A REAL JEWEL THIEF

At 9:30 am on the morning of October 9, Mike Johnson was making his usual rounds at the Lakeside Mall when he came upon an Unnerving sight. One of the glass display cases at the JewelryMart was smashed. The priceless diamond necklace that had been prominently displayed there had vanished!
Johnson immediately called the police.

When the detectives arrived, they were greeted by the store's most experienced salesperson, Tracy Smith, who was just coming to work. She explained that she hadn't been at the store since closing at 9pm the night before, when she had helped a young man named Robert Jones choose an engagement ring for his girlfriend. As they talked, the store telephone rang. Ms. Smith answered it. When she returned to the counter, Mr. Jones was gone. Or was he?

The store alarm had not gone off when the robbery took place. This led the detectives to narrow down their list of suspects to include only the three people who had most recently been inside the store.

All three were called to the police station. Each was asked to provide a cheek swab for a DNA test. The robber must not have realized that the broken glass caused an injury and there was blood left in several drops on the store carpet and there was a small smudge on the glass case. The blood smear did not contain a recognizable handprint or fingerprint. It was swabbed up and taken to the crime lab for DNA testing.

All three suspects swear they aren't the one responsible for the robbery. The detectives aren't worried. They know they would find the culprit. They have the power of forensic science.

Who do you think stole the necklace? ________________________________

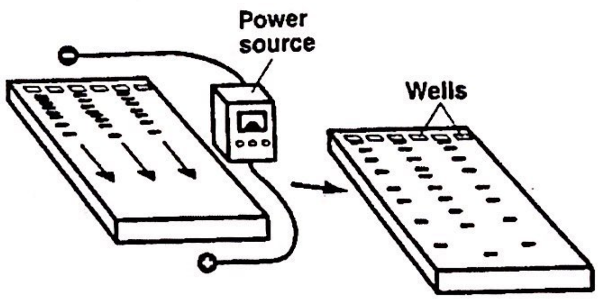
Read the information on the next page to learn about using gel electrophoresis to create a DNA fingerprint. Help the investigators discover the truth behind this terrible crime.

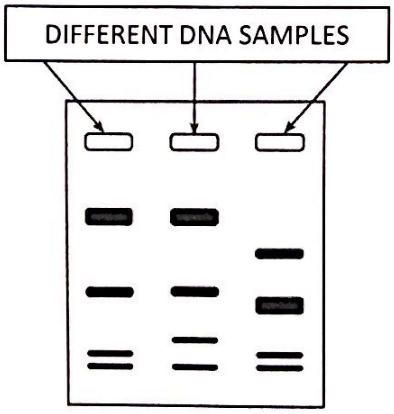
DNA FINGERPRINTING

DNA fingerprinting is a technique that has been used since the 1980s to identify suspects involved in serious crimes, including murder. DNA may be left at a crime scene in the form of saliva, blood, or semen that is then collected and processed in a forensics science lab. No two individuals, except for identical twins, will have the same DNA profile, and just like a fingerprint from a finger, a person's DNA fingerprint can identify the perpetrator of a crime.

One of the most common DNA fingerprinting procedures uses **restriction enzymes** to cut a DNA sample into segments following a simple rule. The enzymes locate a particular base sequence, and cut the DNA apart any time that sequence is identified. This results in DNA fragments being produced in varying lengths. The assortment of fragment sizes varies greatly from one individual to another and makes identification of a particular person possible.

The DNA segments are injected into a gel that is very much like plain jello – with no color and no flavor. An electric charge is applied to the gel using a power source and the DNA fragments separate by size. The smallest fragments move fastest and farthest away from the negative pole and Toward the positive pole. This technique is Called **gel electrophoresis**.





When the process is finished, a visual representation of the results is created by producing an x-ray of the gel material. Investigators then analyze the x-ray and draw their conclusions.

DNA tests have proven very reliable over the years. Continual advances in forensic science and DNA fingerprinting as a whole have made these tests almost foolproof.

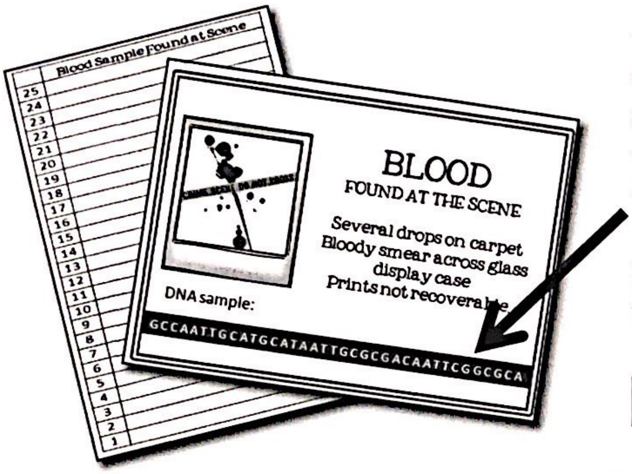
Today the test has many applications. It may be used to determine whether a family relationship exists between two people, to identify organisms causing a disease, to solve crimes, and even to provide hints about the evolutionary relationships of two different species. There have been many instances where DNA fingerprinting has actually been used to release a man who was wrongly jailed for a crime he didn't commit. Prior to the late 1980s, DNA technology was not available to provide information to crime investigators.

MODELING DNA FINGERPRINTING

You are going to act as the crime lab investigator who will prepare the DNA fingerprints that will be used in this case.

For this test, you will use the information provided by your teacher about the blood stain found at the crime scene and about each of the three suspects. Each profile includes a strip of letters that represents a segment of DNA. The letters on these strips stand for the sequence of bases in the DNA molecules. They will be cut and sorted using our model of electrophoresis to form DNA fingerprints.

Scientists use **restriction enzymes** to bind with and cut specific base sequences within the DNA. You will simulate the use of an enzyme that binds to the base sequence AATT and cuts between the AA and TT.



1. Obtain the information graphic about the blood at the scene, and a gel electrophoresis table from your teacher. Locate the DNA sample strip at the bottom of the graphic.

2. Use scissors to cut the DNA strip from the data graphic.

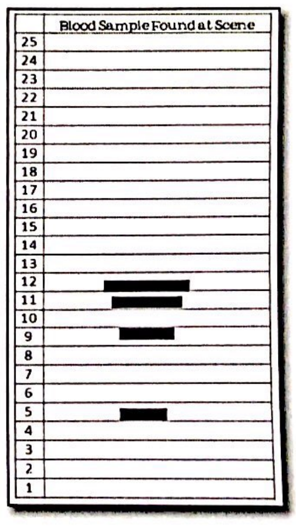
GCCAATTGCATGCATAATTGCGCGACAATTCGGCGCA

3. Look over the pattern of ACGTs on the strip. See if you can locate any areas with the sequence AATT. This is the way a restriction enzyme would know where to cut a DNA molecule. If you find AATT, cut the strip between the AA and the TT. Continue along the strip cutting in the middle of all the AATT sequences. This will result in several fragments of DNA of varying lengths.

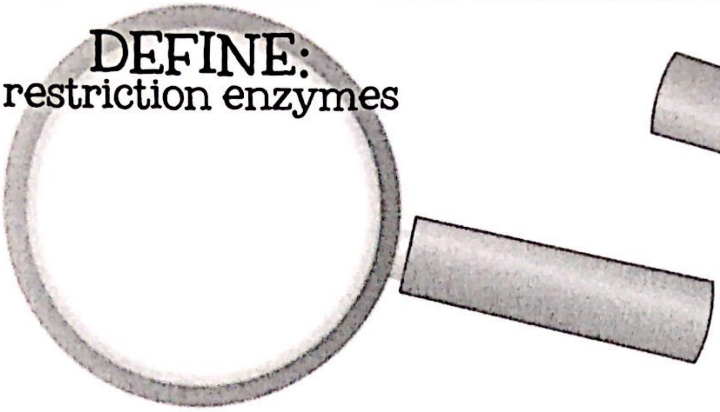
4. Count the number of letters on each fragment. This represents the length of the fragment. Arrange the fragments by size and tape or glue them to the corresponding space on the gel electrophoresis table to show the DNA banding pattern we call the fingerprint.

5. Follow the same procedure for each of the three samples collected from the suspects.

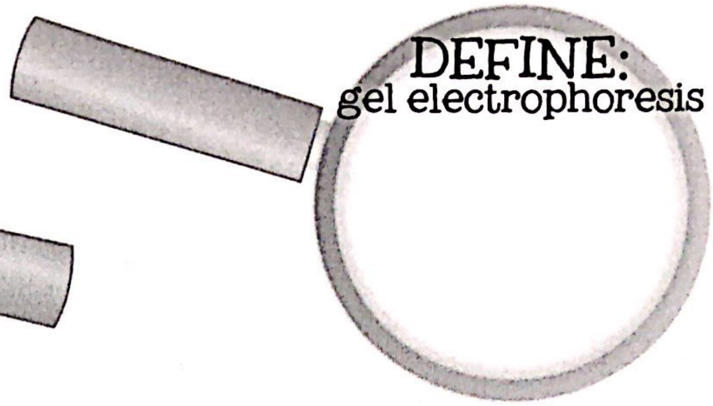
6. Compare the DNA fingerprints of each suspect to the fingerprint of the blood located at the crime scene to determine who broke the glass case to steal the diamond necklace.



DEFINE:
restriction enzymes



DEFINE:
gel electrophoresis



1. Who stole the necklace from the JewelryMart?

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2. How can you tell?

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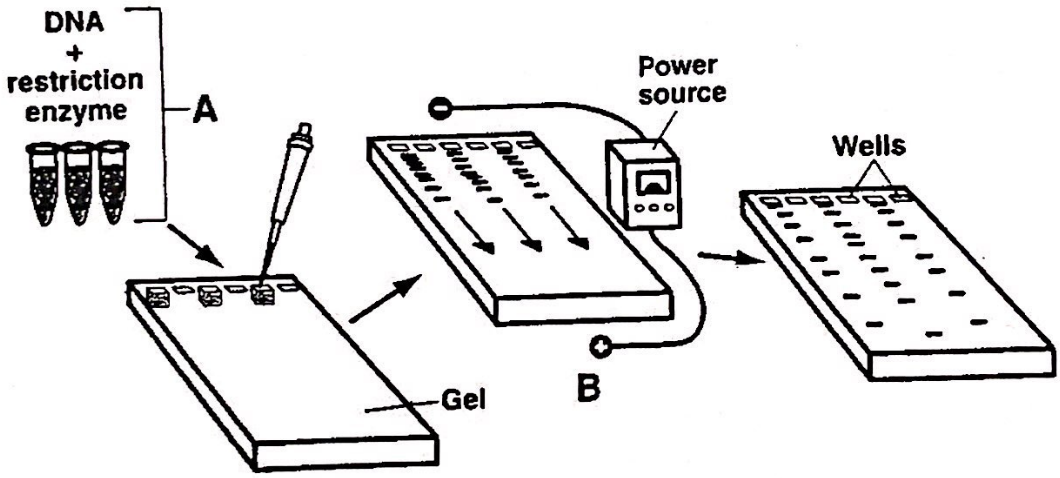

This diagram shows how DNA gel electrophoresis really works. Describe what processes are taking place at A and B.

A. ____

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B. ____

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	BLOOD found at the scene	Robert Jones, shopper	Tracy Smith, salesperson	Mike Johnson, security
23				
22				
21				
20				
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12				
11				
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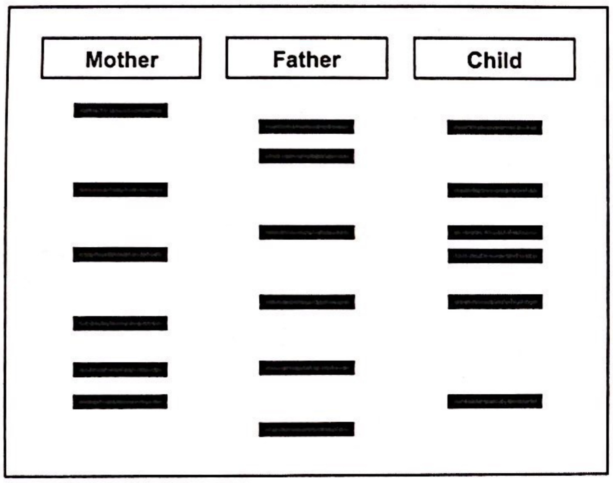
1				

BABY MINE?

The parents of a new baby believe they brought the wrong child home from the hospital. Gel electrophoresis was performed using DNA samples from the parents and the child. A section of the gel electrophoresis result is shown below.

_____ 1. Which conclusion is valid based on the gel electrophoresis results?
A. They have the correct child, because her genetic information is identical to that of the father.
B. They have the wrong child, because her genetic information does not match that of either parent.
C. They have the correct child, because her genetic information came from both parents.
D. They have the wrong child, because her genetic information matches only that of the mother.



2. Circle the band in the diagram in the results for the child that would contain the smallest DNA fragments. Explain your answer.

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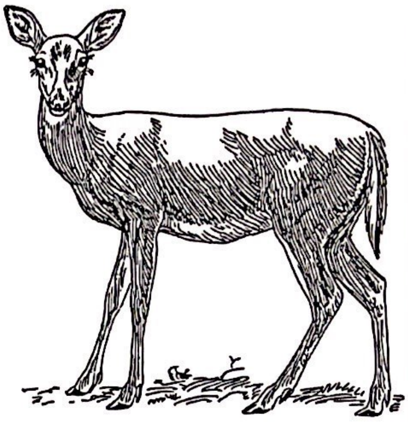
_____ 3. In preparation for an electrophoresis procedure, enzymes are added to DNA in order to
A. convert the DNA into gel
B. cut the DNA into fragments
C. change the color of the DNA
D. produce longer sections of DNA

_____ 4. What determines the kind of genes an organism possesses?
A. type of amino acids in the cells of the organism
B. sequence of the subunits A, T, C, and G in the DNA of the organism
C. size of simple sugar molecules in the organs of the organism
D. shape of the protein molecules in the organelles of the organism

OH, DEER!



The sequences below represent the same portions of a DNA molecule from the same gene used by a student to study the relationship between two Species of deer.

A biological catalyst that recognizes the CCGG site is used to cut the DNA molecules into pieces. The catalyst cuts the DNA between the C and G of the site.

1. Draw lines in the sequences below for species 1 and species 2 to show where the catalyst would cut the DNA.

Species 1: T A C C G G A T T A G T T A T G C C G G A T C G

Species 2: T A C G G A T G C C G G A T C G G A A A T T C G

2. Complete the data table below to show the results of the action of the catalyst.

Results of Catalyst Action

	Number of Cuts	Number of Resulting Pieces of DNA
Species 1		
Species 2		

3. Are the two species of deer closely related? Explain your answer.

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____

_____ 4. Electrophoresis is a method of
A. separating DNA fragments
B. changing the genetic code of an organism
C. indicating the presence of starch
D. separating colored compounds on a strip of paper

_____ 5. The genetic code of a DNA molecule is determined by a specific sequence of
A. ATP molecules
B. chemical bonds
C. sugar molecules
D. Molecular bases