- Glossary -

Archimedes:	A Greek mathematician and inventor born at Syracuse, and killed during the Roman invasion of that city. (c. 287-212 B.C.)
Capillary action:	The tendency of a liquid to be drawn upward.
Cast:	A molded mass of plaster.
Chromatography:	Separation of a mixture into its component substances by a moving solvent front. As different components move at a rate, they separate.
Classification:	The arrangement of things into groups on the basis of a relationship between them.
Constant variable:	A variable which is kept constant or unchanging.
Dichotomous:	Divided into two parts or kinds.
Evidence:	An indication; a sign; the facts available for proving or supporting a notion. Forensic evidence tends to support facts admissible in a court of law.
Forensic:	Of or used in courts of law.
Graphite:	An electrically - conductive form of carbon used in pencils or as a lubricant in electrical devices.
Graphoanalysis:	The study of handwriting, especially as a guide to character.
Graphology:	The study of handwriting.
Hypothesis:	A proposition or supposition made from known facts as the basis for an investigation.
Interlocking weave:	Fabric knitted with closely-interlocking stitches.

Investigation:	A careful study of something in order to discover the facts about it.
Latent:	Concealed; not developed; not clearly visible.
Litmus paper:	A blue-colored paper stained with litmus (made from lichen), that is turned red by an *acidic* substance, and restored to blue by an *alkaline* substance; a pH indicator.
Manipulated variable:	A variable which is changed to affect the results of an experiment.
Matter:	Anything which has mass occupies space and exists ordinarily as a solid, liquid or gas.
Mnemonic:	Of or designed to aid the memory.
Particle:	A minute portion of matter.
Pigment:	A substance that imparts colour to other materials.
Porosity:	The degree to which an article is able to be permeated by water or air.
Prediction:	A foretelling of what might be expected.
Responding variable:	A variable which changes in response to another variable being manipulated.
Scenario:	An imagined sequence of events.
Solvent:	A substance, usually a liquid that can dissolve other substances.

Fingerprints

What is fingerprinting?

---fingerprinting is a process of identification based on the impressions made by the ends of the fingers and thumbs
---these impressions consist of patterns formed by the ridges that cover the skin of the fingerprints
---fingerprints porvide the most reliable method of identification because no person's prints are identical to those of another individual
---even identical twins have different fingerprints
---in almost all cases, fingerprints remain the same throughout a person's lifetime
---the ridges on the fingerprints change only as a result of surgery, disease, or an accident

Steps In Collecting Fingerprints

1. First, the experts dust (brush) a surface with powder.
2. The powder sticks to the oils left on a surface by one of the fingers.
3. The print is photographed and then lifted from the surface with clear, adhesive tape.
4. The tape transfers the print to a piece of paper, which forms a permanent record.
5. Fingerprints in blood, grease, or other visible material are photographed directly.

How Are Fingerprints Recorded?

---fingerprints are recorded by means of a piece of glass or metal coated with a special ink
---the fingerprints are pressed into the ink with a rolling motion from one side of the fingernail to the other

---the inked fingers are pressed on a white card, producing a copy of the prints

Visible Fingerprints
---visible fingerprints are made by fingers soiled with blood, dirt or other substances
---visible prints can be photographed immediately

Latent Fingerprints
---latent fingerprints are made by the perspiration and oils that accumulate naturally on the fingerprints
---latent prints must be made visible
---some latent fingerprints can be developed only with a laser, a device that produces a powerful beam of light
---this causes the perspiration in a fingerprint to shine with a yellow color so it can be photographed

CLASSIFICATION OF FINGERPRINTS

1. **Deltas**---deltas have a triangular pattern on the fingerprint

2. **Arches**
---like a wave or hill
---ridges enter on one side
---they rise in the middle
---exit on the opposite side of the print
---the arch print has no delta

3. **Loop**
---most common
---looks like a loop
---ridges enter one side of the print
---they go up to form a loop
---ridges exit on the same side
---it has one delta

2.

4. Whorl
---like a spiral
---pattern circles around like a whirlpool
---it has two deltas

5. Composite
---combination of patterns
--contains whorls, arches, loop and arch, or whorl and loop

Identifying Fingerprints
---first the police look at the patterns
---they look at the loops, whorls, arches or composites
---they also look for unique features of a print
---to be considered a "match", they must have a number of ridge characteristics in common

Four Ridge Characteristics Looked For
1. Bifurcation (fork)---one ridge splits to form two ridges and then rejoins to one ridge again, forming a shape like a lake

2. Ridge endings---a ridge ends

3. Island---a very short ridge in the print pattern is not connected to any other ridge, much like an island floating by itself

4. Lake---a ridge in the shape of a circle/oval

*****When a fingerprint has a large number of ridge characteristics in common, we "infer" the person is a suspect.**

Powders Used To Lift Prints
---bothersome to some people
---make the nose itch
---cause sneezing

---results often poor
---even experts have limited success
---solid, smooth surfaces such as glasses and mirrors produce the best fingerprintsfor lifting
---porous or rough surfaces produce the poorest fingerprints

<u>Latent Print---a</u> print which is left on a surface and cannot easily be seen

<u>Graphite Powder</u>
---can be purchased from a hardware store
---used for lubricating locks
---dark gray powder
---can be used instead of white powder
---works well
---messier because it is the consistency of fine pencil lead shavings
---clothing should be protected
<u>Other Types of Prints</u>
---bullet
---voice
---eye(iris)
---lip
---bare footprints
---DNA

<u>Tire Tracks</u>
---to preserve tire prints criminologists photograph them
---then a cast of the mark is made with plaster of Paris
---Are all tires the same?
---Is a tire from one manufacturer the same as aa fire from another manufacturer?
---Do all vehicles have the same tires?
---Do trucks use the same tires as cars?
---Do minivans have the same tires as cars and trucks?

4

Track Casting---it can be used as a method of gathering tire or footprint evidence

<u>Plaster of Paris</u>

---it sets very quickly
---messy and dusty
---the dust can be irritating
---mixing must be done gently
---it will clog a drain so must not be poured into a sink
---mixing spoons can be cleaned by allowing the plaster to dry, then chipping off the excess and washing the spoons

<u>Use of Chemicals</u>

--- Acid is used to restore partially erased serial numbers on stolen property
--- Chemicals are used to determine the cause of an explosion or fire
---these chemicals detect traces of flammable substances, including gasoline or kerosene
---chemicals also help identify samples of blood

<u>New Instruments</u>

<u>1. Spectrophotometer</u>

---records light and heat rays that the human eye cannot detect
---this instrument shows the pattern of the rays when they strike an object
---criminologists can detect forgeries or illegal erasures on documents with this instrument by comparing the pattern of rays in ink

<u>2. Gas Chromatograph</u>

---this instrument separates the various components of a substance
---the amount of each component is then measured

---criminologists use a gas chromatograph to determine the amount of alcohol in a person's blood

Chromatography--a technique used for separating mixtures

Possible Questions

---What would happen if I test all of the colors in my felts?
---What solvent will dissolve permanent ink?
---Can other liquids be used as solvent?
---Will things other than ink separate into other colors(ketchup, grape juice, leaf pigment, multi-colored, covered chocolate candies)?
---Will primary colors separate?
---Will the dye from construction paper separate into colors?

Fabric Samples

Stretch--pull fabrics from side to side and diagonally, and measure the amount of stretch with a ruler

Colorfastness

---soak fabric in hot water and soap
---examine the water or let the fabric sit on white paper
---examine for dye remaining on the paper

Absorbency

---drop two or three drops or water onto the fabric using the dropper
---observe if the water is absorbed or if it forms balls on the surface
---or, have students measure 10 mL of water into a container
---then put the fabric into the water and observe whether the fabric absorbs the water
---estimate the amount of water that is absorbed

Wrinkling
---bunch the fabric into a ball and hold it for a minute or tie it with elastics

Thread---pull out a thread and examine it under a magnifying glass or a microscope

Flammability---it is important that this demonstration is carried out by the teacher only, and in a very well ventilated area outside

Safe Laboratory Procedures

1. **Roll up loose fitting sleeves.**
2. **Tie back long hair.**
3. **Wear safety glasses.**
4. **Use oven mitts for tongs.**
5. **Flaming material should be held over a metal tray.**
6. **Students should not lean into the work area.**
7. **Use a well-ventilated room.**
8. **Man made fibres are more likely to melt and give off noxious fumes than natural fibres.**
9. **Natural fibres are more likely to scorch and burn.**
10. **Wool will smell of burnt proteins.**

Codes

1. **Morse**
2. **Maritime**
3. **Braille**
4. **Pig latin**
5. **Color Codes**
6. **Number Codes**

Handwriting Analysis Indicators

1. **Spacing and slant of letters**
2. **Spacing of words**

3. Pressure on the page
4. Formation of the loops in letters such as L, O, f, p, B
5. Dotting of the letters I, j
6. Crossing of the letter t
7. How letters are joined
8. A combination of printing and writing
9. Formation of less common letters
10. Size of words and letters
11. Extraneous marks on the page
12. Writing tool used
13. Graphoanalysis---the premise that handwriting reveals personality

Soil Samples

---color of the soil indicates the material that it is made of
---soil rich in humus will be very dark
---soil from an unpaved parking lot may contain very little humus and a lot of sand and pebbles to keep the water from collecting there
---grittiness can be tested by wetting a small amount and rubbing it between the thumb and two fingers
---soil made up of very small particles will feel smooth
---soil containing sand or larger, coarser particles will feel rough and gritty
---clearer results occur when the soil is damp
---other material found in the soil may be insect parts, fur, hair, bones, branches

Designing a Soil Test

Here are some of the possible test ideas and how they may be performed.
Porasity---how much liquid the soil will hold
---there are two different methods

---the first is to see how long a measured amount of water takes to run through the soil
---the second method is to pour measured amounts of water into the soil at timed intervals
---see which container first shows surface water

Particle Size
---use screens to separate different-sized particles
---or, pour measured amounts of water and soil into a jar
---then put on the lid
---agitate the jar for a set time and let the contents settle

PH(Soil acidity)
---Purple cabbage juice is an indicator for acidic conditions
---litmus paper is also an alternative to test acidity

Chromatography
---soil is moistened
---it is smeared onto a strip of filter paper and tested

Crime Scenes

Crime
---What was the crime?
---Where was it committed?
---What would a floor plan look like?
---How could you "flesh out"the crime?

Suspects
--type of suspects
---name
---physical appearance
---personality
---distinguishing characteristics

---clothing

Motive
---each suspect must have a motive

Opportunity---all of the suspects must have had an oppportunity to commit the crime
---do any of them have believable alibis?
/
Clues
-----handwriting
---clothing fibres
---fingerprints
---foot or tire prints
---soil sample
---ink sample
---eye-witness
---red herrings--clues that will throw off the investigator and that are not really relevant to the crime

Background Information (a good summary)
Evidence must be carefully collected and analysed. To convict, the forensic evidence must prove the suspect guilty beyond a shadow of a doubt.

The process of investigation and the gathering of evidence are the essence of science enquiry. This unit emphasizes questioning, predicting, observing, categorizing and inferring. Law enforcement officials require these skills to solve crimes.

Students love mystery and the idea of investigating crimes. Based on this interest, forensic science is an ideal means to build scientific skills. Students will experience examining evidence (things, suspects, obsreved data) and then will make inferences (possible

hunches based on logic and reasoning). The process of examining evidence leads the students to develop valid tests and to begin to draw conclusions based on the results of their tests. The real world of police investigation is brought home to students as they learn to dust for fingerprints, examine handwriting for unique characteristics and analyse various substances.

When a crime scene is investigated by police, all clues are examined. These clues might include tire prints, shoe prints, fingerprints, fibers, hair, written or print documents and soil evidence.

Anyone entering a tire store or a shoe store will realize that shoes and tires come in a wide variety of treads and sizes. Through continued use, distinctive wear patterns develop. Like tire and shoe prints, fingerprints vary too. Unlike tires and shoes, fingerprints do not wear out.

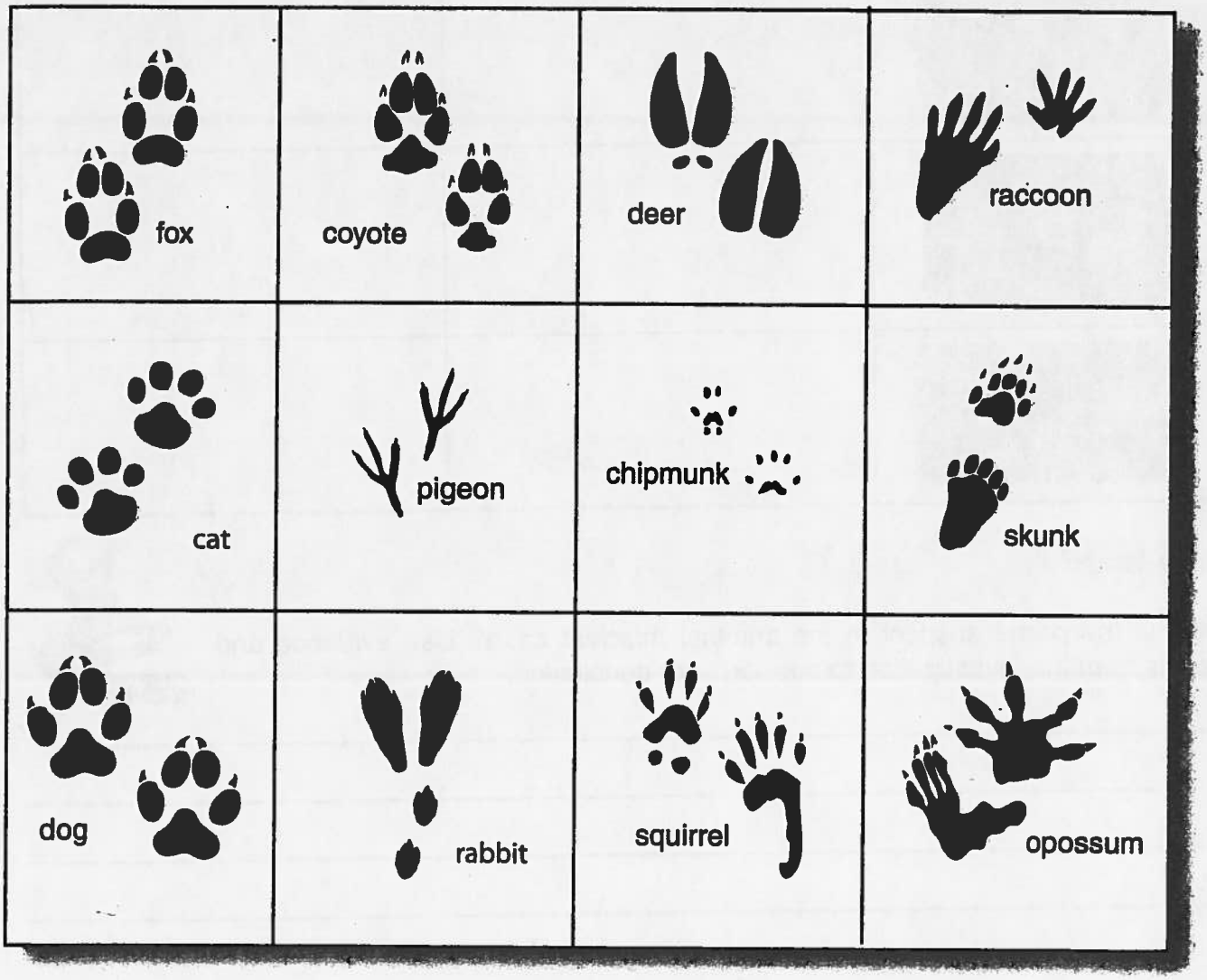
Humans have known about the unique characteristics of fingerprints for thousands of years. Babylonians left fingerprint impressions in soft clay to prevent forgeries. The ancient Chinese and Japanese used fingerprints as their signatures. Canadian Aboriginal Peoples possess artifacts which depict fingerprint patterns. Fingerprint evidence was not accepted as legal evidence until the end of the nineteenth century. The FBI began a fingerprint file in 1930, which has grown to be the largest collection in the world.

Our fingerprints begin to develop when we aare an eleven week fetus. The ridges of our prints remain unchanging throughout our lives. In the 1930's notorious criminals tried to remove their fingerprints using acid, but the ridges grew back, and in connection with the acid scars, made the prints even easier for police to use for identification.

Animal Tracking Guide
Skill-Building Activity

Wildlife can be found almost everywhere, even in densely populated urban areas. The most visible urban wildlife species include birds, squirrels, rats, mice, raccoons, rabbits, deer, bats, foxes, and opossums. Urban wildlife have adapted to the changes in their environment, and as a result, they sometimes become a nuisance to humans. They often snack on trees and shrubs, dig holes in lawns and flower beds, and leave droppings on playgrounds and ball fields.

Wild animals can be difficult to detect in the urban setting because of their instinctive behavior to avoid humans. However, the presence of wild animals can be determined by the tracks they leave behind. The following illustrations are designed to help identify various species of animals by examining examples of their tracks. Special attention should be paid to characteristics such as shape of the track, number of toes, and presence or absence of claw marks.



Name: _____ Date: _____

Mammal Track Analysis Lab

Directions: Examine the four animal prints found at the crime scene. Use the information found on the Mammal Track Characteristics and Animal Tracking Guide pages to identify the mammal prints. Look for any identifiable features, such as print shape, the number of toes, and the presence or absence of claws. Record the information on the table. Analyze each of the prints to determine which match the prints from the crime scene.

Prints	Identifiable Features	Identify the Mammal
		
		
		
		

Whodunit?

Who is the prime suspect in the criminal mischief case? Use evidence and details from the investigation to support your conclusion.

_____

_____

_____

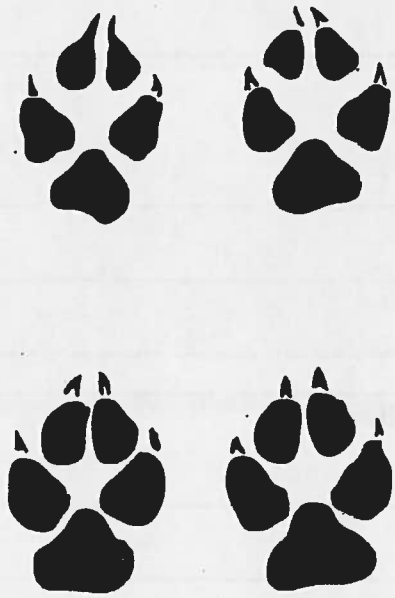
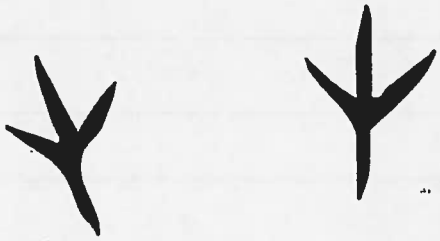
_____

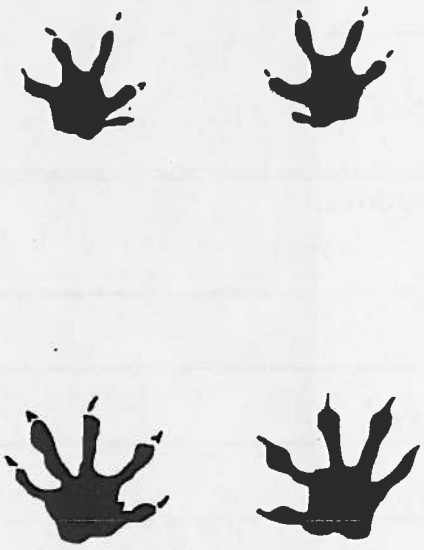
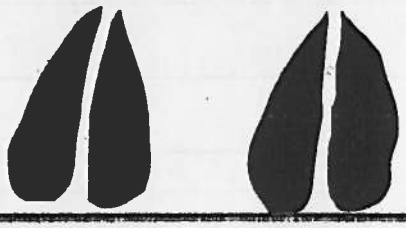
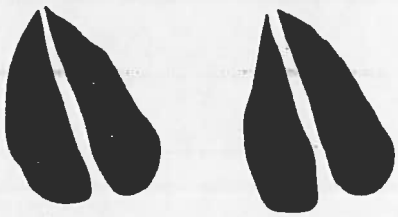
Name: _____

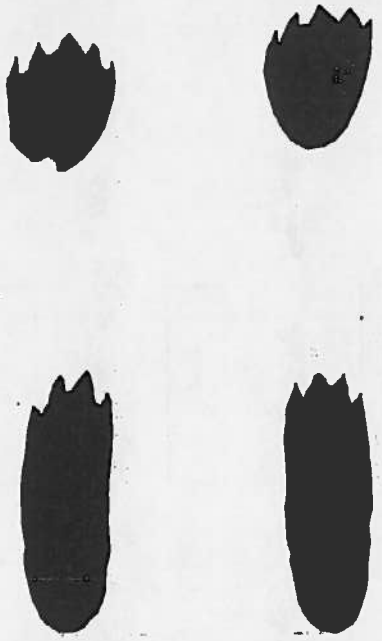
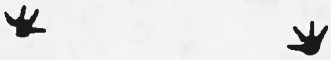
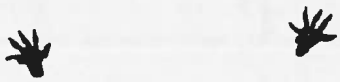
Master #3

Date: _____

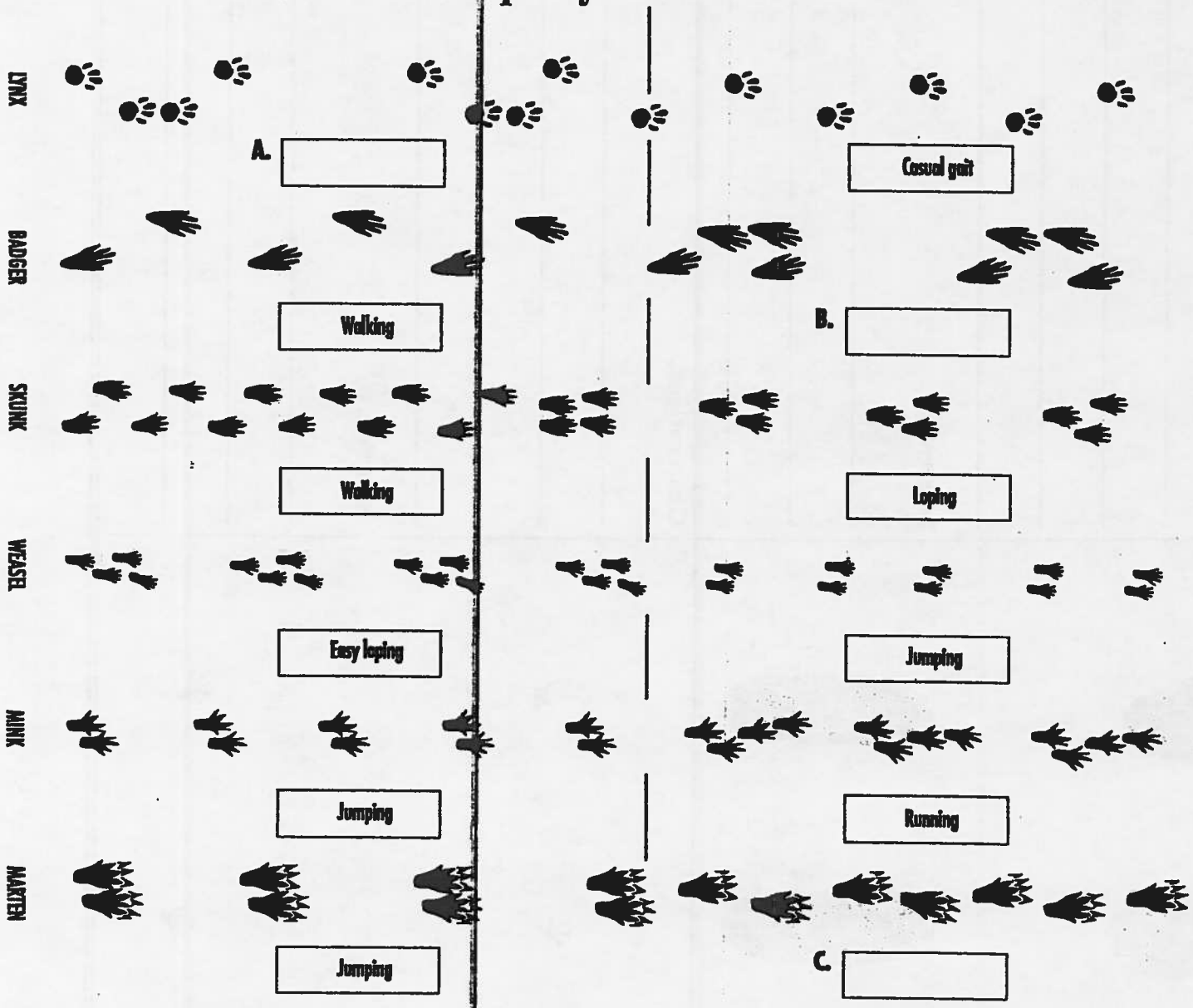
Animal Tracks

A 	**Observations:** _____ _____ _____ _____ **Inference:** _____ _____ _____
B 	**Observations:** _____ _____ _____ _____ **Inference:** _____ _____ _____

C 	**Observations:** _____ _____ _____ _____ **Inference:** _____ _____ _____
D 	**Observations:** _____ _____ _____
	_____ **Inference:** _____ _____ _____

E 	**Observations:** _____ _____ _____ _____ **Inference:** _____ _____ _____
F 	**Observations:** _____ _____ _____
	_____ **Inference:** _____ _____ _____

Speedy Tracks



Name: _____

Master #4b

Date: _____

Looking at Speedy Tracks

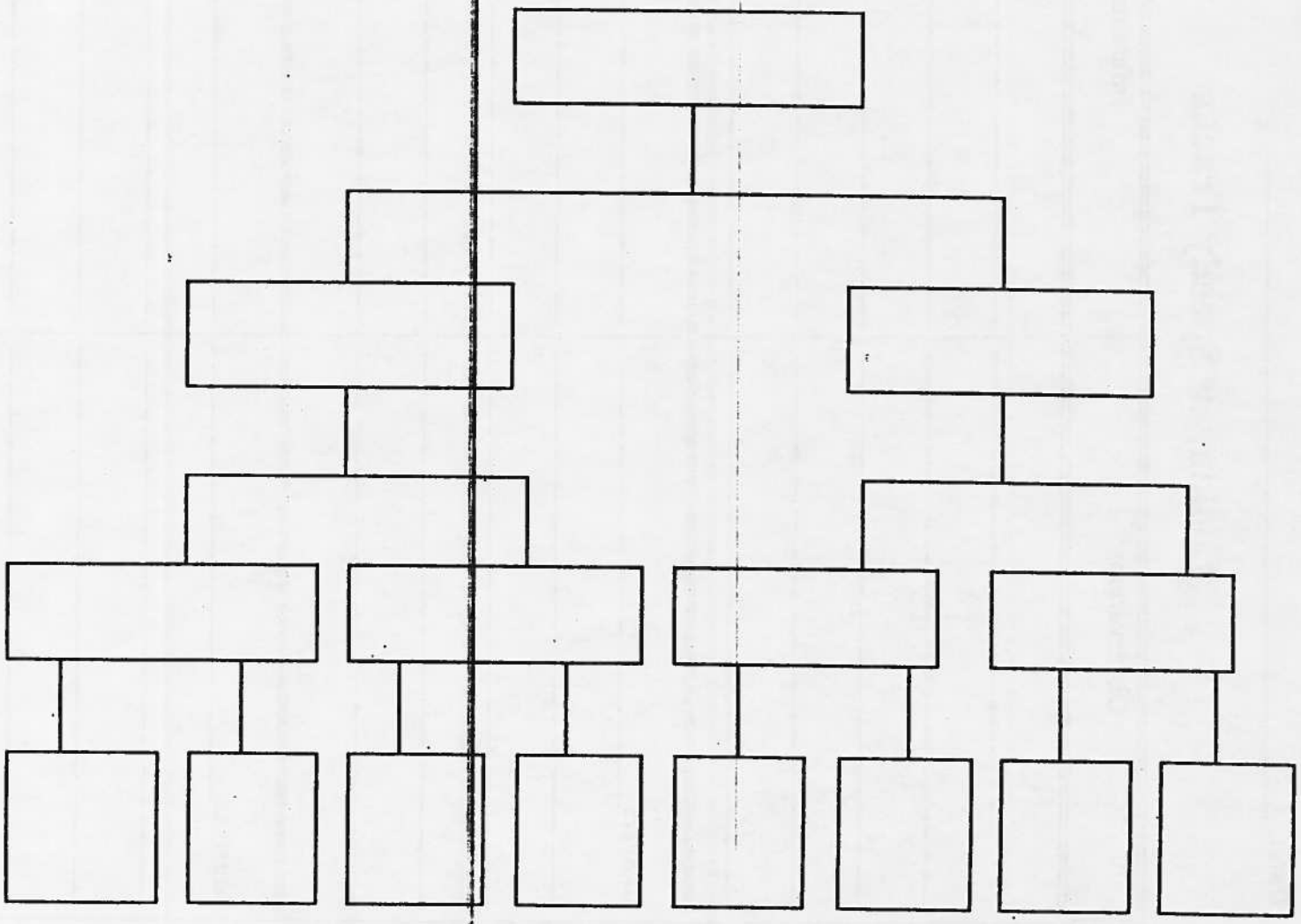
Observations:	Inference:
Lynx: _____	_____
_____	_____
_____	_____
_____	_____
_____	_____
Badger: _____	_____
_____	_____
_____	_____
_____	_____
_____	_____
Marten: _____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Name: _____

Date: _____

Master #5a

Shoe Sorting

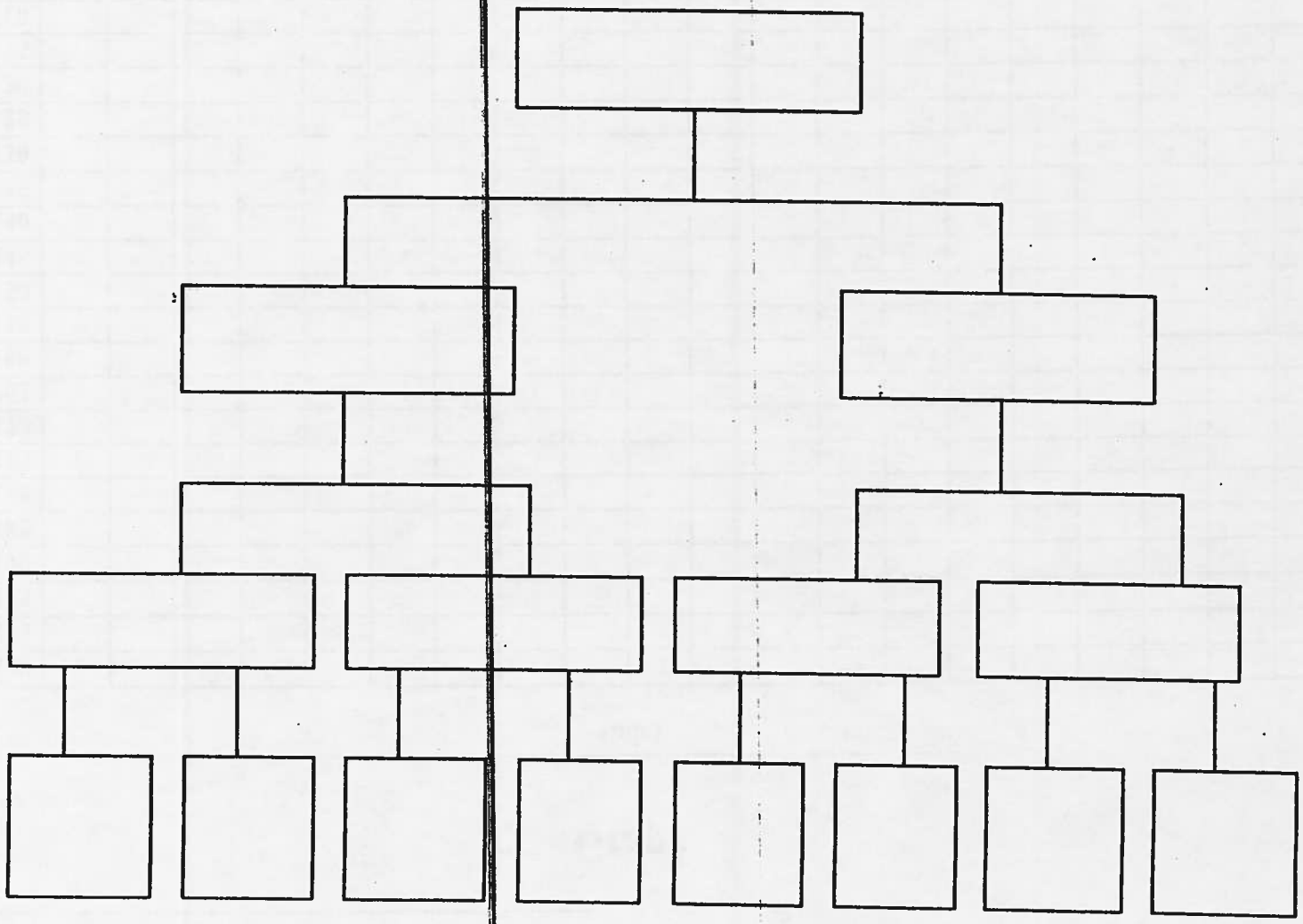


Name: _____

Date: _____

Master #6a

Characteristics of People



Name: _____

Date: _____

Master #7

Graph

_____

(title)

	205																					
	200																					
	195																					
	190																					
	185																					
	180																					
Height	175																					
(cm)	170																					
	165																					
	160																					
	155																					
	150																					
	145																					
	140																					
	135																					
	130																					
	125																					
	120																					
	115																					
	110																					
	105																					
	100																					
		10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

Length of Foot (cm)

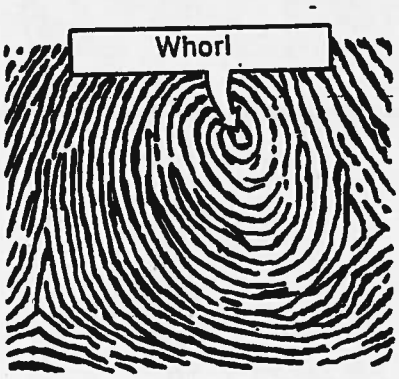
Name: _____

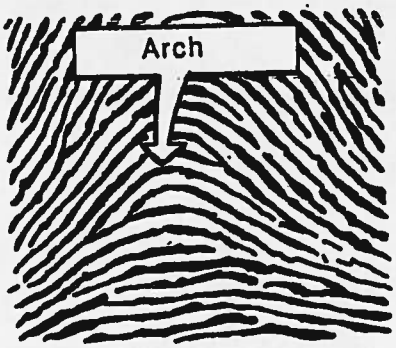
Fingerprint Patterns

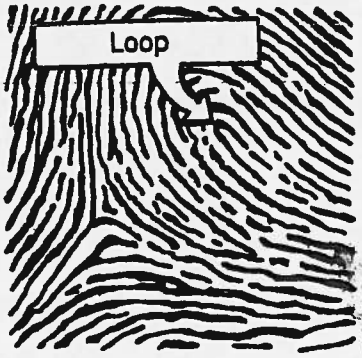
Every person in the world has a unique set of fingerprints, unlike those of any other person who ever lived.

Even though everyone's fingerprints are unique, there are basic patterns that are always found. These patterns help criminalists classify fingerprints.

The three basic patterns are:







Whorl patterns have lots of circles that **do not leave** either side of the print.

Arch patterns have lines that start on one side of the print, rise toward the center, and leave on the **other** side of the print.

Loop patterns have lines that start on one side of the print, rise toward the center, turn back and leave on the **same** side from which they started.

Name: _____

Date: _____

Master #8a

Categorizing Prints

Loop

Whorl

Arch

Composite

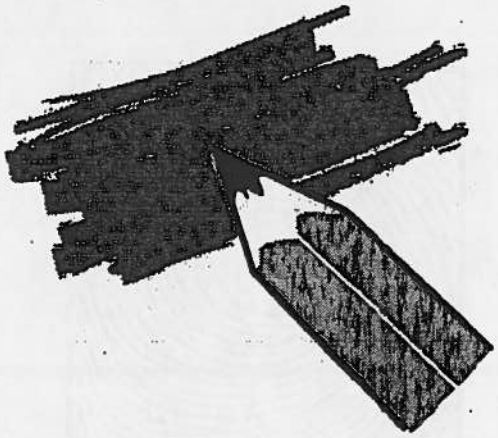
These are the four most common types of fingerprints.

Name: _____

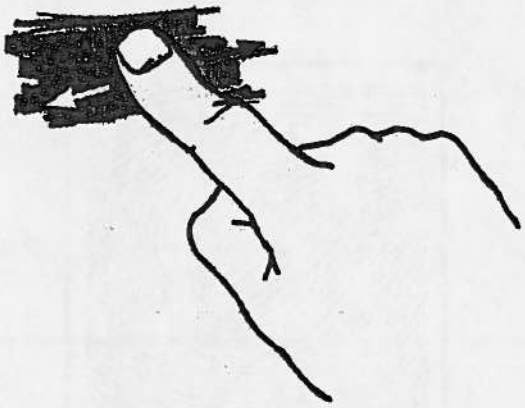
Date: _____

Master #8b

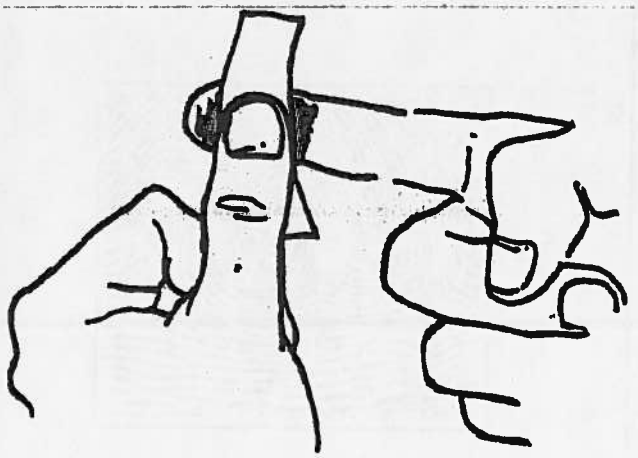
Graphite Prints



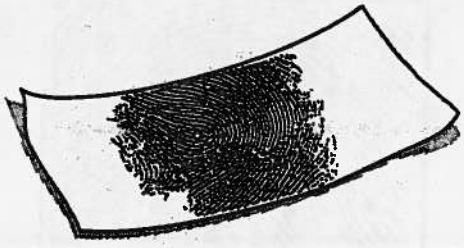
1. Rub a pencil lead (graphite) on a sheet of paper.



2. Rub your finger tip on the paper. Ensure that it is covered with graphite.



3. Put clear tape over your finger. Notice that the tape should be placed over the pad of your finger (not the tip).



4. Carefully pull off the tape and stick it on a sheet of paper.

Name: _____ **Master #9**

Date: _____

Pencil Print

	Thumb	Index	Middle	Ring	Pinkie
Left Hand Print					
Type of Print					
Right Hand Print					
Type of Print					

Total number of finger prints you have of each pattern:

☐ arch ☐ loop ☐ whorl ☐ composite

Name: ______________________________

Date: ______________________________

____

(Title)

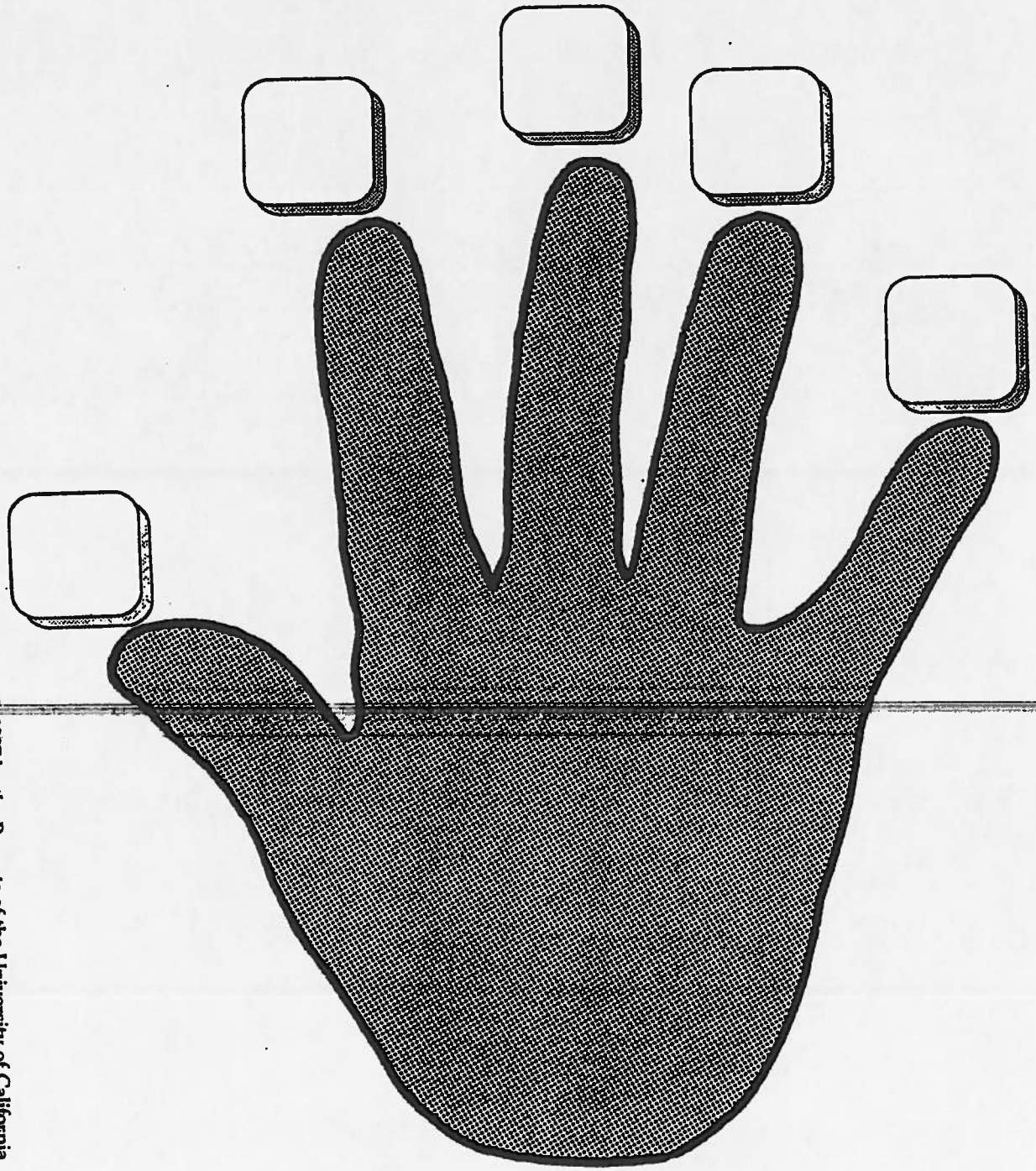
Arch	**Whorl**	**Loop**	**Composite**

(Label) ______________________________

Your Fingerprints

Name _____

Use this sheet with your right hand (palm down) or your left hand (palm up).



Which hand did you use? _____

What is your fingerprint formula? _____

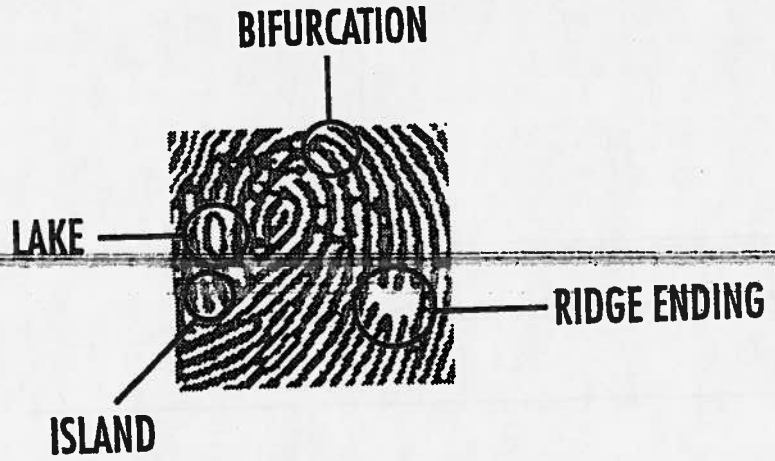
Master #11

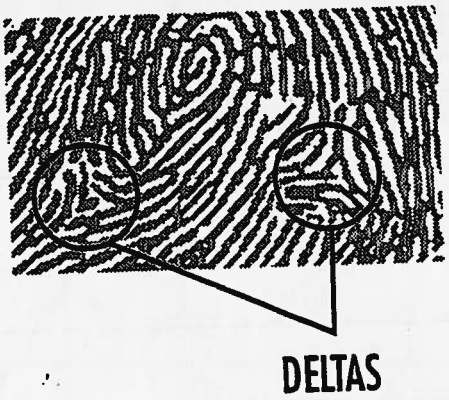
Name: _____

Date: _____

Categorizing Prints

Ridge	Characteristics
Bifurcation (fork)	One ridge splits to form two ridges and then rejoin to one ridge again, forming a shape like a *lake*.
Lake	A ridge in the shape of a circle/oval.
Ridge ending	A ridge ends.
Island	A very short ridge in the print pattern is not connected to any other ridge, much like an island floating by itself.





Name: _____

Date: _____

Master #12

Matching Finger Prints - Ridge Characteristics

Find the following ridge characteristics in your finger prints. Cut it out and glue it in the appropriate box below. Circle the characteristic.

Bifurcation (fork)	**Lake**
Ridge Ending	**Island**

Describing each of the following ridge characteristics:

Bifurcation: _____

_____

Lake: _____

_____

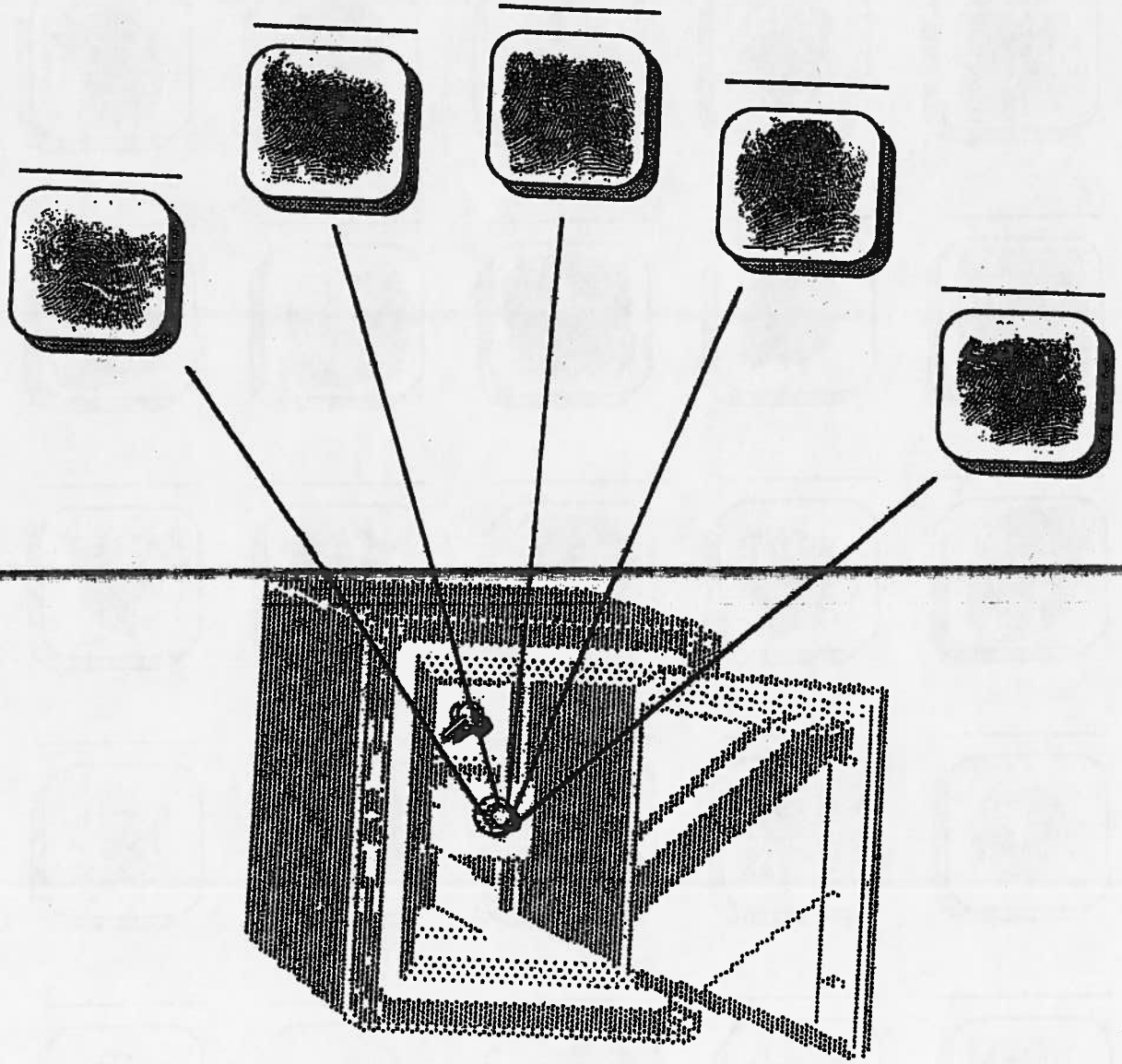
Ridge Ending: _____

_____

Island: _____

_____

Safe with prints

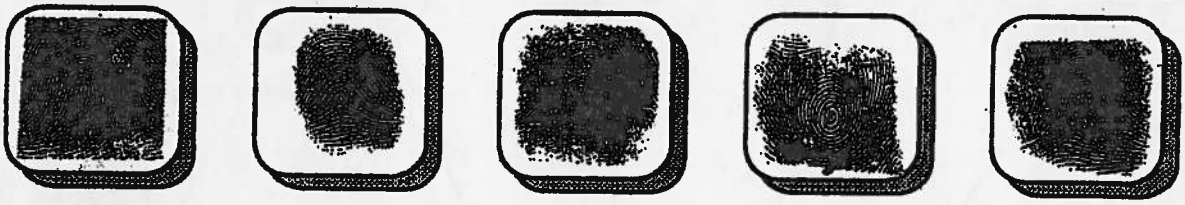


Suspects

Name _____

An Example →

Arch Loop Whorl

	Thumb	Forefinger	Middle finger	Ring finger	Little finger
President					
Secretary					
ce-President					
Accountant					
Janitor					

Name: _____

Date: _____

Master #13

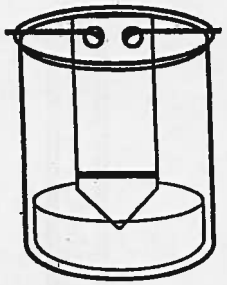
Making Tracks

	Sample #1	Sample #2
Location *(where the sample was found)*		
Tread width		
Number of grooves		
Width of grooves		
Tread pattern *(describe and draw a small part)*		
Worn areas		
Texture		

Name: _____

Date: _____

Master #14



Mystery Dye

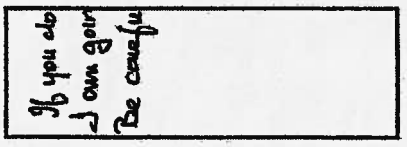
	Pen 1	Pen 2	Pen 3	Pen 4
Test Strip				
Observations:	_____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____

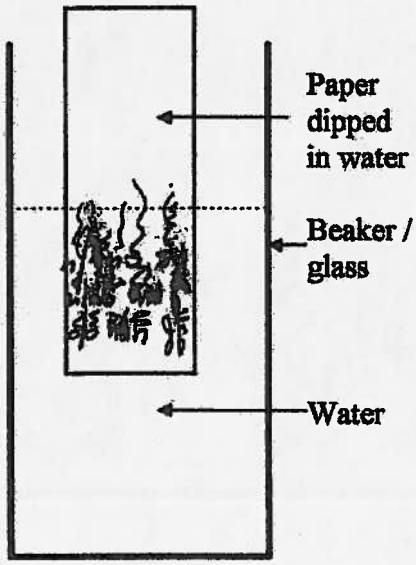
Handwriting Analysis.

Examining handwriting is also a technique used in investigating a crime scene. Another way to help find evidence is to examine ink dyes that are found in pens.
A method to look at ink dyes is as follows,

1. Use filter or tissue paper and make marks on the paper with a pen.
2. Put one end of the paper into a glass of water.
3. The water will rise up the paper and cause a particular pattern.
4. Allow this to dry.
5. You can repeat this with different types of pens and ink.
6. Note how each pattern is different.

Sample of paper with writing





Notice how the writing on the paper in the water has smudged .

Master #15

Name: _____

Date: _____

Fabric Forensics

Sample of Fabric:

Sample of Thread:

Description of the Fabric:

Texture: _____

_____

_____

Colour: _____

Weave: _____

_____

Unique Characteristics:

_____

_____

_____

Results of the *Teacher Demonstration:*

_____

_____

_____

Name: _____ **Master #16**

Date: _____

Mystery Writing

Standard phrases:

1. Today is Wednesday
2. Today is Wednesday
3. Today is Wednesday
4. Today is Wednesday
5. Today is Wednesday
6. Today is Wednesday

Note from crime scene:

I went to the market and did my shopping.

Observations:	Inferences:

Handwriting Characteristics

How each person learns to hold a pencil, form letters, and space words results in every person developing a unique style of handwriting. For this reason, handwriting analysis is a tool used by forensic scientists to detect forged documents.

The police often collect handwriting samples, or exemplars, when they believe forgery is involved in a case. A forensic document examiner is a handwriting expert. An examiner usually looks at the writing characteristics called traits. Traits include letter formation, size, and slant. The expert compares the key points of each trait found in the suspicious document to the exemplars.

Handwriting Traits

Forensic scientists analyze the key points of each handwriting trait when examining written documents. Some examples of handwriting traits and key points are illustrated in the table below.

TRAITS	KEY POINTS		
Baseline	Up crime scene	Down crime scene	Straight crime scene
Slant of Letters	Right handwriting	Left handwriting	Straight handwriting
Letter Size	Large letters	Medium letters	Small letters
Word Spacing	Close Together keypoints	Wide apart key points	Normal key points
Letter Formation "i"	Dots "i" i	Does Not Dot "i" i	Stylized "i" i
Letter formation "t"	Cross "t" t	Does Not Cross "t" t	Stylized "t" t t
Letter Formation "r"	Angle "r" to Point r	Flat-topped r	Stylized "r" r
Letter formation "e"	Looped "e" e	Not Looped "e" e	Stylized "e" e

Name: _____ Date: _____

Handwriting Lab
Skill-Building Activity

Purpose: identify the handwriting traits found in the different writing samples

Materials Needed: an assortment of ink pens

Procedure:

Step 1: Each team member selects a different writing pen. Using cursive writing, each member copies the sample sentence in the correct space provided on the table.

Step 2: Examine the handwriting samples with a magnifying glass. Use the information found on the Handwriting Characteristics page to identify the traits found in the different writing samples.

Every person has a unique style of handwriting.
Team Member #1
Team Member #2
Team Member #3
Team Member #4
Team Member #5

Conclusion (Identify at least two traits of each handwriting sample.)

_____

_____

_____

_____

Handwriting Samples

Directions: When giving handwriting samples, criminals often try to disguise their writing. Even so, their handwriting will contain many similar features. Examine the handwriting samples with a magnifying glass. Note the key points of each trait, such as letter formation, spacing, slant, and baseline.

Permission Note:

Kathy has my permission to go on the science field trip Mrs. Killby

Suspect #1: Kathy

Kathy has my permission to go on the science field trip. Mrs. Killby

Suspect #2: Jordan

Kathy has my permission to go on the science field trip. Mrs Killby

Suspect #3: Amber

Kathy has my permission to go on the science field trip. Mrs. Killby

Suspect #4: Chelsea

Kathy has my permission to go on the science field trip. Mrs. Killby

Suspect #5: Reilly

Kathy has my permission to go on the science field trip Mrs Killby

Name: _____ Date: _____

Handwriting Analysis Lab

Directions: Compare the permission note and each of the handwriting samples. Complete the table. Use the key point words located on the Handwriting Characteristics page to identify the traits found in the different writing samples.

Trait	Permission Note	Suspect #1: Kathy	Suspect #2: Jordan	Suspect #3: Amber	Suspect #4: Chelsea	Suspect #5: Reilly
Baseline						
Slant						
Size						
Spacing						
"l"						
"t"						
"r"						
"e"						

Whodunit?

Who is the prime suspect in the forgery case? Use evidence and details from the investigation to support your conclusion.

_____

_____

_____

_____

Master #17

Name: _____

Date: _____

Mystery Writing - Template

Standard phrases:

Note from crime scene:

Observations:	Inferences:
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Name: _____

Date: _____

Master #18

Soil Samples

Put a small sample of each soil on a piece of clear tape and place it in a box.

Sample #1	Sample #2

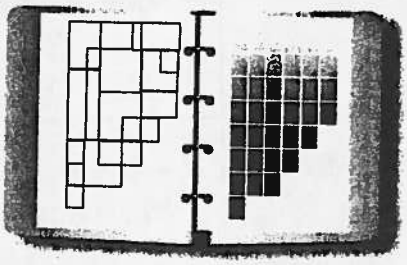
Observations of Soil Characteristics	
Sample #1	**Sample #2**

Soil Characteristics
Skill-Building Activity

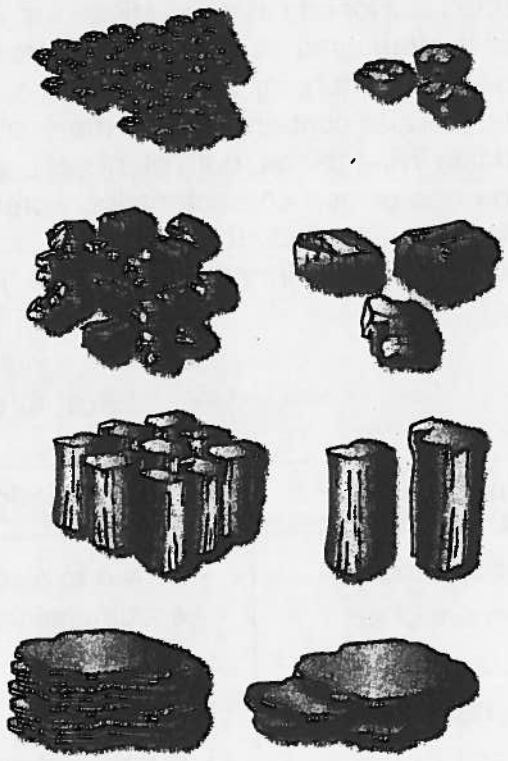
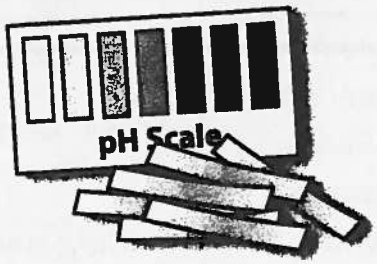
Almost anyone who is present at a crime can affect the scene by picking up or leaving soil evidence behind. Since the early 1930s, the Federal Bureau of Investigation (FBI) has collected and studied soil for criminal investigations. Soil collected at a crime scene is examined at crime labs and is often used as physical evidence during crime trials.

Soil is a mixture of nonliving things, such as sand grains, smaller rock particles, and minerals. Soil also contains organic material that comes from decaying dead plants and animals. It also holds living things, both plants and animals. There are many different types of soil, and each one has unique characteristics. Forensic scientists examine the physical and chemical properties of soil collected at the crime scene. The results of their investigation can provide detectives with the information needed to help solve the crime.

Soil Characteristics

Characteristic	Description	Examples
Color: depends on the amount of air, water, organic matter, and certain elements in the soil	• Brown to black: accumulation of organic matter, humus • Purplish-black: accumulation of manganese • Yellow to reddish: accumulation of iron • White to gray: accumulation of salt	Scientists use the Munsell color system when describing soil samples. 
Texture: determines how well water drains from a soil. Sands promote drainage better than clays.	• Sandy: feels rough • Silt: feels soft, silky, or floury • Clay: smooth when dry; sticky when wet	Rubbing soil samples between fingers can help identify the texture. 

Soil Characteristics (cont.)

Characteristic	Description	Examples
Structure: the arrangement of smaller soil particles: sand, silt, and clay to form larger pieces	• Granular: individual particles of sand, silt and clay grouped together in small, round grains • Blocky: soil particles cling together in block shapes • Prismatic: soil particles have formed into vertical pillars • Platy: soil particles form thin sheets piled horizontally on one another	
Chemical Condition: influences what grows and lives in the soil	• Soil is measured by pH values of 1–14: • pH of 7 is neutral • pH below 7 is acidic • pH above 7 is alkaline	Litmus paper is used to test the pH levels of soil. 

Master #19

Name: _____

Date: _____

Soil Comparison

Soil Sample #	Colour	Texture	Odour	Content	Particle Size	Particle Shape

Name: _____

Date: _____

Master #20

Design a Soil Test

Question: _____

_____

Hypothesis: _____

_____

_____

Materials: _____

_____

Procedure: _____

_____

_____

_____

Observations: _____

_____

_____

_____

_____

_____

Inference: _____

_____

_____

_____

New Questions: _____

_____

_____

_____

What I could do with what I learned (application): _____

_____

_____

_____

_____

_____

_____

_____

_____

Name: _____

Date: _____

Master #21

The Great Detective

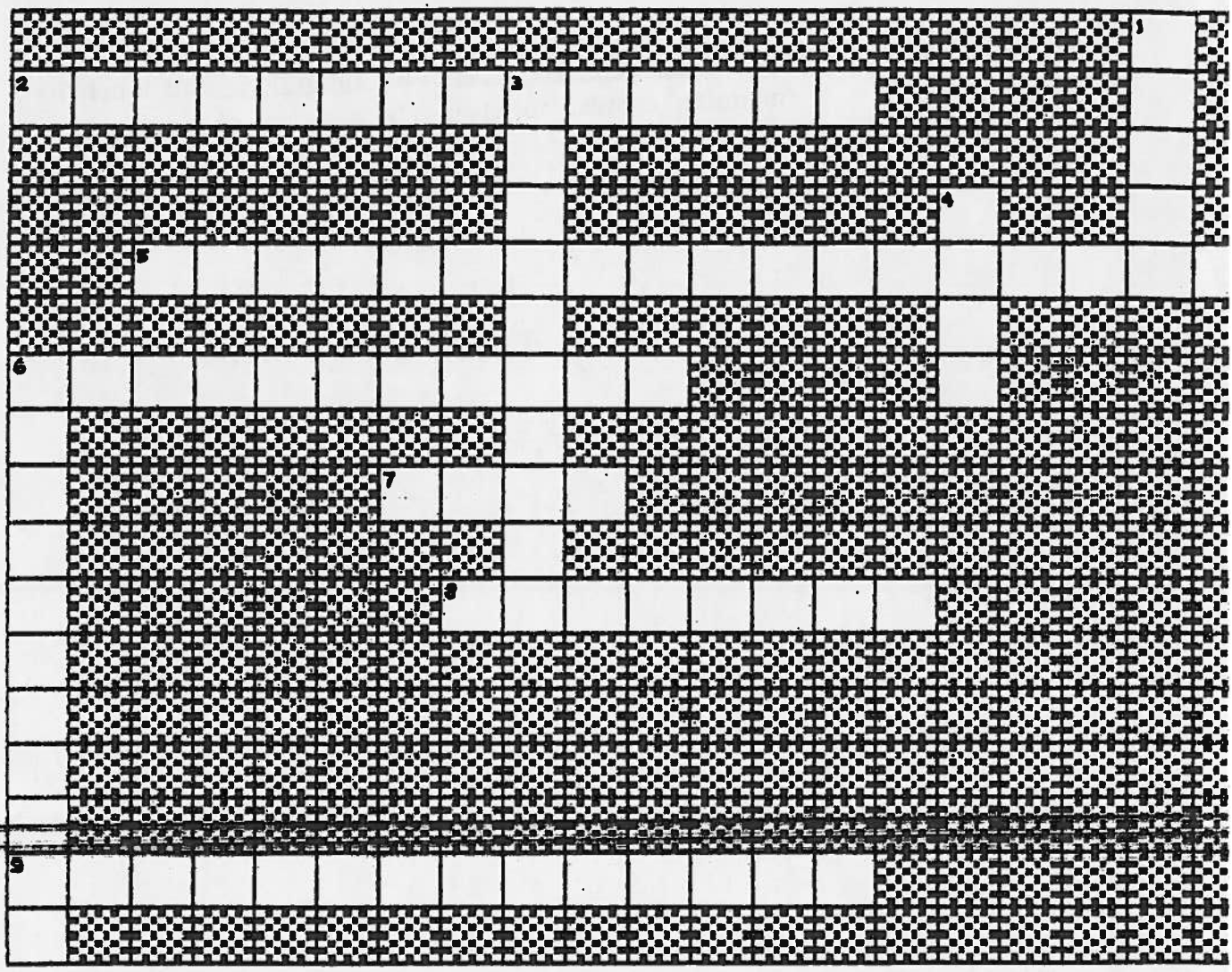
The Great Detective sat before a cozy fire reading a book about THE MANY WAYS THAT SPECIAL SCIENTISTS SOLVE CRIMES. It was great to be on a holiday, he thought. That last case had been difficult. The police had been watching one PERSON WHO SEEMED GUILTY while the real PERSON WHO HAD COMMITTED THE CRIME nearly got away. Fortunately, many SMALL SIGNS POINTING TO THE GUILTY PERSON were found. STUDYING THE LETTER SHAPES IN HANDWRITING on a note found at the crime scene provided some evidence. Eye-witness descriptions had help an artist draw a PICTURE OF THE CRIMINAL. A piece of CLOTH torn from a coat was found hanging from a barb of a wire fence nearby. With so many confusing clues, clearly the police needed the detective's help.

When the Great Detective was called onto the case he began by ASKING MANY QUESTIONS OF everyone who had been involved with the crime. He tried to find a REASON for the THING THAT HAS BEEN DONE.

He went to the scene of the crime. CAREFULLY USING HIS EYES produced more evidence. Now he knew what the REAL THING THAT HAD TO BE SOLVED was.

It was clear that some CAREFULLY DESIGNED SCIENTIFIC TESTS on the clues would be necessary. First the Great Detective asked the lab to study the note. They did AN

FORENSIC SCIENCE



ACROSS CLUES

2. A technique for separating mixtures
5. A list of print classifications for one hand (3 words)
6. A study of why people commit crimes and how crime can be prevented
7. Fingerprints that have lines that enter and exit on the same side of the print
8. The part of the microscope you look through
9. Distinguished from hair because it does not have the medulla or scale pattern (2 words)

DOWN CLUES

1. Fingerprints that have circl that do not exit on either s of the print
3. A study of handwriting patte
4. Fingerprints that have lines starting on one side, rising and exiting on the other sic
6. A person who uses science to analyze physical evidence in legal proceedings

/4 9. Draw a <u>scientific diagram</u> of a <u>human hair</u> and label the 3 parts (medulla, cortex, cuticle). Use a pencil and ruler.

/10 10. Complete the Crossword Puzzle attached.

/6 5. Identify the following fingerprints:

a._____ b._____ c._____

/5 6. What is your fingerprint formula?

_____, _____, _____, _____, _____

/2 7. What colour powder would you use to dust for fingerprints on a dark surface?

_____

/5 8. Why would a forensic scientist make a plaster cast of a tire track?

_____

_____

_____

_____

_____

/50

NAME: _____

DATE: _____

FORENSIC SCIENCE

/5 1. What is forensic science?

_____

_____

_____

_____

/5 2. List five (5) types of evidence a forensic scientist would try to collect from a crime scene:

a. _____

b. _____

c. _____

d. _____

e. _____

/5 3. Why are fingerprints used as a form of evidence?

_____

_____

_____

_____

_____

/3 4. What are the three (3) basic types of fingerprints?

a. _____

b. _____

c. _____

Due :

Crime and Investigation Review [redacted]

Answer all questions in complete sentences. Any answers that are not in complete sentences will receive a score of zero. Spelling, capitalization and punctuation, grammar and sentence structure will be scored.

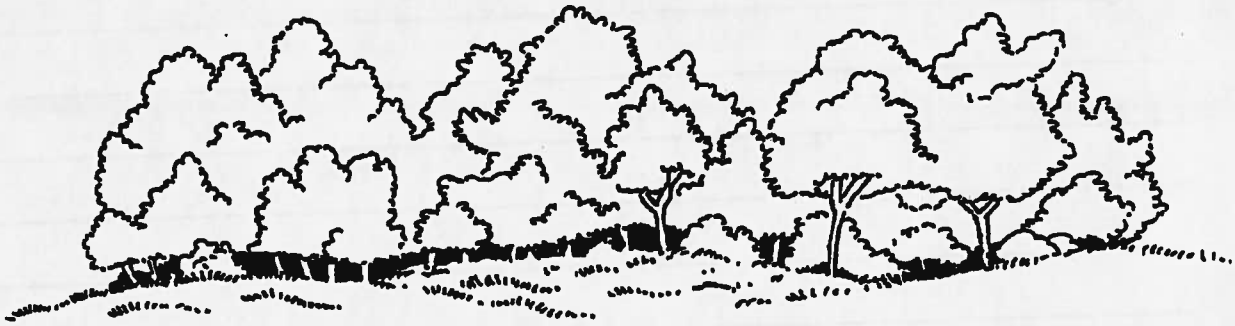
1. Why are fingerprints such a reliable means of identification?
2. When do ridges on fingerprints change?
3. List the five steps in collecting fingerprints.
4. State three facts related to how fingerprints are recorded.
5. How are visible fingerprints made?
6. How are latent fingerprints made?
7. What is the basic difference between visible and latent fingerprints?
8. How are fingerprints classified?
9. Tell how you would distinguish deltas from arches.
10. Tell how you would distinguish loops from whorls.
11. What are composite fingerprints.
12. How do detectives know when they have found a "match"?
13. Describe the four ridge characteristics looked for.
14. Which surfaces produce the best fingerprints for lifting?
15. Which surfaces produce the poorest fingerprints?
16. How do criminologists preserve tire tracks?
17. List six characteristics of plaster of Paris.
18. List four ways chemicals are used in criminology.
19. What is chromotography?
20. Describe how a spectrophotometer works.
21. Describe a gas chromatograph.
22. How can you test the amount of stretch of a fabric?
23. How can you determine colorfastness?
24. Describe how to test for absorbency.
25. How would you test threads?
26. What would you do to test wrinkling?
27. List ten safe lab procedures. (Remember to follow them at all times for safety!!)
28. List six codes.
29. What are the 13 handwriting analysis indicators?
30. What does soil color indicate?
31. How can you test for grittiness?
32. List some materials found in soil.

Task: **Clear As Mud**

Name: _____

Date: _____

Police have found a huge stash of stolen video tapes in the local woods. There are three suspects.



One useful clue might be the soil found in the woods. It is very unusual and found only in that area. You have a sample of the soil from the woods (A). Soil samples B, C and D have been taken from the tires of the three suspects' cars. You are a forensic scientist. You have completed a series of tests and collected the following data.

	Sample A	Sample B	Sample C	Sample D
Particle Size	fine	fine	coarse	fine
Observable Colour	reddish-brown	greyish-brown	reddish-grey	reddish-brown
pH	acidic	not acidic	acidic	acidic
Composition	leaves, twigs	leaves, twigs	leaves, twigs	leaves, sand

34

1. From this data, you infer that the most likely suspect is _____.

2. You have determined this because _____

_____

_____

_____

_____

3. What other tests could you do to confirm your suspicions? _____

_____

_____

_____

_____

_____

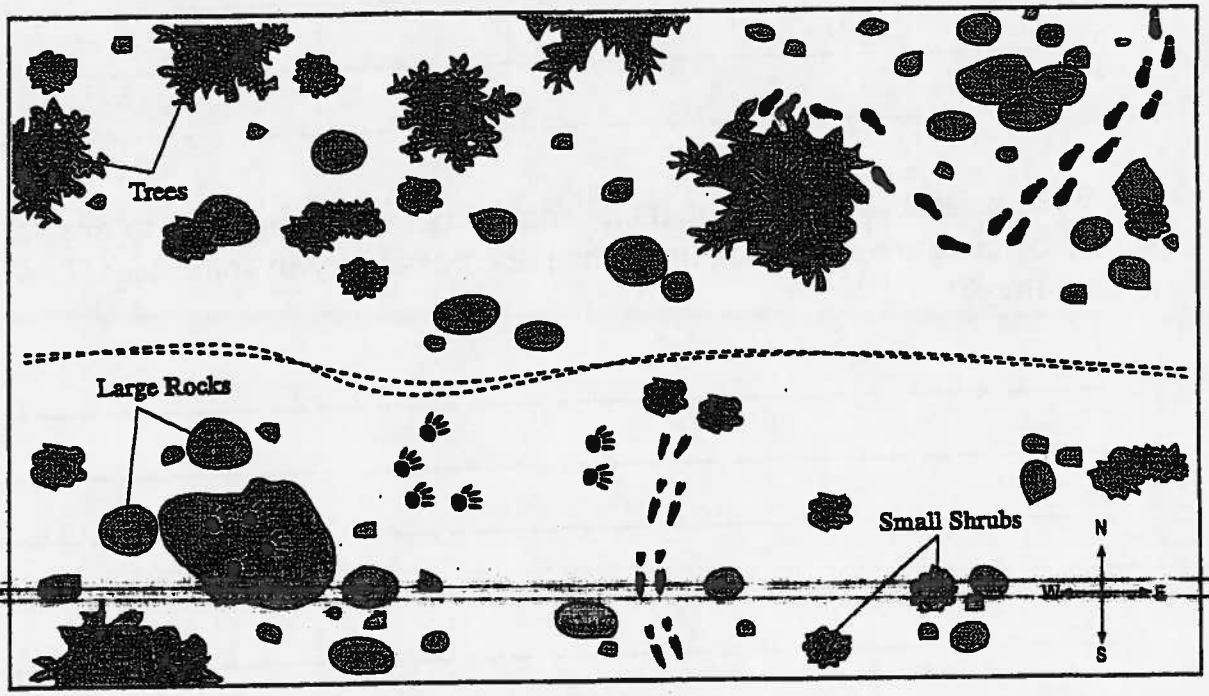
_____

35

Task: **A Forest Clearing**

Name: _____

Date: _____



Study the above diagram of a forest clearing.

1. What observations can you make about:

   a. the number and type of living creatures who left prints?

   _____

   _____

   _____

36

Investigation Report

Suspect Statements

People suspected of a crime are asked to give a statement. The statement often reveals the suspect's connection with the crime, where they were at the time of the crime, and a possible motive for committing the crime.

Alex: "I am a spray paint artist. I paint on poster board. My art is different than graffiti. Graffiti is painted on buildings, walls, or trains."

Callie: "I help my dad out on weekends at the paint store. I wasn't able to go on our class field trip because I had to work. I tried to get our sponsor to change the date so I could attend, but she told me it was impossible to make special arrangements for just one student."

Marcus: "I want to be a tattoo artist when I get out of school. I hang out at the Body Art Shop on weekends and pick up pointers on how to improve my designs. Everyone loves my artwork except my teachers."

Sabrina: "My dream is to become a famous artist and paint murals on buildings in New York. No one at this school appreciates my artwork. I was suspended for trying to brighten up those crummy old bathroom walls."

Investigator's Notes

A detective locates and questions witnesses about persons seen or believed to have been in the area at the time of the crime. Observations, descriptions, and identifications made by witnesses can be useful in solving a crime. Investigators evaluate a witness's information and compare it with the related data they have gathered.

Witness #1 Bus Driver: "Alex usually stops by Fridays after school to see if he can help clean the buses for some extra cash. We didn't need any help, so I sent him on his way."

Witness #2 Crime Stopper Volunteer: "Sunday night, I caught Callie in an alley near the school with a plastic grocery bag. I could see she had several cans of spray paint in the bag. I called her parents and waited with her until they arrived."

Witness #3 Store Clerk: "I sold Marcus's older brother several cans of spray paint Saturday night."

Witness #4 Student: "Sabrina was pretty upset about being suspended from school Friday. She told everyone that no one could stop a great artist, and she planned to get even."

Vandalism
Student Investigation

Crime Scene

Fairfield Police Department officers were called to the Hoover Middle School shortly after 6 A.M. on Tuesday. Someone had vandalized the school's fleet of buses. Officers found that 27 buses had been spray-painted, and windows had been broken in some of them. Officials said the perpetrator didn't sign his or her name, but had left behind the next best thing: partial shoe prints. Police found shoe prints in the sand and a glove on the ground nearby.

Although no other damage was done to the buses, the police said some ignition keys may be missing. The offenders focused primarily on property destruction. Officials reported a preliminary estimate of the damages to be hundreds of dollars. The police believe what may have started as a prank was now a felony offense (a crime which may be punishable by imprisonment). The police are focusing their investigation on Hoover Middle School students because they believe acts of vandalism are most commonly committed by youths between 12 and 14 years old.

School officials told the local newspaper that the act of vandalism was committed sometime before students and staff returned from the Memorial Day weekend. Principal Sands said that vandalism to school property in Fairfield was relatively rare. The vandals had caused enough damage to force Superintendent Dennis Mayberry to cancel school for the day. However, parents were notified that students would need to make up the missed day in the near future. He apologized for the inconvenience and asked anyone with information to call Crime Stoppers or the local police. Who is responsible for the vandalism?

Suspect Information

1. Alex is a seventh-grade student. He won second place at the art show for his spray paint mural.
2. Callie is an eighth-grade student and the student body president. She works at her father's paint store on weekends.
3. Marcus is an eighth-grade student. He is often sent to the principal's office for drawing detailed pen art on his and other student's arms.
4. Sabrina is a sixth-grade student. She was recently suspended from school for drawing on the bathroom walls.

Investigation Directions

Vandalism plagues almost every community in the country. It presents special challenges for law enforcement and takes a variety of forms: broken windows, graffiti, and destruction of property.

Step 1: Read the Investigation Report page.
Step 2: Complete the Shoe Print Analysis Lab page.
Step 3: Use the evidence from your investigation to identify the prime suspect.

Science Vocabulary

classify: to use a system to group information into categories

conclusion: a summary of the results of the experimentation and a statement of how the results relate to the hypothesis

data: a group of measurements, facts, or statistics

data analysis: to organize and examine collected data using narratives, charts, graphs, or tables

experiment: the steps used to test a hypothesis

examine: to look closely at somebody or something

hypothesis: an idea about the solution to a problem that can be tested or investigated

identify: to name or recognize a person, place, or thing

laboratory: a place used for conducting scientific experiments

measure: a system of assigning numbers to an observation

observation: to use the senses to gather information about an object or event

predict: a forecast of future events based on previous observations and experiments

research: the method of collecting information and data about a topic being studied

science: the study of the natural world

scientific method: a series of steps scientists use to solve a problem

Name: _____ Date: _____

Science Word Search

Find and circle the words from the list below in the word search. Words may be printed horizontally, vertically, diagonally, forward, and backward.

A	N	A	L	Y	S	I	S	C	F	D	H	B	R	Y
H	C	R	A	E	S	E	R	O	Z	N	A	Z	E	R
S	W	R	J	U	F	B	X	N	J	G	D	T	E	O
I	F	M	B	V	B	B	T	C	H	P	T	X	A	T
S	S	C	I	E	N	C	E	L	L	E	P	D	Y	A
P	C	R	I	B	I	D	G	U	K	E	C	Q	M	R
Y	B	I	D	D	A	O	H	S	R	Q	U	A	Y	O
O	B	S	E	R	V	A	T	I	O	N	Q	F	E	B
T	I	R	N	N	Z	E	M	O	I	V	I	U	R	A
V	P	I	T	S	T	E	N	N	V	S	U	L	U	L
J	Y	I	I	J	N	I	K	I	S	P	E	N	S	D
G	D	I	F	T	S	Q	F	A	M	V	W	Q	A	R
S	L	J	Y	D	N	U	L	I	L	A	W	S	E	F
M	F	L	B	W	N	C	O	S	C	D	X	G	M	Y
S	I	S	E	H	T	O	P	Y	H	I	H	E	W	A

ANALYSIS
DATA
HYPOTHESIS
MEASURE
RESEARCH

CLASSIFY
EXAMINE
IDENTIFY
OBSERVATION
SCIENCE

CONCLUSION
EXPERIMENT
LABORATORY
PREDICT
SCIENTIFIC