



DIAGNOSTIC FORENSIC SOLUTIONS, INC.

PROBLEM:

Local police were called to the scene of a car accident late last night when a newly-purchased car collided with a street light at the intersection of North and Main. By the time the police arrived the driver had fled the scene. The police couldn't find any witnesses.

The Crime Scene Investigation team was called out to collect evidence. They collected the following:

- **Glass fragments** from the front seat of the car
- **Glass fragments** from around the outside of the car.
- **Blood** on the broken windshield of the car
- **Fingerprints** on the outer door handle
- **Fingerprints** on the steering wheel
- **Footprints** in the mud under the street light.

Police traced the car back to a local dealership, where the salesman identified the owner of the vehicle—a Mr. James Hatfield, who lives with his wife, Joanne Hatfield, 2 miles from the scene of the accident. When the police questioned Mr. Hatfield, he said his car had been stolen earlier that evening, but he had not yet filed a formal report. Mr. Hatfield claimed he saw his neighbor, Mr. Winston McCoy, use a coat-hanger to break into his car earlier that evening. It appears Hatfield and McCoy have been feuding with each other for many months, and the police have been called out on several occasions.

The police questioned Mr. McCoy regarding the matter. Despite his several complaints against Mr. Hatfield and his obvious jealousy over the new car, Mr. McCoy maintains he did not steal the car—he just scratched the exterior paint with a key. He claims he never entered the vehicle.

Police officers were able to obtain DNA samples from both Mr. Hatfield and Mr. McCoy. Mrs. Hatfield refused to give police a DNA sample, but she did allow herself to be fingerprinted along with both men.

Your company, Diagnostic Forensic Solutions, has been asked to analyze the evidence for the local police department. You've been asked to 1) prepare an invoice describing which forensic analyses you recommend performing on the given evidence and 2) write a summary report describing the results of the experiments and your interpretation. The police department has a budget of \$2,000 for this investigation.

ACTIVITY:

Students are provided with a blank invoice outlining the available forensic procedures and their costs. Due to the budget constraint, students will not be able to order every possible forensic analysis. Instead, they must choose which test they feel will be most relevant to the investigation.

Once the invoice has been submitted, students are provided with the appropriate results. (NOTE: students are only given the results of the analyses they order). The results of all the analyses are given on the following pages. They should be photocopied onto separate sheets of paper.

We've provided test results for two different cases. You may want to have students try case 1 first; then the more difficult case 2. Both involve the same basic facts of the crime. In the first (marked Case No.1) there is a clear culprit who committed the crime, and all the tests implicate this man. In the second scenario (marked Case No.2) the evidence isn't as revealing, and the students' interpretations will likely depend on which tests they elect to perform. In the second scenario many different interpretations are possible depending on the students' creativity. It is up to the teacher to decide the relative merit of each individual solution. Alternatively, the solutions may be shared with the whole class and discussed as to which is more plausible.

Once the students have obtained the results, they write-up a summary report describing:

- The tests they ordered
- The results of those tests
- Which suspects, if any, are implicated or exonerated by those results
- Their interpretation of how the crime occurred





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TEACHER NOTES:

This exercise simulates the actual workings of a private forensics laboratory. It is designed to demonstrate the effects of real-world economic constraints on criminal investigations. Providing a set budget limits the number of forensic analyses that can be performed, so students must weigh the relative merits of each analysis and determine which ones will provide the most relevant information.

The two scenarios provided with this exercise both reflect real life possibilities. Often the evidence conclusively incriminates one suspect, and the case is brought to a swift and successful close. Sometimes, however, the evidence is not strong enough to convict a suspect, a case must be solved through further analysis and police work. Not every case can be solved as quickly as it is on television.

MATERIALS:

None



CLASSROOM MANAGEMENT:

This activity can be completed individually, but having the students work in small groups will foster interactivity and debate. There are several possible correct ways to carry-out this assignment, and the student may enjoy debating the merits of their various solutions.

It is suggested the assignment conclude with each student or group of students sharing their own interpretation of the crime. Additionally, several questions are included below which can be discussed among the class as a whole.

DISCUSSION QUESTIONS:

1. How did the analysis you choose to perform effect your interpretation of the crime?
2. Would having more money have affected your final interpretation?
3. Is it realistic to spend a large amount on every case the police investigate?
4. What should determine how much money gets spent on each investigation?



TEACHER ANSWER KEY



DIAGNOSTIC FORENSIC SOLUTIONS, INC.

INVOICE

EXAMPLE: This is just one of many possible ways to complete this invoice.

I. FACILITIES AND LABOR

<u>ITEM</u>	<u>RATE</u>	<u>NUMBER</u>	<u>TOTAL</u>
FACILITIES	\$ 300/DAY	1	\$ 300
PROTECTIVE EQUIPMENT	\$ 20/DAY	1	\$ 20
TESTIMONY	\$ 300/DAY	1	\$ 300
CLERICAL SUPPORT	\$ 60/DAY	1	\$ 60
FORENSIC SCIENTIST LABOR	\$ 50/DAY	<u>4</u>	<u>\$ 200</u>
TRAVEL TIME	\$ 500/DAY		\$

II. INDIVIDUAL ANALYSES

****The fee for each test will include analysis of ALL the pieces of evidence of that nature.**

<u>ITEM</u>	<u>RATE</u>	<u>NUMBER</u>	<u>TOTAL</u>
A. DNA ANALYSIS (4 HOURS/ANALYSIS) DNA SAMPLES FROM BLOOD, SALIVA, ETC. ARE COMPARED AGAINST EACH OTHER AND CODIS DATABASE.	\$ 300/ANALYSIS		\$
B. FINGERPRINT COMPARISON (2 HOURS/ANALYSIS) COMPARISON OF PROVIDED PRINTS AGAINST ONE ANOTHER AND AGAINST ENTIRE IAFIS DATABASE.	\$ 300/ANALYSIS	<u>1</u>	<u>\$ 300</u>
C. GLASS ANALYSIS (1 HOUR/ANALYSIS) GLASS FRAGMENTS ARE ANALYZED TO DETERMINE ORIGIN, ANY CHEMICAL TREATMENTS, ETC.	\$ 150/ANALYSIS	<u>1</u>	<u>\$ 150</u>
D. TOOLMARK COMPARISONS (2 HOURS/ANALYSIS) SCRATCHES OR INDENTATIONS CAN BE MATCHED TO THE SPECIFIC TOOL THAT MADE THEM.	\$ 200/ANALYSIS		\$
E. TOXICOLOGY ANALYSIS (4 HOURS/ANALYSIS) BLOOD, URINE, AND OTHER BIOLOGICAL MATERIALS ARE TESTED FOR ALCOHOL, DRUGS, AND OTHER SUBSTANCES.	\$ 300/ANALYSIS		\$
F. IMPRESSION EVIDENCE ANALYSIS (1 HOUR/ANALYSIS) FOOTPRINTS ARE COMPARED AGAINST POSSIBLE SOURCES BASED ON CLASS AND INDIVIDUAL CHARACTERISTICS.	\$ 150/ANALYSIS	<u>1</u>	<u>\$ 150</u>

SUBTOTAL	<u>\$ 1480</u>
PROFIT MARGIN (30%)	<u>\$ 444</u>
GRAND TOTAL	<u>\$ 1924</u>

TEACHER ANSWER KEY

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STUDENT ACTIVITY WORKSHEET

1. Look over the list of evidence collected from the crime scene. What evidence do you think is most important to the investigation? Why?

The blood and fingerprints can tell us who was in the car. The footprints can tell us who was at the scene of the crash. The glass fragments aren't as interesting since they probably come from the broken windshield.

2. Diagnostic Forensic Solutions, Inc. requires that all clients must purchase facilities, protective equipment, testimony, and clerical support. Are there any other facilities or labor the local police need to purchase? How much money is left to for running analyses?

Since this is a local job, travel should NOT be required. However, the client will be required to pay for forensic labor. How many hours they should pay for depends on how many and what kind of analyses are ordered.

3. Which of the following analyses would you suggest the police purchase for this investigation? For each one, explain what you think it will reveal about the crime.

DNA analysis – ***should purchase; could tell whose blood is on the windshield.***

Fingerprint Comparisons – ***should purchase; could tell who opened the door and who was driving the car (whose fingerprints were on the steering wheel).***

Glass Analysis – ***should NOT purchase; could tell us where the glass came from inside and outside of the car (but probably came from windshield).***

Toolmark Comparisons – ***should purchase; could determine if Mr. McCoy really did scratch the car with a key and/or if a coat hanger was used to break into the car.***

Toxicology Analysis – ***should NOT purchase; could tell us if the person who left their blood on the windshield had any chemicals in their body (but no indication drugs had a role in the crime).***

Impressing Evidence Analysis – ***should purchase; could tell us whose footprints are at the scene of the crime under the street light.***

4. Complete the invoice on the next page and submit it to your teacher. If he or she approves your invoice, you will learn the results of the tests you have ordered. **Remember—you have a strict budget of \$2000.**

TEACHER ANSWER KEY

DIAGNOSTIC FORENSIC SOLUTIONS, INC.

STUDENT ACTIVITY WORKSHEET

After your proposal has been approved, you will learn the results of the forensic analyses you ordered.

Write a letter to the Chief of Police explaining:

- Which analyses that were performed, and their results
- Whether these results incriminate or exonerate any of the suspects
- Whether any further analyses need to be performed, and why
- Your interpretation of how the crime occurred.

For the first crime—

No matter which tests the students chose to run, all test results should incriminate Mr. Hatfield. The interpretations as to how the crime occurred may vary, but they should all explain how his fingerprints, blood, and shoe prints wound up at the crime scene.

Sample scenario: Mr. Hatfield lied when he said he saw his neighbor break into his car. He did, however, see the damage Mr. McCoy did when he used a key to scratch the outside surface. Mr. Hatfield then concocted a plan. He decided he would frame Mr. McCoy for the theft of his new car, then sue him for the money to buy a new, non-scratched up vehicle. Mr. Hatfield purposely crashed his own car into the light pole, then calmly walked away from the scene (unknowingly leaving behind incriminating evidence) and waited for the police to call him so he could blame his neighbor for stealing the car.

For the second crime—

Whether any suspects are incriminated or exonerated depends on which tests the students elected to run. Any interpretation should be considered viable so long as it explains the results of any analyses the students chose to run.

Sample scenario: Mr. McCoy did scratch the outside door with a key, but Mrs. Hatfield did not notice before she drove off to her weekly BINGO game that night. As she was driving home later that evening she swerved to avoid a cat in the road and lost control of her vehicle. She crashed into the street light. She called her husband for help, but when he arrived they couldn't get the car door open. Mr. Hatfield used a coathanger to open the door and free his wife. They decided to flee the scene and claim the car had been stolen in order to get money from the insurance company.

Name: _____

Date: _____

DIAGNOSTIC FORENSIC SOLUTIONS, INC. **STUDENT ACTIVITY WORKSHEET**

PART 1: THE EVIDENCE

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Police officers were able to obtain DNA samples from both Mr. Hatfield and Mr. McCoy. Mrs. Hatfield refused to give police a DNA sample, but she did allow herself to be fingerprinted along with both men.

Your company, Diagnostic Forensic Solutions, has been brought in to analyze the evidence for the local police department. Before you can begin work the police department needs to approve the funding for your tests. They only have \$2000 to spend on this investigation.

PART 2: THE RESULTS

After your proposal has been approved, you will learn the results of the forensic analyses you ordered.

Based upon the results of those tests, write a letter to the Chief of Police explaining:

- **Which analyses that were performed, and their results**
- **Whether these results incriminate or exonerate any of the suspects**
- **Whether any further analyses need to be performed, and why**
- **Your interpretation of how the crime occurred.**



DIAGNOSTIC FORENSIC SOLUTIONS, INC.

INVOICE

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SUBTOTAL	\$
PROFIT MARGIN (30%)	\$
GRAND TOTAL	\$

Name: _____

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DIAGNOSTIC FORENSIC SOLUTIONS, INC.
STUDENT ACTIVITY WORKSHEET

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DNA analysis –

Fingerprint Comparisons –

Glass Analysis –

Toolmark Comparisons –

Toxicology Analysis –

Impressing Evidence Analysis –

4. Complete the invoice on the next page and submit it to your teacher. If he or she approves your invoice, you will learn the results of the tests you have ordered. **Remember—you have a strict budget of \$2000.**

STUDENT WORKSHEET

DNA ANALYSIS RESULTS:

DNA from the blood on the windshield was a match to the DNA sample provided by Mr. James Hatfield. All three samples (Mr. Hatfield, Mr. McCoy, and sample from windshield) were compared to the CODIS database, but no match was found.

FINGERPRINT COMPARISON RESULTS:

There were two fingerprints discovered on the door. One belonged to Mr. Hatfield, one belonged to Mr. McCoy. There were two additional fingerprints on the steering wheel—both belonged to Mr. Hatfield. All four prints were compared to the FBI's IAFIS database but no matches were found.

GLASS ANALYSIS RESULTS:

The glass fragments were equal in density and chemical treatments to the type of glass used in the windshield for that particular car. Both the glass fragments inside the car and outside the car were of the same type.

TOOLMARK COMPARISON RESULTS:

There were many scratches and dings on the outside of the car, mainly caused by the collision with the street light. There were several scratches on the outside of the car consistent with damage from a key. These scratches had the same individual characteristics as a key in Mr. McCoy's possession.

TOXICOLOGY ANALYSIS RESULTS:

The blood collected from the windshield was tested for the presence of alcohol, prescription drugs, and illegal drugs.

All tests came back negative, indicating the blood donor had no foreign substances in his or her blood stream.

IMPRESSION EVIDENCE RESULTS:

Impressions of the shoeprints collected from the crime scene were compared to shoes collected from the Hatfield and

McCoy residences. The class characteristics of the footprints indicated they were made by a pair of men's size 10

Nike shoes. Mr. Hatfield owns such a pair of shoes. In addition, the individual characteristics from the footprint match

those on the muddy pair of shoes found in his closet.

DNA ANALYSIS RESULTS:

No match could be found between the three samples provided (Mr. McCoy, Mr. Hatfield, sample from crime scene).

All three samples were compared to the CODIS database, but no match was found.

FINGERPRINT COMPARISON RESULTS:

There were two fingerprints discovered on the door. One belonged to Mr. Hatfield, one belonged to Mr. McCoy.

There were two additional fingerprints on the steering wheel—one from Mrs. Hatfield and one that did not match any of the suspects' prints. All four prints were compared to the FBI's IAFIS database but no matches were found.

GLASS ANALYSIS RESULTS:

The glass fragments were equal in density and chemical treatments to the type of glass used in the windshield for that particular car. Both the glass fragments inside the car and outside the car were of the same type.

TOOLMARK COMPARISON RESULTS:

There were many scratches and dings on the outside of the car, mainly caused by the collision with the street light. There were several scratches on the outside of the car consistent with damage from a key. These scratches had the same individual characteristics as a key in Mr. McCoy's possession. There were also scratches around the driver's side window consistent with using a coat hanger to open the door, but these marks could not be matched to any coat hangers in Mr. McCoy's house.

TOXICOLOGY ANALYSIS RESULTS:

The blood collected from the windshield was tested for the presence of alcohol, prescription drugs, and illegal drugs.

All tests came back negative, indicating the blood donor had no foreign substances in his or her blood stream.

IMPRESSION EVIDENCE RESULTS:

Impressions of the shoeprints collected from the crime scene were compared to shoes collected from the Hatfield and McCoy residences. The class characteristics of the footprints indicated they were made by a pair of men's size 10 Nike shoes. Mr. Hatfield owns such a pair of shoes. However, there were not enough individual characteristics in the impression to make a positive identification.