. When do the CSIs take photographs in relation to other tasks?

_____

B. **Number these tasks from *1* to *7*, in the order in which they are done by the CSI team.**

___ dust objects for fingerprints
___ take photographs
___ send evidence to a forensics laboratory
___ present their evidence in a court of law
___ look for drops of blood or strands of hair
___ label the evidence
___ consult with the police chief

REVIEW A SKILL **Identifying Examples** (See pp. 52–53)

What kind of examples are listed in paragraph 4?

_____

What kind of examples are listed in paragraph 5?

_____

Vocabulary Activities STEP I: Word Level

The adjective *technical* refers to the knowledge of machines, materials, and processes used in science and industry.

*Forensic scientists use their **technical** skills to analyze crime scene evidence.*

This unit also uses the adverb *technically*, which means "according to an exact interpretation of a law or a fact."

*You can't come in yet. It's only 9:58. **Technically**, the store doesn't open until 10:00.*

Another common use of the word *technical* is to refer to words and concepts related to a particular subject.

*"Stress" is a **technical** word used in engineering.*

CORPUS

A. Complete the story with the words from the box.

technical assistance	technical person	logic	site
technical explanation	technical words		

My computer printer wasn't working right, so I called the company hotline for (1) _____ _____. The guy on the phone gave me a (2) _____ _____ of the problem. I said, "Stop! You're using too many (3) _____ _____. I'm not a (4) _____ _____."

So he said, "See the button that says ON? Just push that."

B. With a partner, complete these sentences with your own ideas. Share your ideas with the class.

1. "I know your 21st birthday is tomorrow, but today you are technically..."
2. "The sign says three lemons for one dollar. Technically, one lemon would cost..."
3. "Waiter, a fly fell into my soup." "I'm sorry, but the restaurant is not technically responsible for..."
4. "I see the sign that says No Parking, but technically I'm not parked, I'm just..."

C. With a partner, decide who has the authority to punish someone who breaks the rules or laws in these situations.

1. in a soccer game
2. in a classroom
3. in a city
4. in a family
5. in an office
6. in a store

An *authority* is a recognized expert in a field. The adjective form is *authoritative*.

*Professor West is an **authority** on the history of crime.*

*He wrote an **authoritative** book titled Crime in Nineteenth Century Britain.*

An *authority* is also a person or group that has the power to make rules or laws.

*The city transportation **authority** wants the bus company to add new routes.*

Authority (noncount noun) refers to the power that such a person or group has.

*Parental **authority** today is not as strong as it was in the past.*

CORPUS

D. When police detectives need special information to solve a crime, they consult an *authority*. With a partner, match the authorities on the left with their areas of special knowledge. Take turns making sentences with the information. Look up unfamiliar words in your dictionary.

a	1. ornithologist	a. birds
	2. zoologist	b. weather
	3. graphologist	c. animals
	4. toxicologist	d. handwriting
	5. meteorologist	e. poisons

*An ornithologist is an **authority** on birds.*

Vocabulary Activities STEP II: Sentence Level

Word Form Chart			
Noun	**Verb**	**Adjective**	**Adverb**
detective detection detector	detect	detectable	_____

E. Complete this paragraph by using a form of *detect* in each blank. Compare work with a partner.

A polygraph is a machine that is often called a "lie (1)_____." It is used by some (2)_____ when they question suspects. The polygraph is based on the belief that, if a person is lying, his or her body will react with (3)_____ physical changes, such as increased blood pressure and heart rate. The machine (4)_____ these changes and records them. If the polygraph shows that physical changes occurred when the suspect answered, the (5)_____ concludes that the suspect is lying. However, polygraph tests are only 70–90% accurate. This means that 10–30% of those tested might escape (6)_____ even if they are guilty—or they might be considered guilty even though they are innocent.

An *instance* is an example or case of a particular kind of occurrence.

*Yesterday's bank robbery was another **instance** of crime in the neighborhood.*

For instance is a common phrase that means, "for example."

*Bank security was poor. **For instance**, the cashiers had no warning alarms.*

F. Match each sentence on the right with the example that goes with it on the left. Use *for instance* to join the sentences, and write them in your notebook. Compare answers with a partner.

Bank security was poor. ***For instance,*** *there was no guard at the door.*

d 1. Bank security was poor.	a. one was wearing a black ski mask.
___ 2. The robbers were armed.	b. none had a specific job to do.
___ 3. The robbers didn't plan very well.	c. each robber had a gun or a knife.
___ 4. The robbers covered their faces.	d. there was no guard at the door.
___ 5. The robbers did not seem very smart.	e. the note said GIV ME YOR MONEE.

The verb *conclude* has the general meaning of "end" or "finish." It can also mean "to reach a decision after thought or study." The adjective *conclusive* refers to something that is definitely true.

The lawyer ***concluded*** *his summation of the case and calmly sat down.*

The jury ***concluded*** *that the suspect was guilty.*

His fingerprint on the knife is ***conclusive*** *proof that he is guilty.*

The noun form is *conclusion*. It is used in some common expressions:

reach a ***conclusion***	make a judgment after careful consideration
come to a ***conclusion***	make a decision after careful consideration
jump to ***conclusions***	make a judgment based on feelings, not facts

CORPUS

G. Read these statements about a crime. In your notebook, answer each question that follows, using a form of *conclude*. Be prepared to read aloud and explain your answers in a small group.

- **A valuable painting was stolen from a popular art museum.**
- **Jim's fingerprints were found on the wall where the painting had been.**
- **Jim said he didn't steal the painting. A polygraph test showed that he was not lying.**
- **His friend, Dave, said that Jim was with him at the time the theft took place.**
- **The painting was found in Dave's house. It had Dave's fingerprints on it.**

1. Who did the police decide was guilty?
2. What did the police decide about the fingerprints on the wall? Why?
3. What evidence proved who was guilty?