

Evidence and Investigation Unit Study Guide

Review the following concepts:

- know the difference between observation and inference
 - observe = examining something carefully (using all your senses)
 - infer = interpret or explain what is observed
- recognize evidence of recent human activity
 - look closely at a crime scene to determine what likely happened
- recognize evidence of animal activity
 - look closely at a scene to determine what likely happened
- observe a set of footprints (infer direction and speed of travel)
 - length of stride (shorter = walking, longer = running)
 - description of imprint (clear and shallow = walking, may only see parts and deeper = running)
 - determine the sequence in which tracks are made

Be able to analyze information from charts:

- classify tire prints, soil samples
 - match a partial print of a tire to a sample
 - match shoe print to the original
 - use a classification chart to infer the location of where soil was found
- analyze ink (chromatography)
 - pen tips (fine, medium, thick)
 - whether ink bleeds (yes = water soluble, no = permanent)
 - color separation (what colors did the ink separate into)
- analyze handwriting samples
 - hint: look for letters that are unique in the sample
 - forgery = altering a document (forge/fake a signature)
- compare samples of fabric
 - colorfast = fabric will retain its original color è flammability = how it burns (melts, burns to a residue)
 - absorbency = ability to take up water è weave = how threads are interlaced (tight, loose, etc.)
 - texture = smooth, rough, etc. è knows the steps in performing a chromatography test
- classify fingerprints
 - loop, arch, whorl, composite

Fingerprints and Footprints

4 types of prints:

Whorl, Arch, Loop, Composite – See notes, Key Book, or Science Links for pictures

Are all fingerprints different?

Fingerprints are the most reliable system of identification used today. Height, weight, hair colour, and appearance change over time. Fingerprints remain constant over a person's lifetime.

Every person in the world has a unique set of fingerprints, all fingerprints can be classified as one of three basic patterns. The basic patterns are: loop, whorl, arch.

Are the prints of every finger the same?

Every finger has a different print, and usually even a different pattern of print. The more prints that can be obtained, the more conclusive the identification can be.

Positive identification of a print

The actual positive identification of a fingerprint involves the comparison of tiny ridge characteristics. These characteristics are contained within the ridges of a fingerprint. There are 4 different types of characteristics:

ridge endings -- where a ridge abruptly ends

bifurcations -- where a single ridge splits into two or more ridges

lakes -- where a ridge bifurcates, then almost immediately reforms back to a single ridge. The resulting characteristic appears to be a lake

islands -- a very short ridge or ridge dot



Other type of 'prints'

Fingerprint experts can make positive identification from the *palms of the hands* and the *soles of the feet* .

Most hospitals take footprints of newborn babies to make certain the infants are given to the right mothers.

Lip prints , found on drinking glasses or cups can be used as trace evidence as *we all have a distinct lip pattern too !*

Did you ever hear of such a thing??? In England, there was almost a case of an individual being charged and convicted of numerous apartment break-ins based on trace evidence from his 'ear print' being left behind on apartment doors. The thief would put his ear up to the apartment door and 'listen' to see if anyone was home before breaking in. All the police ever found for evidence on these random break-ins, was this "interesting ear print" on the door, rather than fingerprints because he wore gloves! However, one day someone caught the perpetrator breaking in, and through some deductive and logical research, investigators linked this thief's 'ear print' to many other break ins! The thief confessed prior to the 'ear evidence' being brought to court!

Where do fingerprints come from?

- What causes a fingerprint to be left behind? Basically, sweat from the pores of the skin on the ridges, or the 'lines' we see as a print. In order to live, you have to perspire. When you're nervous, you perspire more, leaving more sweat, or skin oil on a surface, with the dirt that is attached to it, thus, leaving a print.

What to use them for?

- Fingerprints can be used to: convict criminals, identify cadavers (as in plane crashes), people who have lost their memory, and prove the innocence of convicted persons.

Why not cut them off?

- Some criminals try to file or cut off their fingertips and even burn them with acid to change or obliterate their fingerprints. Interestingly enough, fingerprints grow back, and often, enough characteristics remain (after damage) for identification.
- Did you know that fingerprints are developed before birth and remain the same until decomposition after death!
- Fingerprints penetrate through 5 layers of skin and are therefore nearly impossible to obliterate! * Removing one's fingerprints requires surgically removing the fingertip and replacing it with skin grafted from another part of the body. Even after this complicated surgery, the ridges on the side of the finger can often still be seen.

* Think of the combinations that can exist for fingerprints (arch, loop, whorl)
 $3 \times 3 \times 3 \times 3 \times 3 = 3^5$ or 243 (arch, loop, whorl, composite) $4 \times 4 \times 4 \times 4 \times 4 = 4^5$ or 1,024 possible fingerprint-formula combinations.

* Every individual has a unique set of fingerprints – even identical twins!

What can we tell from FOOTPRINTS?

- A footprint can tell us more than the type of a shoe a person was wearing at the time the footprint was made.
- Animals leave behind their own unique footprint, you often see it in movies or cartoons where an animal is 'followed' based on their tracks.
- The size of the print allows investigators to estimate the height and gender of a person. The depth of the print gives information about the person's weight. The distance between prints gives information about how fast the person was walking or running. The amount of erosion of the print can even give us information about when it was made.

See Footprint activities at end.

Cars leave "footprints" too!

- Tire prints can give us as much information about a car as footprints give us about people. Each tire has a different tread, and different cars have different types of tires. The type, weight, speed, age, and direction of a car can often be determined from a tire print.

The difference between an Observation and an Inference

Observation:

- The facts
- What you see, where it is, how big is it, etc.
- It's like a picture, there is no disputing it
 - ~ e.g. Mr. W is a man, he has blue eyes
 - ~ e.g. Mr. W is 187 cm tall
 - ~ e.g. today, Mr. W is wearing ...
 - ~ e.g. today, Mr. W rode his bike to school

Inference:

- A guess as to what happened based on the information (Does NOT necessarily have to be true)
- To come to a conclusion based on reasoning
- An educated guess based on the facts/clues

~ e.g. your teacher is married, because he is wearing a ring on his left hand on his ring finger --this may not be true, but is a logical inference for the observation
~ e.g. Mr. W is smart, he took 7 years of university ... is this true? Maybe he failed the first 3 years or it took him 7 years to complete a 3 year degree
~ e.g. Mr. W is healthy, he rode his bike to school -- is this true? Maybe I'm overweight, or have a heart condition and I HAVE to ride my bike, or maybe I have no money to afford a car so I have no choice but to ride a bike to work
~ e.g. Mr. W is smart, he's wearing glasses ... Is this true? Are you basing it on a stereotype because all smart people wear glasses? Or does he just have bad eyes and can't see -- but what can't he see, far, or close up?
~ e.g. Mr. W got into a fight and got slashed by a glass bottle and that's how he got his scars under his jaw line (Is it necessarily true, Mr. W got the scar from the fight?)

Graphology

- The study of handwriting analysis
- Look for the patterns or style of writing, just think we as teachers often do this daily, we know who handed in something without a name based on the child's handwriting.

Ink & Fabric Identification

How can we identify different types of ink?

- Inks are made of different combinations of chemicals and dyes. Each of these chemicals has its own molecular weight.
- In *paper chromatography*, the molecules that make up inks are dissolved in a suitable solvent. They are then drawn up through absorbent paper. The lighter the weight of the molecules, the farther they will travel through the paper. The result will be a pattern on the paper that is unique to that particular ink, called a *chromatogram*.

Chromatography

- A technique for *separating mixtures of chemicals*
- Used in crime labs to separate components of 'clue' substances as blood, ink or other mixtures found at the scene of a crime
- Allow detectives to tell if objects with coloured dye in them (pens, foodstuffs) were made by the same manufacturer

Useful definitions when dealing with chromatography

Pigment - a colouring matter

Solvent - a substance, usually a liquid that can dissolve other substances (e.g. water, vinegar, rubbing alcohol)

Capillary Action

~ an attraction between liquid and solid matter

~ a force that raises the part of the surface of a liquid that is in contact with a solid

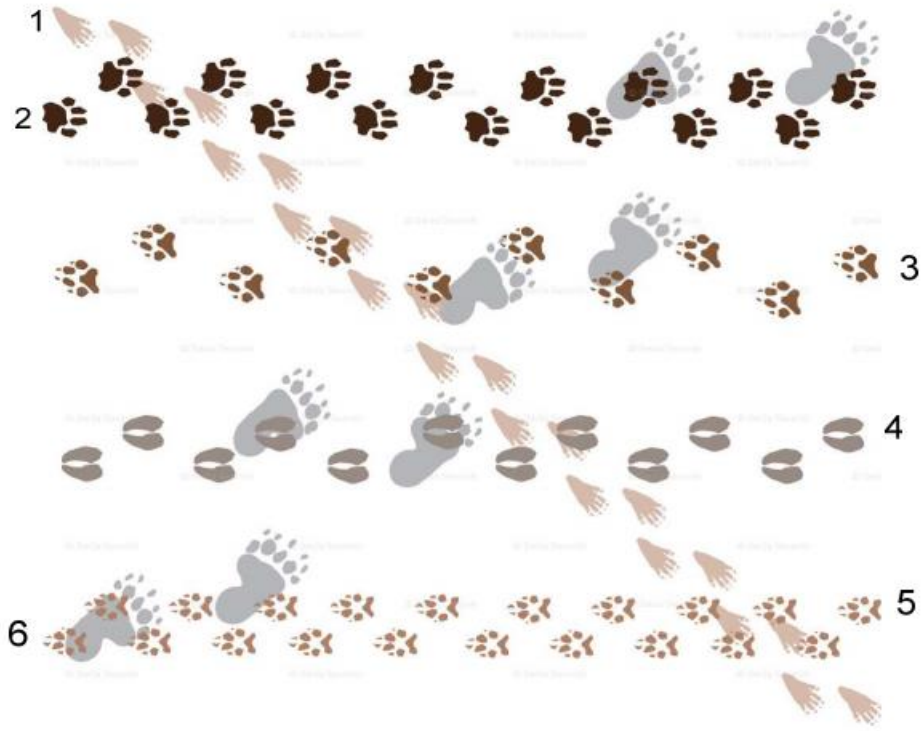
~ the ability of a porous/sponge-like substance to soak up a liquid

Comparing FABRICS at a 'crime' scene

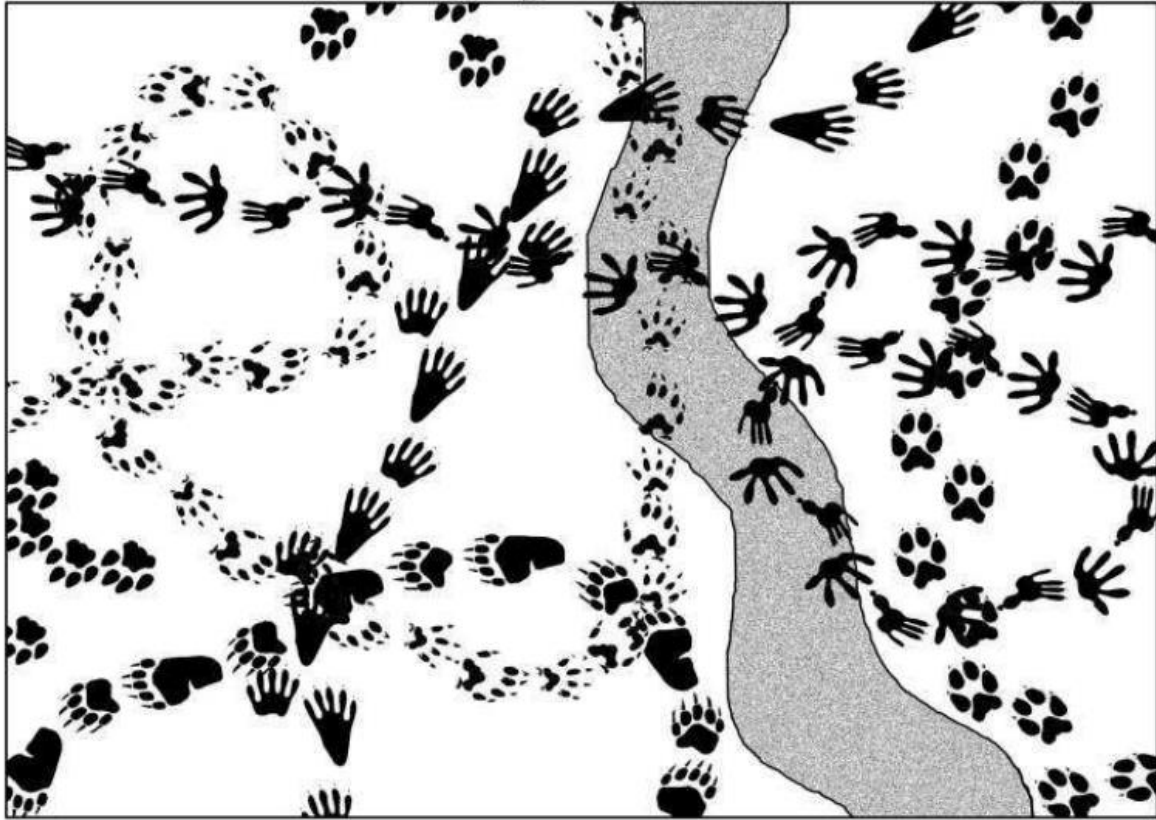
- Fabrics are made of woven fibers. We can compare fabrics by studying the *size of the fibers* and the *type of weave*. Fabrics can also be identified this way.
- The woven fibers of fabrics tend to trap particles within them. Hair, dirty, and blood trapped within the fibers can be seen clearly with a microscope. Clues found in fabrics are invaluable to criminologists.
- Clothing manufactures keep photographic records of the different fibres they use. These are used by detectives to match fibre samples to suspects' clothing!
- Using a microscope, a detective may determine the way that a rope was cut whether by scissors or frayed on a sharp edge.

Footprints!

Which prints came first? Last? How can we tell?



Making Tracks!



Animal footprints, called tracks, can tell stories to a careful observer. Using the guide below, see if you are able to read the story these woodland animal tracks tell!



Bobcat



Raccoon



Groundhog



Opossum



Skunk



Red Fox

Who crossed the stream? _____ and _____.

There are _____ raccoon footprints.

Which other animal tracks do the groundhog tracks encounter? _____, _____, and _____.

Do you think the bobcat was walking, running, or leaping? (Watch a housecat for some clues!)