

FORENSIC CRIMINAL INVESTIGATION

OBJECTIVES/RATIONALE

Forensic medicine includes investigation procedures involving the collection and evaluation of evidence from a crime scene. The student will investigate collection and evaluation procedures.

TEKS 121.2 6A, 6B, 6C

TAKS ELA 1, 4
Mathematics 1, 6, 8, 9
Science 1, 4

KEY POINTS

- I. Roles of forensic evidence
 - A. establishes the element of the crime.
 - B. Associates/disassociates suspect with the crime.
 - C. reconstruct the crime scene.
 - D. investigative personnel and the laboratory scientists work as a team.
- II. Forensics assist in investigations by
 - A. Aids in the solution of the case by providing analysis
 - B. Proves an element of the crime
 - C. Identifies the suspect or victim
 - D. Develop and corroborate the evidence
 - E. Test statements and alibis
 - F. Reconstruct crime scene
- III. Classification of evidence
 - A. individual identifying characteristics
 - 1. fingerprints
 - 2. handwriting
 - 3. bullets
 - 4. tool marks
 - 5. shoeprints
 - 6. pieces of items with matching edges
 - B. class characteristics
 - 1. soil
 - 2. blood
 - 3. hairs
 - 4. fibers
 - 5. paint form an item
- IV. Evidence Types
 - A. *Fingerprints*
 - 1. basic fingerprint patterns
 - a. Loops
 - b. Arches

- c. Whorls
 - 2. Within basic patterns are points
 - a. about thirty different types of points
 - b. no two people have the same types of points in the same number in the same places on their fingertips
 - c. This is why our fingerprints are totally unique
 - 3. Fingerprints are formed underneath the skin in the dermal papillae layer - as long as that layer of papillae is there, fingerprints will always come back, even after scarring or burning
 - 4. Prints are left on a surface because humans constantly secrete water and body oils and other compounds through pores. This material is left on the surface touched in the form of a fingerprint.
 - 5. Gloves
 - a. prints can be left through surgical gloves
 - a. they fit so tightly that fingerprints 'pass through' the latex membrane
 - b. can be turned inside out to yield fingerprints from the inside surfaces
 - b. leather gloves can leave a print that is unique to that glove - leather comes from cow skin, which is just as random as human skin
 - c. cloth gloves, such as mittens, can leave a distinctive print
 - 6. Developing prints
 - a. powder processing
 - a. Minute particles of powder cling to the print residue as the brush passes over it.
 - b. The print is then lifted with tape
 - b. Fuming - Vapors of iodine and superglue (bonds in seconds) will coalesce inside the print residue to reveal a latent print
 - 7. Computers have revolutionized the techniques used to match fingerprints
 - a. AFIS. Automated Fingerprint Identification System
 - b. Prints can be image scanned directly into a computer
 - c. Prints can be compared at a rate of 400,000 per second
- B. Lip prints—unique lip prints to each individual; heredity plays a role in lip patterns; lip print patterns are divided into six types all based on the wrinkles and grooves on the lip
- 1. TYPE I: Clear cut lines or grooves that run vertically across the lip.
 - 2. TYPE IA: Straight grooves that disappear halfway into the lip instead of covering the entire breadth of the lip.
 - 3. TYPE II: Grooves that fork
 - 4. TYPE III: Grooves that intersect.

5. TYPE IV: Grooves that are net-like.
 6. TYPE V: Grooves that do not fall into any of the above categories and cannot be differentiated.
- C. Body fluids—blood, semen, saliva, urine, perspiration, and pus
1. A blood sample can determine:
 - a. the sample is blood
 - b. the blood species, animal or human
 - c. the type-A,B,AB,O or subgroups
 - d. alcohol content
 - e. the presence of drugs
 - f. whether the sample is venous, fetal, or menstrual blood
 - g. ways the blood was deposited on the item
 2. Seminal stains-major type of evidence collected in rape and sex-related crimes
- D. DNA Examination
1. significant breakthrough in forensic science
 2. a sample of human cells is extracted to determine the DNA pattern.
 3. DNA degrades slowly in a decomposed body, samples can be analyzed for some time after a person's death
 - a. DNA is durable and relatively resistant to adverse environmental conditions such as heat or moisture
 - b. National DNA Index
- E. Hair Comparisons
1. The body area from which a questioned hair came can be identified.
 2. Race may be determined.
 3. Disease conditions may be determined.
 4. A hair found at a crime scene can be matched to the person that left it there - involves side by side examination of the suspect and known hairs.
- F. Entomology.
1. Used to determine time of death
 2. Used to determine if a body has been moved from one geographic location to another
 3. If bugs are found on a corpse, the age of the bugs can be extrapolated backward to estimate time of death
- G. Blood Spatter - The patterns of the spatters and the shapes of the individual blood droplets can tell how the crime was committed
1. Drops falling from different heights (i.e. at different speeds) will leave different looking patterns
 - a. A drop falling from a low height of a few inches will leave a small cohesive circle.
 - b. At greater heights, the circle will be larger and may even have a crown effect.

2. Hitting a surface at an angle does even more to disrupt a blood droplet
 - a. Perpendicular impact leaves a droplet fairly uniform
 - b. A droplet hitting a surface at an angle will bulge out in one direction, indicating the direction of travel of the droplet
 3. Cast off stains- a result of blunt force trauma
 - a. Pulling back from a blow produces a blood spatter that indicates direction, by creating an arc of blood droplets
 - b. the number of blows inflicted can be determined by counting the arcs
 - c. position of the individuals involved
 - d. the size of the object used
 - e. right or left handedness of the assailant
- H. Trace evidence-material small enough that it lacks the potential for absolute individualization. This includes cloth fragments, threads, fibers, hair, soils, rocks, and mineral debris.
- I. Firearms
1. Evidence includes
 - a. fired cartridge cases
 - b. bullets
 - c. live rounds of ammunition
 - d. firearm residue.
 2. Laboratory findings
 - a. Type and caliber of weapon
 - b. bullet or cartridge fired from specified weapon

ACTIVITIES

- I. Complete Lip Print Activity.
- II. Complete Fingerprinting Activity.
- III. Complete Fingerprint Detection Activity.
- IV. Research forensic websites and present an investigative technique used in solving crimes

Teacher Note

A fun activity to do for lip prints—have each student place their lip print on two pieces of paper (get sample lipsticks and hand one out to each student). Pick up one lip print from each student and record their name on the back. Then lay out all the prints on a poster board and have students exchange lip prints and try to identify each persons lip print from their sample. Number the lip prints on the poster board 1-?. This is like a scavenger hunt, not very scientific , but fun!

MATERIALS NEEDED

Forensic Terms Sheet

Forensic Crossword

Six Types of Distinguishing Feature of Lip Prints

Fingerprint Identification Guide

Sample lipsticks

zip lock baggie

tube of superglue (gel version works a little better)

can of soda or drinking glass

Crossword Puzzle Key

Web sites for forensic information:

www.public.asu.edu/~langland/forensics.html

www.schoolnet.ca/vp-pv/fscience/e/teachles/tchintro.htm

www.forensicdna.com/index.htm

ASSESSMENT

Successful completion of activity

ACCOMMODATIONS

For reinforcement, the student will complete the Forensic Science Crossword Puzzle.

For enrichment, the student will design a “Clue Game” dealing with forensic terminology, mystery scenario, weapons used and suspects involved.

REFLECTIONS

Fingerprint Detection Activity

Materials

zip lock baggie

tube of superglue (gel version works a little better)

can of soda or drinking glass

1. Place the can or glass in the zip lock baggie.
2. Lay the baggie flat on the counter.
3. Squeeze out a generous amount of superglue into the baggie (*don't glue the glass to the baggie*).
4. Seal up the baggie.
5. Blow some hot, moist air into the baggie, like when you're trying to fog up a window with your breath.
6. Seal it tight.
7. The vapors from the superglue will build up in the tiny zip lock atmosphere and creep up into the prints on the glass or can.
8. There, they will crystallize and, after awhile, you should see starchy white fingerprints develop on the glass or can.

Fingerprinting

Materials

Black Ink Pad

Magnifying glass

Paper Towels/Baby wipes

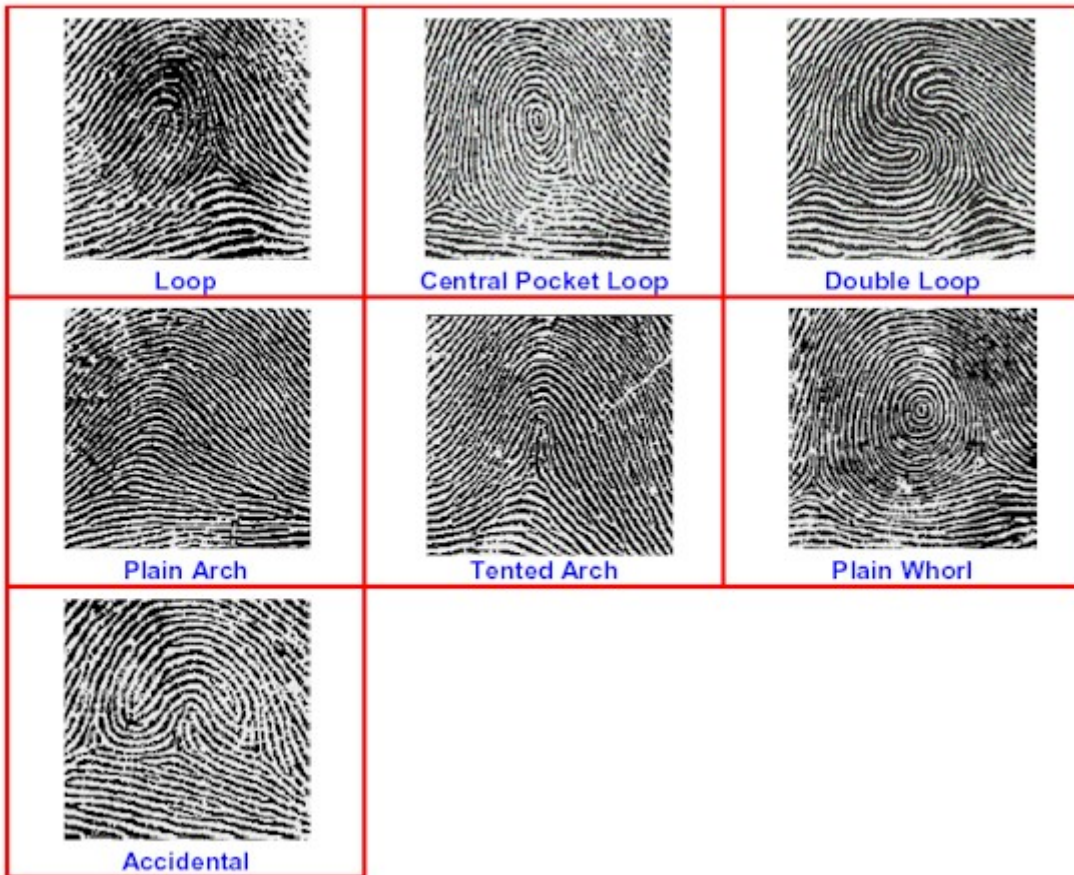
Fingerprint Identification Guide

Procedure

- Roll your right index finger lightly on the ink pad, then roll the inked finger onto the space in your chart (you may have to practice this technique until you can produce a legible fingerprint).
- Repeat this method for each finger on your right hand
- Examine each print and identify its pattern. Record this information on the chart.
- Compile data from classmates on type of fingerprint of the right thumb and create a graph.

Thumb	Index	Middle	Ring	Pinky

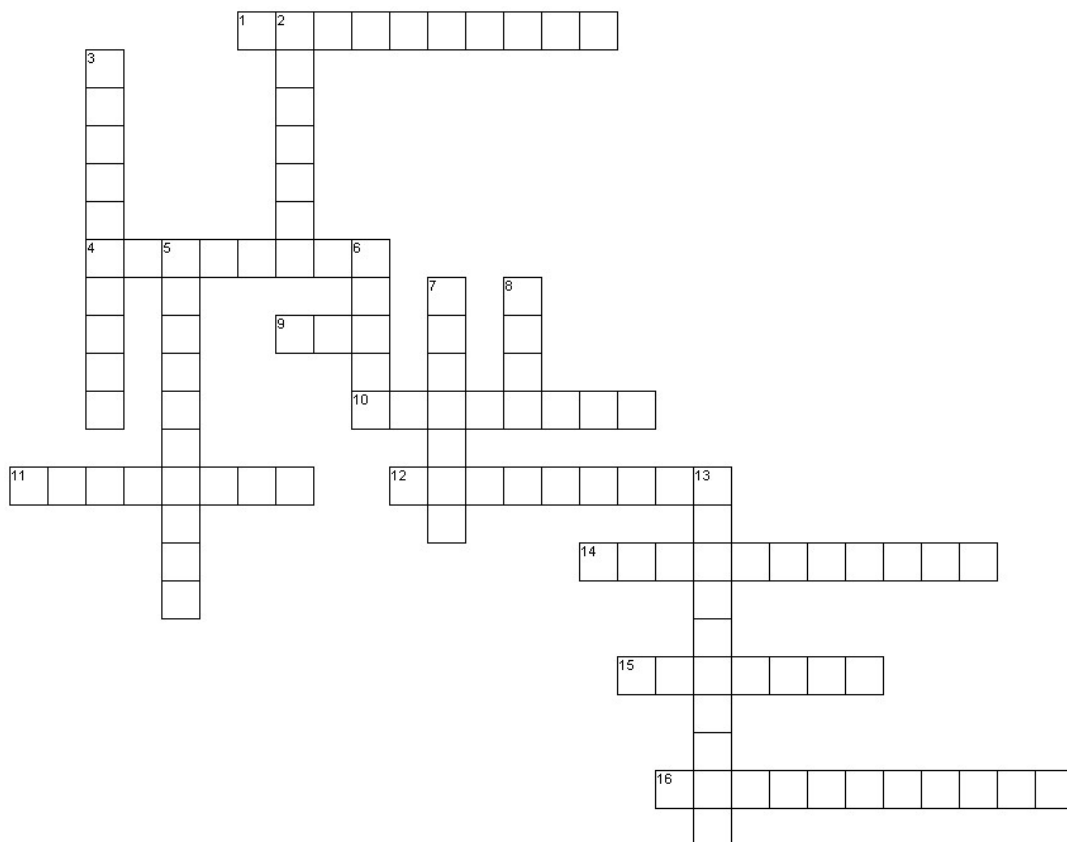
Fingerprint Identification



SIX TYPES OF DISTINGUISHING FEATURES IN LIP PRINTS

- 1. TYPE I: Clear cut lines or grooves that run vertically across the lip.**
- 2. TYPE IA: Straight grooves that disappear halfway into the lip instead of covering the entire breadth of the lip.**
- 3. TYPE II: Grooves that fork**
- 4. TYPE III: Grooves that intersect.**
- 5. TYPE IV: Grooves that are net-like.**
- 6. TYPE V: Grooves that do not fall into any of the above categories and cannot be differentiated.**

Forensic Science



Across

1. the study of the motion of bullets and their examination for distinctive characteristics after being fired. Examiners can use this evidence to match bullets or bullet fragments to specific weapons.
4. a substance that accelerates a chemical reaction but is not itself permanently changed by the reaction.
9. deoxyribonucleic acid; genetic code
10. anything that has been used, left, removed, altered, or contaminated during the commission of a crime or other event under investigation.
11. a technology dealing with the properties and actions of serums in blood; also known as blood analysis.
12. A machine that charts how respiration and other bodily functions change as questions are asked of the person being tested.
14. the study of criminal activity and how it is dealt with by law.
15. the diameter of the bore of a rifled firearm usually expressed in hundredths of an inch or millimeters.
16. the unique patterns created by skin ridges found on the palm sides of fingers and thumbs.

Down

2. the internal and external examination of a body after death. An autopsy is performed to confirm or determine the cause of death and establish other pre-death conditions.
3. the path of a projectile.
5. the study of poisons and drugs and their effect on human and animal populations.
6. material deposited at a crime or accident that can only be detected through a deliberate processing procedure.
7. a chemical that is capable of detecting bloodstains diluted up to 10,000 times. It is an invaluable tool for investigators at altered crime scenes.
8. unit of inheritance consisting of a sequence of DNA that determines a particular characteristic in an organism.
13. a red blood cell protein responsible for transporting oxygen in the blood stream and provides the red coloring of blood.

Forensic Science Crossword Key

Across

1. Ballistics
4. Catalyst
9. DNA
10. Evidence
11. Serology
12. Polygraph
14. Criminology
15. Caliber
16. Fingerprint

Down

2. Autopsy
3. Trajectory
5. Toxicology
6. Trace
7. Luminol
8. Gene
13. Hemoglobin

FORENSIC TERMS

Autopsy---the internal and external examination of a body after death. An autopsy is performed to confirm or determine the cause of death and establish other pre-death conditions.

Ballistics—the study of the motion of bullets and their examination for distinctive characteristics after being fired. Examiners can use this evidence to match bullets or bullet fragments to specific weapons.

Blood spatter—the pattern of blood that has struck a surface. This pattern can provide vital information about the source of the blood.

Bullet Track—the path of a bullet or projectile as it passes through matter, such as a body or wall.

Caliber—the diameter of the bore of a rifled firearm usually expressed in hundredths of an inch or millimeters.

Catalyst—a substance that accelerates a chemical reaction but is not itself permanently changed by the reaction.

Criminology—the study of criminal activity and how it is dealt with by law.

DNA—deoxyribonucleic acid; genetic code

Evidence—anything that has been used, left, removed, altered, or contaminated during the commission of a crime or other event under investigation.

Fingerprint—the unique patterns created by skin ridges found on the palm sides of fingers and thumbs.

Forensic Science—the application of science to law.

Gene—unit of inheritance consisting of a sequence of DNA that determines a particular characteristic in an organism.

Hemoglobin—a red blood cell protein responsible for transporting oxygen in the blood stream and provides the red coloring of blood.

Lie Detector—also known as a polygraph. A machine that charts how respiration and other bodily functions change as questions are asked of the person being tested. Lie detector tests are usually not admissible in court because many scientists consider the results to be unscientific and inconsistent.

Luminol—a chemical that is capable of detecting bloodstains diluted up to 10,000 times. It is an invaluable tool for investigators at altered crime scenes.

Physical Evidence—any object that can help explain an event under investigation. It can sometimes provide a link between a crime and its victim or between a crime and its perpetrator.

Serology—a technology dealing with the properties and actions of serums in blood; also known as blood analysis.

Toxicology—the study of poisons and drugs and their effect on human and animal populations.

Trace Evidence—material deposited at a crime or accident that can only be detected through a deliberate processing procedure. Common types are hairs and clothing fibers.

Trajectory—the path of a projectile.