

Key - Study Guide - Unit 2 - Hair, Fibers, Documents, Glass & Soil Evidence

1. a. hair without a follicular tag - class
- b. hair with a follicular tag - individual
- c. fibers - class
- d. glass - class unless it can be pieced together like a puzzle, then it's individual
- e. soil - class
- f. handwritten ransom note - individual
- g. typed check - class

2. Hairs most characteristic forensic feature is **its color, length, & curliness.**

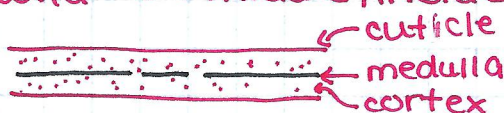
3. Hair is made of **keratin**

4. The 3 parts of a hair are

(1) the cuticle - outside covering

(2) the cortex - inside the cuticle & contains pigment granules

(3) the medulla - the middle, inside the cortex.



5. The medullary index measures the ratio of the diameter of the medulla to the diameter of the hair shaft

$$\text{medullary index} = \frac{\text{diameter of medulla}}{\text{diameter of hair shaft}}$$



animal medullary index = .5 or greater b/c they have really thick medullas

human medullary index = .33 or less b/c humans have thin medullas

6. 5 human medulla patterns

(1) continuous

(2) interrupted

(3) fragmented



(4) solid

(5) none



7. 3 types of hair cuticles

(1) spinous

(2) coronal

(3) imbricate *



* humans only have imbricate hair cuticles!

8. The main purpose for examining a hair at a crime scene is to establish if it is human or animal hair

9. A hair that has been bleached or dyed shows a uniform (smooth & consistent) color, similar to tinted glass. Natural hair usually contains granules with a texture similar to a picture colored by crayon.

10. If a hair contains a follicular tag, it was most likely pulled out forcibly. If the follicular tag is absent, it most likely fell out naturally.

11. DNA found in a hair shaft is mitochondrial DNA, which a person only receives from their mother. It is not usually enough to determine identity. Recent developments have made it possible to determine i.d. from mitochondrial DNA, but it is time consuming and very expensive.

12. 3 phases of hair growth

(1) Anagen - active growth stage, lasts 2-6 years *

(2) Catagen - transition stages, lasts 1-2 weeks

(3) Telogen - resting phase, hair falls out, lasts 5-6 weeks

* A criminalist will most likely find DNA from hair pulled out forcibly during the anagen phase because it is more likely to contain a follicular tag.

13. standard/reference hair - hair whose origin is known (i.e. victim, suspect). Questioned hair & standard/reference hair must come from the same area of the body (head, arm, pubic area) because hair is different in each of these areas

14. natural fibers come from animals, plants, & minerals.
synthetic fibers are man-made and are regenerated fibers and polymers.

Natural fiber examples

Animal - made of proteins

- wool, cashmere, angora, silk, fur

Plant - comes from seeds, fruits, stems, & leaves - made of cellulose

16. → -seed-cotton

- fruit - coir (coconuts)
- stem - flax, jute, hemp
- leaf - manila (banana), sisal

mineral - fiberglass, asbestos

Synthetic fiber examples

Regenerated fiber - derived from cellulose

- rayon, celanese

Polymers - derived from petroleum products

- polyester, nylon, acrylic, olefin

15. Difference between natural and synthetic fibers
synthetic fibers are stronger than natural fibers, are not damaged by microorganisms, are cheaper, can deteriorate in bright sunlight and melt at lower temperatures, and have regular diameters under magnification.

17. Tests used to identify fibers

18. ↗
- (1) observe color & diameter of hair with and without a microscope
 - pros: color & diameter matching, non-damaging
 - cons: doesn't identify type of fiber
 - (2) microspectrophotometer - looking at fiber under a microscope while using a beam of light to obtain the fiber's absorption spectrum
 - pros: allows comparison of colors of fibers, non-damaging
 - (3) chemical composition tests
 - (A) burn test
 - pros - identify type of fiber
 - cons - destroys the fiber evidence
 - (B) chemical tests
 - pros - identify type of fiber
 - cons - destroys the fiber evidence

19. A questioned document is any signature, handwriting, typewriting, printed document, or other written work whose source or authenticity is in dispute or uncertain.

20. An exemplar is a sample of handwriting or a document with a known source or author. It is used to compare with a questioned document.

21. Forgery is a document made with the intent to deceive. An example is forged employment records or other legal agreements.

Fraudulence is forgery done for material gain. An example is a forged check or a will.

22. 12 characteristics of handwriting

- (1) Line quality - do the letters flow or are they erratic & shaky?
- (2) Spacing - are the letters equally spaced or crowded?
- (3) Size consistency - is the ratio of height to width consistent?
- (4) Continuous - is the writing continuous or does the writer lift the pen?
- (5) Connecting Letters - are capitals and lowercase letters connected and continuous?
- (6) Letters Complete - are the letters completely formed? Is part of the letter missing?
- (7) Cursive & Printed Letters - are there printed letters, cursive letters, or both?
- (8) Pen Pressure - is equal pressure applied to upward and downward strokes?
- (9) Slant - left, right, vertical, or variable?
- (10) Line Habits - is the text on the line, above or below the line?
- (11) Fancy Curls or Loops - are there fancy curls?
- (12) Diacritics (Placement of dots on i's & crosses on t's) - correct or misplaced? Are t's crossed in the middle, toward the top or the bottom? Are the i's dotted, dotted toward the right, left, or centered?

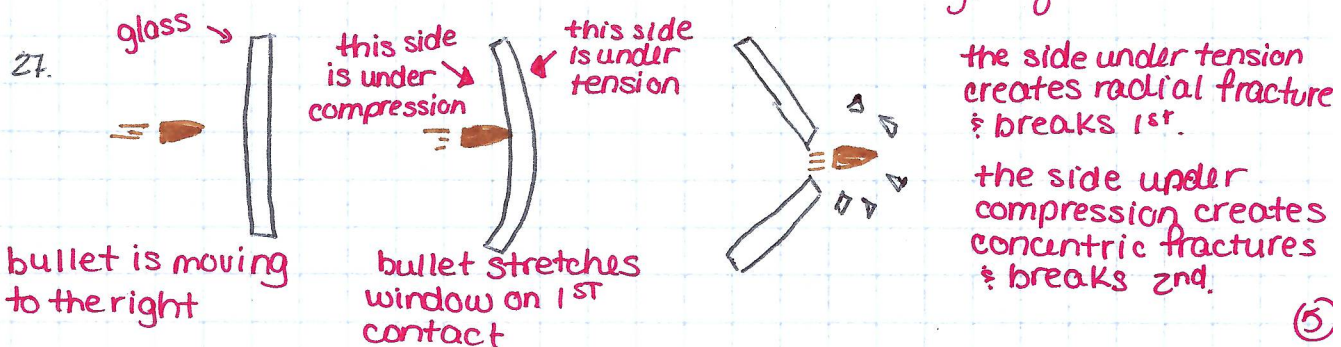
23. Forged documents are chemically treated (sometimes) to make them appear older.

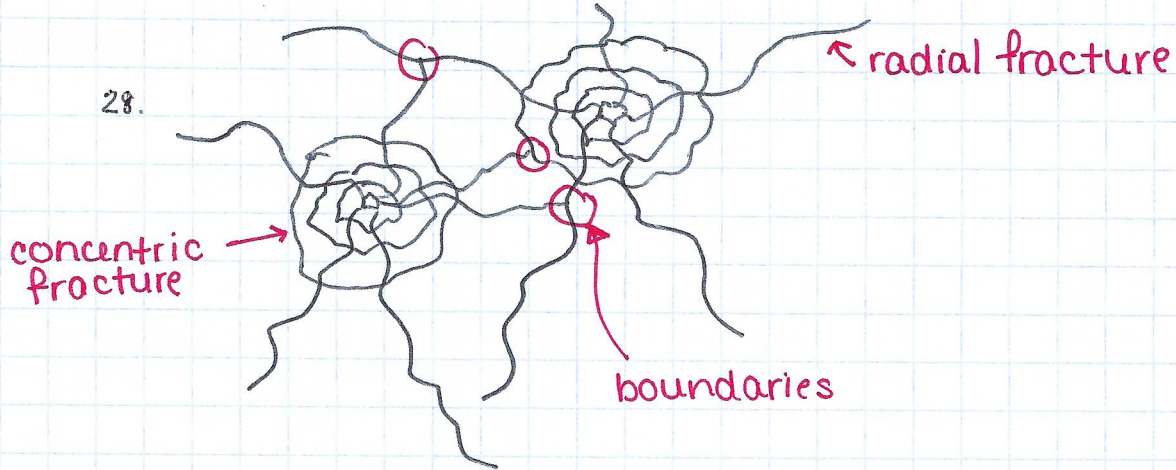
24. Security Features on U.S. Currency

- 26.
- (1) Feel of the bill - you can feel the raised ink on the bill, also it is made of 75% cotton and 25% linen
 - (2) Portrait - stands out from the background & appears raised off the paper
 - (3) Microprinting - on security threads and around the portrait
 - (4) Serial Number - evenly spaced and the same color as the Treasury seal
 - (5) Check letter & Quadrant Number
 - (6) Federal Reserve Seal - does not have sharp points
 - (7) Treasury Seal - has sharp points
 - (8) Clear blue & red silk fibers woven through the bill.
 - (9) Vertical Security strip
 - (10) Federal Reserve Number & Letter
 - (11) Series
 - (12) Check Letter & Face Plate Number
 - (13) Watermark
 - (14) Color shifting ink - from green to copper
 - (15) Distinct background details & lines
 - (16) Distinct border edge

See the \$20 pdf for visuals on a \$20 bill.

- ## 25. Counterfeiting pens have an iodine solution in them. Iodine reacts with cellulose in regular paper and turns a dark purple-black color. Most counterfeit bills are made with paper. Real currency is made of a cotton/linen blend, which has no cellulose and iodine will remain a light yellow/brown.





29. Refraction is the bending of light as it moves from one substance to another.

$$\text{refractive index} = \frac{\text{speed of light in a vacuum}}{\text{speed of light in a given substance}}$$

- In forensics, a criminalist will use the refractive index to identify a type of glass. Different types have different refractive indices.
31. In the immersion/submersion test, a piece of glass is dipped into different liquids that have the same or nearly the same refractive indices as the different types of glass. If the glass seems to disappear completely, then the glass has the same refractive index as the liquid. If it almost disappears, then it's close. You can use the refractive index of the liquid to match to the refractive index to the types of glass.
30. Becke lines are white lines that outline a piece of glass during the immersion/submersion test. If the white outline appears inside the glass, the glass has a higher refractive index than the liquid. If the white outline appears outside the glass, the glass has a lower refractive index than the liquid.
32. Plain glass is called 'soda-lime glass'. Tempered glass is soda-lime glass that has been tempered or repeatedly and quickly heated and cooled down to strengthen the glass. Plain glass tends to fracture into large sharp pieces while tempered glass fractures into small, non-sharp pieces. Glass properties can also be changed by adding other chemicals to them or bonding a piece of plastic between 2 pieces of glass - laminated glass.

33. Common ways to differentiate soils are by color, texture, mineral content, and density. Color is the most important factor!
↑ and pH too!

34. Soil tests:

(1) macroscopic - looking at color & larger items in soil

(2) microscopic - to identify minerals in soil

(3) pH - to determine if soil is acidic, basic, or neutral

(4) density - to determine & compare densities of different materials in the soil.

35. Soil consists of minerals, decaying plants and organisms, water, and air.

Different layers of soil

(1) O horizon - called humus - loose topsoil

(2) A horizon - minerals mixed w/ humus, dark } topsoil

(3) E horizon - light in color, sand & silt

(4) B horizon - subsoil, accumulation of clay

(5) C horizon - has partially broken up rocks, very little humus

(6) R horizon - solid rock layer