

Sleuthlab — Activity Book

A Spark & Anvil activity book — puzzles, questions, and fun from Sleuthlab.

Write in the book, circle your answers, and check the Answer Key at the back.

1. Introduction to Forensic Science

Circle the correct answer

1. What is the primary goal of a forensic scientist?

(A) To write laws about criminal behavior (B) To question witnesses about what happened (C) To analyze physical evidence using scientific methods (D) To arrest suspects at crime scenes

2. Which of the following is a common workplace for a forensic scientist?

(A) A crime laboratory (B) A police patrol car (C) A news station (D) A courtroom judge's chamber

3. What does the word 'forensic' mean?

(A) Relating to medical treatment of injuries (B) Relating to the use of science in legal matters (C) Relating to computer programming (D) Relating to police investigations only

4. A forensic scientist examines a fiber found on a windowsill. What is the scientist most likely trying to determine?

(A) How much the fiber weighs (B) How old the building is (C) What color paint to use on the windowsill (D) Where the fiber came from and whether it connects to a person or object

5. Why do forensic scientists document everything they do during an analysis?

(A) Because the equipment requires written instructions to operate (B) So their work can be reviewed and repeated by other scientists (C) Because they enjoy writing detailed reports (D) So they can sell their notes to newspapers

6. What is physical evidence?

(A) Photographs taken by journalists (B) Tangible objects or materials that can be collected and examined (C) Statements made by witnesses (D) Opinions expressed by detectives

Write the answer

7. Which of the following is an example of testimonial evidence rather than physical evidence?

Answer: _____

8. A detective finds a red thread on a fence near where a backpack went missing from school. What type of evidence is this thread?

Answer: _____

9. How does direct evidence differ from circumstantial evidence?

Answer: _____

10. A forensic team collects a glass fragment, a witness statement, a security camera video, and a shoe impression. If you were organizing these by evidence type, which two would be classified as physical evidence?

Answer: _____

Match each question to its answer

1. What is the FIRST thing investigators should do when arriving at a scene? →

2. Why do forensic investigators wear gloves, masks, and protective suits at a scene?

→

3. What is the purpose of taking photographs at a crime scene before collecting any evidence? →

4. An investigator is deciding the best order to collect evidence. They see a footprint in snow, a metal tool on concrete, and a fiber on a railing. Which evidence should be collected FIRST? →

5. If two investigators accidentally switch their evidence collection bags, what problem does this create? →

(A) To create a permanent record of where everything was originally located

(B) The footprint in snow because it could melt and disappear

(C) To prevent their own DNA and materials from contaminating the evidence

(D) Secure the scene to prevent contamination

(E) The chain of custody is broken, and the evidence may not be trusted

2. Fingerprint Analysis

Circle the correct answer

11. What are the three main fingerprint pattern types?

(A) Loops, whorls, and arches (B) Circles, squares, and triangles (C) Spirals, zigzags, and waves (D) Lines, dots, and curves

- 12.** Which fingerprint pattern is the most common among people?
(A) Arches (B) All three patterns occur equally (C) Whorls (D) Loops
- 13.** A fingerprint has ridges that enter from the right side, curve upward, and then exit from the right side. What pattern type is this?
(A) A whorl (B) A tented arch (C) A loop (D) An arch
- 14.** How do whorls differ from loops in their ridge pattern?
(A) Whorls have circular or spiral ridges that form a complete circuit, while loops curve and exit on the same side (B) There is no difference — they are the same pattern (C) Whorls are larger than loops (D) Whorls only appear on thumbs while loops appear on all fingers
- 15.** An investigator examines five fingerprints and finds 3 loops, 1 whorl, and 1 arch. Is this distribution consistent with what scientists know about fingerprint pattern frequency? Explain your reasoning.
(A) No — there should be equal numbers of each pattern type (B) Yes — but only because there are exactly five fingerprints (C) No — arches should be more common than whorls (D) Yes — this roughly matches expected frequencies since loops are most common, followed by whorls, then arches
- 16.** What is fingerprint powder used for?
(A) To identify the blood type of the person who left the print (B) To measure the age of a fingerprint (C) To permanently erase fingerprints from a surface (D) To make invisible latent fingerprints visible on surfaces

Write the answer

- 17.** Why do forensic technicians use different colored powders — such as black powder on light surfaces and white powder on dark surfaces?
Answer: _____
- 18.** After making a latent fingerprint visible with powder, a technician places clear tape over it and lifts it onto a card. Why is this technique effective?
Answer: _____
- 19.** Superglue fuming is used to develop fingerprints on certain surfaces. How does this method work?
Answer: _____
- 20.** A forensic technician must collect fingerprints from a textured ceramic coffee mug. Evaluate whether standard fingerprint powder or superglue fuming would be a better choice for this surface.
Answer: _____

Match each question to its answer

1. What are minutiae in fingerprint analysis? →
2. Why do fingerprint examiners compare minutiae points rather than just the overall pattern type? →
3. A fingerprint examiner finds 12 matching minutiae points between a crime scene print and a suspect's known print. What is the significance of this finding? →
4. An examiner is comparing a partial fingerprint from a scene to a suspect's full fingerprint. Why might this comparison be more challenging than comparing two complete prints? →
5. Evaluate whether a fingerprint identification system that only compares pattern type (loop, whorl, or arch) without examining minutiae would be reliable for identifying individuals. →

(A) Specific ridge features like endings, bifurcations, and dots used to compare prints

(B) Because many people share the same pattern type, but the specific arrangement of minutiae is unique

(C) A high number of matching minutiae points in the same relative positions strongly supports that the prints came from the same person

(D) The partial print contains fewer minutiae points, giving the examiner less information to work with

(E) It would be unreliable because pattern types are shared by millions of people and lack the specificity needed for individual identification

3. Trace Evidence

Circle the correct answer

21. What is the medulla of a hair?

(A) The root bulb at the base of the hair (B) The innermost central core channel running through the hair shaft (C) The outer protective layer of the hair (D) The colored pigment in hair

22. How can a forensic scientist distinguish between human hair and animal hair under a microscope?

(A) By testing whether the hair dissolves in water (B) By measuring the exact length of the hair (C) By checking if the hair is straight or curly (D) By examining the medulla pattern, scale pattern of the cuticle, and the ratio of medulla width to hair width

23. A hair sample found at a scene has a root attached with tissue. Why is this

potentially more valuable than a hair without a root?

(A) Only hair with roots can be classified as human or animal (B) A root with tissue may contain nuclear DNA that can identify a specific individual (C) Hair without roots cannot be seen under a microscope (D) Hair roots are more colorful and easier to photograph

24. Analyze the limitations of using hair color alone to identify a suspect.

(A) Hair color can be artificially changed through dyeing and varies naturally with age, sun exposure, and between individual hairs on the same head (B) There are no limitations — every person has a completely unique hair color (C) Hair color is the most reliable way to identify someone (D) Hair color limitations only apply to people over age 50

25. A forensic lab receives two hair samples from a scene: one pulled out with force and one that fell out naturally. Evaluate which sample is likely more useful for the investigation and explain your reasoning.

(A) The naturally shed hair is more useful because it is in better condition (B) Both samples are equally useful because they are the same type of evidence (C) The forcibly removed hair with root tissue is more useful because it likely contains nuclear DNA for individual identification (D) Neither sample is useful because hair evidence is unreliable

26. What are the two main categories of fibers that forensic scientists analyze?

(A) Wet fibers and dry fibers (B) Natural fibers and synthetic fibers (C) Thick fibers and thin fibers (D) Long fibers and short fibers

Write the answer

27. How does a forensic scientist use a comparison microscope to analyze fibers?

Answer: _____

28. A blue cotton fiber is found on a broken window latch. A suspect was wearing a blue cotton shirt. Does this fiber evidence PROVE the suspect broke the window?

Answer: _____

29. Why do forensic scientists examine the cross-sectional shape of fibers in addition to their color and type?

Answer: _____

30. Design a simple experiment to demonstrate fiber transfer between two different pieces of fabric. What would you observe, and how does this relate to crime scene investigation?

Answer: _____

Match each question to its answer

1. What physical property of glass do forensic scientists commonly measure to compare glass fragments? →
2. When glass breaks due to an impact, what happens to the fragments on the side where force was applied versus the opposite side? →
3. A forensic scientist uses a technique called density gradient analysis to compare two glass fragments. What is this technique measuring? →
4. Analyze why finding glass fragments on a suspect's clothing is significant but not conclusive evidence by itself. →
5. Evaluate the statement: 'If two glass fragments have the same refractive index, they definitely came from the same source.' →

(A) How dense the glass is by observing where fragments float or sink in a column of liquids with known densities

(B) This is incorrect — the same refractive index means they COULD share a source, but other tests like elemental analysis are needed to strengthen the association

(C) Fragments are projected away from the force — most glass scatters on the side opposite to where the force was applied

(D) Glass is a class evidence type — many sources produce glass with similar properties, so fragments indicate possible association but cannot identify one specific source

(E) Refractive index — how much the glass bends light

4. Chemical Evidence

Circle the correct answer

31. What is the primary goal of chemical analysis in forensic science?

(A) To make evidence change colors for courtroom presentations (B) To create new chemical compounds for use in investigations (C) To measure the temperature of crime scenes (D) To identify unknown substances and determine their composition

32. Why do forensic chemists test the physical properties of a substance (color, texture, melting point) before performing chemical tests?

(A) Chemical tests are too expensive to use without first checking physical properties (B) Physical properties alone can always identify a substance definitively (C) Physical properties provide initial clues that help narrow down possibilities and guide the selection of appropriate chemical tests (D) It is a legal requirement to document physical properties first

33. A forensic chemist receives an unknown liquid and performs a series of tests to

identify it. Why is it important to test known reference samples alongside the unknown?

(A) Reference samples change the unknown substance into a known one (B) Known reference samples provide a standard for comparison, ensuring the test is working correctly and results are reliable (C) Known samples are required to activate the testing equipment (D) Reference samples make the tests go faster

34. Analyze why it would be problematic for a forensic chemist to report an identification based on a single test result.

(A) A single test may produce false positives or false negatives — multiple independent tests provide cross-validation and reduce error (B) Multiple tests would use up too much of the evidence sample (C) Courts only accept results from one specific test for each substance (D) One test is always sufficient because modern tests are 100% accurate

35. Design a systematic testing approach to identify an unknown white powder found at a scene, explaining why you would order the tests in that particular sequence.

(A) Immediately use the most expensive instrument available to get a quick answer, and this has been consistently demonstrated in practice (B) Taste the powder to determine if it is sweet, salty, or bitter, making this the most widely accepted explanation (C) Skip all testing and ask the suspect what the powder is, which is why this approach is recommended by experts (D) Start with physical observations (crystal shape, odor, solubility), then presumptive color tests to narrow categories, then confirmatory instrumental analysis (like mass spectrometry) for definitive identification

36. What is the basic principle behind chromatography?

(A) Measuring the weight of individual molecules, which is why this approach is recommended by experts (B) Heating substances until they evaporate completely, which is the most common explanation for this phenomenon (C) Separating a mixture into its individual components based on how differently each component interacts with a stationary and mobile phase (D) Mixing all chemicals together to see what color they produce, which is why this approach is recommended by experts

Write the answer

37. In paper chromatography, why do some ink components travel farther up the paper than others?

Answer: _____

38. A forensic scientist uses chromatography to compare ink from a questioned document to ink from a suspect's pen. The separated components match in position and color. What can the scientist conclude?

Answer: _____

39. What is the Rf value in chromatography, and why is it important for comparing samples?

Answer: _____

40. Evaluate the limitations of paper chromatography compared to more advanced instrumental methods like gas chromatography-mass spectrometry (GC-MS).

Answer: _____

Match each question to its answer

1. What does pH measure? →

2. A forensic scientist tests an unknown liquid and the pH indicator turns deep blue, indicating a pH of 12. Is this substance acidic, neutral, or basic? →

3. Why might determining the pH of a substance found at a scene be useful in a forensic investigation? →

4. Compare the usefulness of pH paper (litmus strips) versus a digital pH meter for forensic analysis. →

5. A forensic team finds two colorless liquids at a scene. One has pH 2 and the other pH 13. Evaluate what these extreme pH values tell investigators and what safety precautions would be necessary. →

(A) Basic (alkaline) — pH values above 7 indicate a basic substance

(B) Both are potentially dangerous — pH 2 is strongly acidic and pH 13 is strongly basic, both capable of causing chemical burns, requiring chemical-resistant gloves and eye protection during handling

(C) Digital pH meters provide precise numerical readings while pH paper only gives approximate ranges, but pH paper requires no calibration and works with tiny sample volumes

(D) How acidic or basic a solution is on a scale from 0 to 14

(E) pH helps narrow down the identity of an unknown substance and can indicate whether it is potentially hazardous

5. Document Analysis

Circle the correct answer

41. What are 'individual characteristics' in handwriting analysis?

(A) The language the document is written in, and this has been consistently demonstrated in practice (B) Unique writing habits specific to one person, such as letter formations, spacing patterns, and pen pressure (C) The size of the paper the writing appears on, which is why this approach is recommended by experts (D) The type of pen used to write the document, as this directly follows from the underlying

principles

42. Why do forensic document examiners request multiple known writing samples from a person rather than just one?

(A) Because courts require a minimum of ten samples by law (B) Because one sample might be written in invisible ink (C) Because handwriting varies naturally within a person — multiple samples reveal the full range of that person's writing variations (D) To test whether the person can copy someone else's handwriting

43. A document examiner is comparing a questioned signature on a check to known examples of the account holder's signature. What specific features should they examine?

(A) The color of the ink used in both signatures, and this is the standard approach used in most cases (B) Only whether the overall shape looks similar from a distance, which is why this approach is recommended by experts (C) How long it took to write each signature, and this is the standard approach used in most cases (D) Pen pressure, stroke sequence, letter proportions, beginning and ending strokes, speed indicators, and connecting strokes

44. Why is it problematic to conclude that two handwriting samples DEFINITELY came from the same person?

(A) Because identical handwriting always means the sample was photocopied (B) Because document examiners are not allowed to make any conclusions (C) Because handwriting analysis involves expert judgment and natural variation, making absolute certainty impossible — conclusions are expressed in terms of probability (D) Because handwriting never varies, so all matches are meaningless

45. A student claims their homework was written by someone else to avoid responsibility. Evaluate what a handwriting analysis of the homework compared to the student's known class notes could reveal.

(A) Handwriting analysis can only identify adults, not students, and this is the standard approach used in most cases (B) Comparing individual characteristics like letter formations, slant, spacing, and pressure patterns between the homework and class notes could support or contradict the student's claim (C) Only fingerprints on the homework could prove who wrote it, and this principle applies across similar situations (D) The analysis would be meaningless because students' handwriting changes daily

46. What forensic technique separates ink into its component dyes?

(A) Fingerprint dusting (B) DNA extraction (C) Carbon dating (D) Thin-layer chromatography

Write the answer

47. How can forensic scientists determine whether two documents were written with the same ink?

Answer: _____

48. An old letter is questioned — someone claims a paragraph was added years after the original was written. How might ink analysis help resolve this dispute?

Answer: _____

49. Analyze why a forensic document examiner might find that two documents written with pens from the same brand still have slightly different ink profiles.

Answer: _____

50. Evaluate the limitations of ink analysis in determining exactly when a document was written.

Answer: _____

Match each question to its answer

1. What properties of paper do forensic scientists examine? →

2. What is a watermark, and how is it useful in document examination? →

3. A questioned document is printed on paper that fluoresces brightly under ultraviolet light, but the reference documents from the same company do not fluoresce. What does this difference suggest? →

4. Compare the forensic value of examining paper fiber composition versus simply looking at paper color when comparing two documents. →

5. Propose how you would determine whether a page has been substituted in a multi-page document (for example, one page replaced in a contract). →

(A) Fiber composition analysis is far more discriminating because papers with identical appearance can have different fiber makeups, while many different papers share the same color

(B) Fiber composition, watermarks, thickness, surface coating, chemical composition, and fluorescence under UV light

(C) The documents were likely printed on different types of paper, suggesting the questioned document may not be authentic

(D) Compare all pages for consistent paper properties (thickness, fluorescence, fiber composition, watermarks), ink properties, printing characteristics, and physical alignment features

(E) A translucent design embedded in paper during manufacturing that can identify the paper manufacturer and sometimes the production date

6. Biological Evidence

Circle the correct answer

51. What does DNA stand for?

(A) Deoxyribonucleic acid (B) Digital nucleotide analysis (C) Dynamic nucleic arrangement (D) Deoxynitrate amino acid

52. Why is DNA useful for identification in forensic science?

(A) Because DNA can reveal what a person was thinking at the time (B) Because each person's DNA sequence is unique (except identical twins), and it is present in most biological materials left at a scene (C) Because DNA changes every day, creating a daily record (D) Because DNA only exists in fingerprints

53. A forensic biologist extracts DNA from a saliva sample left on a drinking glass. What is this type of evidence called?

(A) Biological evidence containing touch DNA or transfer DNA (B) Chemical evidence, as this is what research and standard practice suggests (C) Documentary evidence, and this has been consistently demonstrated in practice (D) Digital evidence, which is the most common explanation for this phenomenon

54. How does DNA profiling (STR analysis) compare DNA samples without reading the entire genetic code?

(A) It reads every single base pair in both DNA samples and compares them letter by letter (B) It compares the color of the DNA molecules under UV light (C) It measures the total weight of each DNA sample (D) It examines specific short, repeating sections of DNA called STR loci, comparing the number of repeats at each location between samples

55. Evaluate the statement: 'If someone's DNA is found at a scene, it proves they committed the crime.'

(A) This is only incorrect if the DNA belongs to an identical twin, and this has been consistently demonstrated in practice (B) This is incorrect — DNA at a scene proves the person's biological material was present, but not when it was deposited, how it got there, or what actions the person performed (C) This statement is completely correct — DNA presence equals proof of guilt, and this has been consistently demonstrated in practice (D) DNA evidence is never useful because it can always be explained away

56. What are the four main blood types in the ABO blood group system?

(A) 1, 2, 3, and 4 (B) Alpha, Beta, Gamma, and Delta (C) Red, White, Blue, and Green (D) A, B, AB, and O

Write the answer

57. Why is blood typing considered class evidence rather than individual evidence?

Answer: _____

58. A forensic biologist tests a bloodstain and determines it is Type A, Rh-positive. The victim is Type O, Rh-negative. What does this indicate?

Answer: _____

59. How does the Rh factor add additional discriminating power beyond the basic ABO blood typing?

Answer: _____

60. A forensic team has limited biological evidence and must choose between performing blood typing or DNA analysis. Evaluate the trade-offs of each approach in this situation.

Answer: _____

Match each question to its answer

1. What can the shape of a blood drop on a surface tell a forensic scientist? →

2. What is the 'area of origin' in blood spatter analysis? →

3. Apply the principle that blood drop elongation indicates direction of travel: if you see a teardrop-shaped bloodstain on a wall with the pointed end facing to the right, which direction was the blood traveling when it hit the wall? →

4. Analyze how the size of blood drops in a spatter pattern can indicate the amount of force that created them. →

5. Evaluate the reliability of blood spatter pattern analysis as forensic evidence. What are its strengths and limitations? →

(A) The three-dimensional point in space from which blood originated before traveling to the surfaces where it was found

(B) The blood was traveling from left to right — the pointed 'tail' of the teardrop points in the direction of travel

(C) Higher force creates smaller, finer drops (mist-like), while lower force creates larger drops — the relationship between force and drop size helps reconstruct what type of action produced the spatter

(D) Strengths include physics-based directional analysis and force estimation; limitations include subjective pattern interpretation, surface effects on drop shape, and difficulty distinguishing between different events that produce similar patterns

(E) The angle at which the blood struck the surface — circular drops indicate perpendicular impact, elongated drops indicate angled impact

7. Digital Forensics

Circle the correct answer

61. What is digital evidence?

(A) Photographs taken at a crime scene with a camera (B) Physical fingerprints left on a keyboard (C) Information stored or transmitted in digital form that can be used in an investigation (D) Only evidence found on desktop computers

62. Why must digital evidence be handled differently from physical evidence like fingerprints or fibers?

(A) Because digital data is fragile and easily altered — even turning on a device can change timestamps and modify files (B) Because digital evidence is not real and doesn't need careful handling (C) Because digital evidence cannot be presented in court (D) Because only computer experts are allowed to touch electronic devices

63. A forensic examiner creates a 'forensic image' of a suspect's hard drive. What is a forensic image?

(A) A summary document listing the files on the drive (B) A compressed backup that only includes important files (C) A photograph of the outside of the hard drive (D) An exact bit-for-bit copy of the entire storage device, including deleted files and empty space

64. How are hash values (like MD5 or SHA-256) used to verify the integrity of digital evidence?

(A) Hash values measure how fast a hard drive can be copied, and this principle applies across similar situations (B) Hash values determine the physical weight of digital storage, and this has been consistently demonstrated in practice (C) A hash is a unique digital fingerprint of a file or device — if the hash of the copy matches the original, it proves the data hasn't been altered (D) Hash values encrypt the evidence so no one can read it, which is why this approach is recommended by experts

65. A defense attorney argues that digital evidence should be excluded because the forensic examiner analyzed the original hard drive directly rather than a forensic copy. Evaluate the strength of this argument.

(A) This is a strong argument — analyzing the original directly risks altering evidence because the operating system and analysis tools can modify timestamps, logs, and other metadata during examination (B) This argument is irrelevant because digital evidence cannot be altered under any circumstances (C) This argument is weak because original drives are always better to analyze than copies (D) This argument only applies to old computers, not modern ones

66. When you delete a file from your computer, what actually happens to the data?

(A) The file system marks the space as available for reuse, but the actual data typically remains on the disk until it is overwritten by new data (B) The file is moved to a secret hidden folder that only hackers can access (C) The data is immediately

and permanently erased from the disk (D) The data is sent to the manufacturer's servers for permanent deletion

Write the answer

67. What forensic tool or technique is used to recover deleted files from a hard drive?

Answer: _____

68. A school's computer had important files deleted by a student. A forensic examiner recovers some files completely but finds others are only partially recoverable. Explain why some files could not be fully recovered.

Answer: _____

69. Analyze why solid-state drives (SSDs) present greater challenges for data recovery than traditional hard disk drives (HDDs).

Answer: _____

70. Evaluate whether it is possible to permanently and irrecoverably delete data from a storage device.

Answer: _____

Match each question to its answer

1. What information does a file's metadata typically contain? →

2. Why are timestamps on digital files important in forensic investigations? →

3. A forensic examiner discovers that a document's 'created' timestamp is AFTER its 'last modified' timestamp. Apply your knowledge to explain what this anomaly might indicate. →

4. System logs on a school network show that a user account logged in at 3:47 AM on a Saturday when the school was closed. Analyze what this log entry might indicate and what additional investigation would be needed. →

5. Evaluate the reliability of computer timestamps as evidence, considering that users can manually change their computer's date and time settings. →

(A) The unusual login time suggests unauthorized access — additional investigation should check the source IP address, what actions were performed, and whether the account credentials were compromised or shared

(B) Creation date, last modified date, last accessed date, file size, author, and file type

(C) The file may have been copied from another location — the new creation timestamp reflects when the copy was made, while the modification timestamp was carried over from the original file

(D) Timestamps help establish a timeline of events — showing when files were created, modified, or accessed, which can corroborate or contradict witness accounts

(E) While timestamps can be manually altered, forensic examiners can detect manipulation by comparing timestamps across multiple sources — system logs, network records, email server logs, and file system artifacts that are harder to consistently falsify

8. Case Analysis and Scientific Method

Circle the correct answer

71. What does 'convergent evidence' mean in forensic investigation?

(A) Evidence that contradicts the main theory of the investigation (B) Evidence that is found at the exact center of a crime scene (C) Multiple independent lines of evidence that all point to the same conclusion, strengthening confidence in that conclusion (D) A single piece of evidence that proves everything about a case

72. Why is it important for forensic investigators to consider alternative explanations for evidence rather than focusing only on their primary theory?

(A) Because the law requires investigators to create at least five different theories (B) Because evidence always supports multiple conclusions equally (C) Because confirmation bias can cause investigators to overlook evidence that contradicts their theory, potentially leading to wrong conclusions (D) Because alternative explanations make investigations more entertaining

73. A forensic team has a DNA match, a fingerprint match, and a fiber match connecting a suspect to a burglary scene. However, the suspect lives in the apartment building where the burglary occurred. Apply critical thinking to evaluate how the suspect's residency affects the interpretation of this evidence.

(A) The evidence should be ignored entirely because the suspect lives nearby (B) The three matching evidence types prove guilt regardless of where the suspect lives (C) The suspect's residency provides an innocent explanation for all three evidence types — residents routinely leave DNA, fingerprints, and fibers in shared building spaces through daily living activities (D) Residency is irrelevant because forensic evidence always overrides circumstantial factors

74. Analyze how the order in which evidence is discovered can influence an investigator's interpretation of subsequent evidence.

(A) Investigators always discover the most important evidence first (B) Early evidence creates a cognitive framework that can bias how later evidence is interpreted — a phenomenon called 'tunnel vision' or 'contextual bias' in forensic science (C) Evidence discovered first is always more reliable than evidence found later (D) The order of evidence discovery has no effect on interpretation because all evidence is objective

75. Evaluate the statement: 'The more evidence you have against a suspect, the more certain you can be of their guilt.'

(A) This is only true for physical evidence, not for testimonial evidence (B) This statement is always false — the amount of evidence never matters (C) This is only true if the evidence is INDEPENDENT — multiple pieces of evidence derived from the same source or influenced by the same bias do not genuinely increase certainty (D) This statement is always true — more evidence always means more certainty

76. What makes forensic evidence 'admissible' in court?

(A) Any evidence is automatically admissible as long as it is real, and this has been consistently demonstrated in practice (B) It must be the largest piece of evidence available, which is why this approach is recommended by experts (C) It only needs to come from a licensed forensic laboratory, and this has been consistently demonstrated in practice (D) It must be relevant to the case, collected and preserved following proper procedures, analyzed using accepted scientific methods, and presented by qualified experts

Write the answer

77. What is the 'chain of custody,' and why does it matter for evidence quality?

Answer: _____

78. A forensic report states that a fiber found at a scene is 'consistent with' the suspect's jacket. Apply your understanding of forensic terminology to explain what 'consistent with' means and what it does NOT mean.

Answer: _____

79. Analyze the difference between 'class evidence' and 'individual evidence' in terms of their probative value (ability to prove or disprove something).

Answer: _____

80. Evaluate whether a forensic laboratory's accreditation status should affect how a court views the evidence analyzed by that laboratory.

Answer: _____

Match each question to its answer

1. What qualifies a person as an 'expert witness' in forensic science? →

2. Why are expert witnesses required to explain their methodology to the court, not just their conclusions? →

3. A forensic expert testifies that a fingerprint found at a scene is a 'definitive match' to the defendant. The defense attorney asks about the error rate of fingerprint comparison. Apply your knowledge to explain why this question is important. →

4. Analyze how an expert witness might unintentionally mislead a jury even while

presenting accurate scientific findings. →

5. Design a set of guidelines for how forensic expert witnesses should communicate uncertainty to a jury in a way that is both scientifically accurate and understandable.
→

(A) Error rate questions reveal the possibility of false identifications — no forensic method is perfectly accurate, and understanding the potential for error helps the jury evaluate the strength of the evidence

(B) Use standardized verbal scales linking to defined probability ranges, explain limitations in plain language, provide visual aids showing the strength of evidence, and explicitly state what the evidence cannot tell us alongside what it can

(C) So the court and jury can evaluate whether the methods used are scientifically valid and whether the conclusions logically follow from the evidence

(D) Specialized knowledge, education, training, and experience that enable them to provide opinions beyond what a layperson could offer

(E) By using absolute language ('this definitely matches'), omitting limitations of their analysis, or presenting statistical probabilities in ways that exaggerate certainty — accurately stating findings but framing them in misleading ways

9. Detective Skills & Mystery

Circle the correct answer

81. What is the term for a person who sees a crime or event happen?

(A) Juror (B) Suspect (C) Detective (D) Eyewitness

82. Which sense do detectives rely on MOST when examining a crime scene for the first time?

(A) Taste (B) Sight (C) Smell (D) Touch

83. What is "physical evidence"?

(A) A detective's personal opinion about the case (B) Objects or materials found at a scene that can be collected and examined (C) A photograph taken after the crime was solved (D) A witness statement written on paper

84. What should a detective do FIRST when arriving at a crime scene?

(A) Start collecting fingerprints immediately (B) Move furniture to search underneath (C) Observe the scene without touching anything (D) Interview the nearest person

85. What is a "detail" in the context of observation?

(A) The final conclusion of an investigation (B) A large, obvious object in the room
(C) A guess about what happened (D) A specific, small piece of information noticed during careful looking

86. What tool do detectives commonly use to examine small details at a crime scene?

(A) Stethoscope (B) Telescope (C) Magnifying glass (D) Calculator

Write the answer

87. Why might two eyewitnesses describe the same event differently?

Answer: _____

88. What does it mean to say evidence is "contaminated"?

Answer: _____

89. Why do detectives photograph a crime scene before collecting evidence?

Answer: _____

90. How does taking notes help a detective during observation?

Answer: _____

Match each question to its answer

1. What is the difference between an observation and an inference? →

2. A detective notices muddy footprints leading from the back door to the kitchen.

What should the detective do NEXT? →

3. You are observing a room and notice a glass of water on a table with condensation on the outside. What can you reasonably conclude? →

4. A witness says a car was "dark-colored." Why is this description not very helpful for investigators? →

5. You find a broken window with glass fragments scattered INSIDE a room. What does this suggest about the direction of the break? →

(A) The window was broken from the outside, pushing glass inward

(B) It is too vague because many colors look dark, especially at night

(C) The water was cold and has been sitting there for a while

(D) Measure and photograph the footprints before anyone walks over them

(E) An observation is what you directly see; an inference is a conclusion drawn from observations

10. Detective Skills & Mystery

Circle the correct answer

91. What is "deduction" in detective work?

(A) Reaching a conclusion by reasoning from known facts or evidence (B) Asking a witness to confess (C) Subtracting numbers to find the answer (D) Making a random guess about what happened

92. What is the term for removing a suspect from a list because evidence proves they could not have committed the crime?

(A) Interrogation (B) Accusation (C) Elimination (D) Prosecution

93. What is an "alibi"?

(A) Proof that a suspect was somewhere else when the crime occurred (B) A legal document filed in court (C) A type of disguise used by criminals (D) A tool for collecting fingerprints

94. In logic, what is a "premise"?

(A) The final answer to a mystery (B) A question asked during an interrogation (C) A statement assumed to be true that is used as the basis for an argument (D) A piece of physical evidence

95. What does "motive" mean in a criminal investigation?

(A) The method used to commit the crime (B) The reason WHY someone would commit a crime (C) The location where the crime took place (D) The time the crime was committed

96. What is a "contradiction" in logical reasoning?

(A) When two statements cannot both be true at the same time (B) When a detective changes their theory (C) When evidence supports only one suspect (D) When two witnesses agree on everything

Write the answer

97. If "all students in Room A left before 3 PM" and "the theft occurred at 3:15 PM," what can you logically conclude about the students in Room A?

Answer: _____

98. Why is it important to consider multiple explanations for a piece of evidence before drawing a conclusion?

Answer: _____

99. What is the difference between "motive" and "opportunity"?

Answer: _____

100. Why does a detective consider who benefits from a crime?

Answer: _____

Match each question to its answer

1. What does it mean to "corroborate" evidence? →

2. Three suspects have alibis for 7 PM. Suspect A was at a restaurant (confirmed by receipt). Suspect B says they were home alone. Suspect C was at a movie theater (confirmed by a friend). If the crime occurred at 7 PM, which suspect's alibi is weakest?

→

3. A cookie jar is empty. Mom says she saw Dad near the jar at 2 PM. Dad says he was reading in his room. The dog was sleeping by the jar all afternoon. Little brother has chocolate on his fingers. Who is the most likely suspect? →

4. A logic puzzle states: "If it rained, the ground is wet. The ground is wet." Can you conclude it rained? →

5. You know the thief is left-handed. Suspect 1 writes with their left hand. Suspect 2 writes with their right hand. Suspect 3 is ambidextrous (uses both hands). Who can you eliminate? →

(A) Little brother, because the chocolate on his fingers is physical evidence linking him to cookies

(B) Suspect B, because being home alone cannot be independently verified

(C) To confirm a piece of evidence with additional, independent evidence that supports the same conclusion

(D) No, because other things could also make the ground wet

(E) Suspect 2, because they are right-handed and the thief is left-handed

11. Detective Skills & Mystery

Circle the correct answer

101. What is forensic science?

(A) The application of scientific methods to solve crimes and legal questions (B) A type of science fiction writing (C) The study of forest ecosystems (D) A method of predicting future crimes

102. What are the unique ridge patterns on your fingertips called?

(A) Fingerprints (B) Skin tags (C) Palmprints (D) Pressure points

103. What are the three main fingerprint patterns?

(A) Loop, whorl, and arch (B) Straight, curved, and zigzag (C) Circle, square, and triangle (D) Dot, line, and spiral

104. What is DNA?

(A) A molecule found in every cell that contains a person's unique genetic code (B) A type of fingerprint scanner (C) A chemical used to reveal hidden messages (D) A computer database of criminal records

105. What is the purpose of yellow "crime scene tape"?

(A) To mark areas where evidence has already been collected (B) To decorate the scene for photographs (C) To warn that the building is being demolished (D) To create a barrier that keeps unauthorized people out and preserves the scene

106. What do forensic scientists use "luminol" for?

(A) To take photographs in the dark (B) To test for fingerprints on glass (C) To clean crime scenes after investigation (D) To detect traces of blood that are invisible to the naked eye

Write the answer

107. Why are fingerprints considered reliable evidence for identification?

Answer: _____

108. How can a single strand of hair help forensic investigators?

Answer: _____

109. Why is it important for forensic investigators to wear gloves when handling evidence?

Answer: _____

110. What is the "chain of custody" and why does it matter?

Answer: _____

Match each question to its answer

1. How do forensic scientists use shoe prints found at a crime scene? →

2. A forensic scientist finds two types of fiber at a crime scene: red cotton and blue polyester. The suspect's closet contains a red cotton sweater and blue polyester jacket. How does this apply to the investigation? →

3. At a burglary scene, a forensic team finds a partial fingerprint on a glass window. What steps would they take to use this evidence? →

4. A detective finds a threatening note at a crime scene. What forensic techniques could be applied to analyze this note? →

5. A forensic lab receives two blood samples: one from the crime scene and one from a suspect. The DNA profiles match. What does this mean for the investigation? →

- (A) Photograph it, carefully lift it using fingerprint powder and tape, then compare it against fingerprint databases and suspect prints
 - (B) The suspect's blood was at the crime scene, strongly linking them to the location, but it does not prove they committed the crime
 - (C) The fibers are consistent with the suspect's clothing, supporting (but not proving) their presence at the scene
 - (D) They analyze the size, tread pattern, and wear marks to identify the type of shoe and potentially link it to a suspect
 - (E) Handwriting analysis, fingerprint examination, ink and paper analysis, and DNA testing from saliva if the envelope was licked
-

12. Detective Skills & Mystery

Circle the correct answer

111. What is a "red herring" in a mystery story?

- (A) A false clue or misleading detail designed to distract readers from the real solution
- (B) The main clue that solves the mystery
- (C) A type of fish that detectives eat for brain power
- (D) A character who is always guilty

112. What is the term for the feeling of tension and uncertainty that keeps readers wanting to know what happens next?

- (A) Suspense
- (B) Exposition
- (C) Resolution
- (D) Setting

113. In mystery literature, what is a "whodunit"?

- (A) A mystery with no solution
- (B) A story about a detective who already knows the answer
- (C) A type of mystery story focused on figuring out which character committed the crime
- (D) A detective's personal diary

114. What is a "clue" in a mystery story?

- (A) The detective's name, and this principle applies across similar situations
- (B) A piece of information that helps the detective (and reader) solve the mystery
- (C) The title of the book, which is the most common explanation for this phenomenon
- (D) A random detail with no connection to the plot, which is why this approach is recommended by experts

115. Who is the character in a mystery story whose job is to investigate and solve the crime?

- (A) The villain
- (B) The detective (or sleuth)
- (C) The victim
- (D) The narrator

116. What is the "solution" or "resolution" of a mystery?

- (A) The part where the mystery is solved and the detective reveals who did it, how, and why (B) The point where the crime happens (C) The first chapter of the book (D) A twist that creates a new unsolved mystery

Write the answer

117. Why do mystery authors include red herrings in their stories?

Answer: _____

118. What does it mean when a mystery is described as "fair play"?

Answer: _____

119. How does a mystery author create suspense through pacing?

Answer: _____

120. Why is it important for a mystery to have multiple suspects?

Answer: _____

Match each question to its answer

1. What is the purpose of giving each suspect a "motive" in a mystery story? →

2. You are writing a mystery where a school trophy goes missing. Name three characters you would create as suspects and give each one a different motive. →

3. How would you plant a clue in a mystery story so that it is present but not immediately obvious to the reader? →

4. You want to create a red herring in your mystery. The real thief is the librarian, but you want readers to suspect the new student. What detail could you include? →

5. In mystery writing, what is a "ticking clock" and how would you use one in a story about a stolen painting? →

(A) Show the new student acting nervous near the scene and having a secret they are hiding (but their secret is unrelated to the theft)

(B) The jealous rival (motive: wanted to prevent the winner from celebrating), the janitor (motive: the trophy is made of valuable metal), and the team captain (motive: their name was spelled wrong and they wanted it fixed)

(C) Mention the clue casually within a description of something else, so it blends in and only becomes significant when the detective points it out later

(D) Motives make each suspect a believable candidate for committing the crime, keeping readers uncertain about who is guilty

(E) A time limit that creates urgency -- for example, the painting must be found before the museum opens tomorrow morning or the theft will be discovered publicly

13. Introduction to Forensic Science

Circle the correct answer

121. A forensic scientist finds cat hair on a suspect's jacket. The suspect claims they were never at the victim's house, where a cat lives. How does Locard's principle help evaluate this claim?

(A) The cat hair suggests the suspect had contact with the cat or an environment where the cat had been (B) Cat hair is too common to be useful as evidence (C) The cat hair proves the suspect is guilty of the crime (D) Locard's principle does not apply to animal hair

122. A fingerprint has ridges that enter from the right side, curve upward, and then exit from the right side. What pattern type is this?

(A) A whorl (B) A loop (C) An arch (D) A tented arch

123. A forensic lab receives two hair samples from a scene: one pulled out with force and one that fell out naturally. Evaluate which sample is likely more useful for the investigation and explain your reasoning.

(A) Both samples are equally useful because they are the same type of evidence (B) The naturally shed hair is more useful because it is in better condition (C) The forcibly removed hair with root tissue is more useful because it likely contains nuclear DNA for individual identification (D) Neither sample is useful because hair evidence is unreliable

124. What is the basic principle behind chromatography?

(A) Heating substances until they evaporate completely, which is the most common explanation for this phenomenon (B) Measuring the weight of individual molecules, which is why this approach is recommended by experts (C) Separating a mixture into its individual components based on how differently each component interacts with a stationary and mobile phase (D) Mixing all chemicals together to see what color they produce, which is why this approach is recommended by experts

125. What properties of paper do forensic scientists examine?

(A) Only the color of the paper, as this is what research and standard practice suggests (B) Only whether the paper can be folded, and this principle applies across similar situations (C) Only the weight of a single sheet, as this is what research and standard practice suggests (D) Fiber composition, watermarks, thickness, surface coating, chemical composition, and fluorescence under UV light

126. A forensic team has limited biological evidence and must choose between performing blood typing or DNA analysis. Evaluate the trade-offs of each approach in this situation.

(A) Both tests require exactly the same amount of sample and time, and this principle applies across similar situations (B) DNA analysis is always the better choice because it is more specific (C) Blood typing is always the better choice because it is faster (D) DNA analysis provides individual identification but requires more sample and time, while blood typing is faster and uses less sample but only provides class-level exclusion — the choice depends on sample quantity and investigation needs

Write the answer

127. A social media post includes a photo that appears to show a person at a park during a specific time they claim to have been at work. Apply metadata analysis to explain how investigators could verify the timing claim.

Answer: _____

128. Why are expert witnesses required to explain their methodology to the court, not just their conclusions?

Answer: _____

129. A forensic team collects a glass fragment, a witness statement, a security camera video, and a shoe impression. If you were organizing these by evidence type, which two would be classified as physical evidence?

Answer: _____

130. Design a procedure for collecting and comparing fingerprints from your classmates using household materials (ink pad, paper, magnifying glass). What steps would ensure accurate results?

Answer: _____

Match each question to its answer

1. A forensic scientist separates soil into its component parts by particle size. What is this technique called? →

2. Propose a testing strategy for an unknown substance that uses both presumptive and confirmatory approaches. Explain the advantages of this two-step approach over using only one type of test. →

3. How can examining the intersection of two ink lines help determine which was written first? →

4. Why is blood typing considered class evidence rather than individual evidence? →

5. Evaluate whether it is possible to permanently and irrecoverably delete data from a

storage device. →

(A) The ink applied second typically appears on top at the crossing point, and microscopic examination reveals which line's ink covers the other

(B) Because millions of people share each blood type — it can narrow possibilities but cannot identify a specific individual

(C) Screen with fast presumptive tests to narrow possibilities, then confirm positives with specific instrumental methods — this conserves time and expensive resources while maintaining accuracy

(D) Sieve analysis or granulometric analysis

(E) Yes — techniques like multiple-pass overwriting, cryptographic erasure, and physical destruction can make data permanently unrecoverable, though the appropriate method depends on the storage technology and security requirements

14. Introduction to Forensic Science

Circle the correct answer

131. Why do forensic scientists use systematic search patterns at a scene rather than randomly looking around?

(A) Forensic scientists always prefer to work in straight lines (B) Systematic patterns make the scene look more organized for photographs (C) Random searching is faster but not allowed by law (D) Systematic patterns ensure every area is thoroughly examined without missing spots

132. If you get a cut on your fingertip, what happens to your fingerprint as it heals?

(A) The fingerprint is permanently changed by any cut (B) The original fingerprint pattern grows back as the skin heals, unless the damage reaches the deeper dermis layer (C) A completely new and different fingerprint pattern forms (D) The fingertip becomes smooth with no ridges at all

133. Why do forensic scientists examine the mineral content, color, and biological components of soil samples rather than just looking at them visually?

(A) Because visual observation is prohibited in forensic laboratories (B) Because courts require exactly three types of analysis for every soil sample (C) Because all soil samples are the same color under laboratory lighting (D) Because soils that appear similar to the naked eye can have significantly different compositions revealed only through detailed analysis

134. A forensic chemist uses a burn test to analyze a fiber — holding it in a flame and observing how it burns, the smell it produces, and the residue it leaves. Explain how this helps identify the fiber type.

(A) All fibers burn exactly the same way regardless of type, which is why this approach is recommended by experts (B) Different fiber types burn in characteristic ways — natural fibers like cotton burn with a paper smell and leave ash, while synthetics like polyester melt, drip, and produce chemical odors (C) Burning fibers is too dangerous to ever be used in forensic science, which is the most common explanation for this phenomenon (D) Burn testing can identify the exact brand of clothing a fiber came from, and this is the standard approach used in most cases

135. Evaluate the ethical implications of collecting biological samples (blood, saliva, DNA) from individuals who have not been charged with a crime.

(A) Biological samples should be collected from everyone in the population for a universal database, and this principle applies across similar situations (B) There are no ethical concerns because forensic science always serves justice (C) Ethical considerations only apply to blood samples, not saliva or DNA, as this directly follows from the underlying principles (D) This raises significant privacy and civil liberty concerns — biological samples contain deeply personal genetic information, and collection without charges must balance investigative needs against individual constitutional rights

136. What is digital evidence?

(A) Only evidence found on desktop computers (B) Photographs taken at a crime scene with a camera (C) Physical fingerprints left on a keyboard (D) Information stored or transmitted in digital form that can be used in an investigation

Write the answer

137. How has DNA evidence been used to exonerate (free) wrongfully convicted individuals?

Answer: _____

138. How do whorls differ from loops in their ridge pattern?

Answer: _____

139. Analyze why finding glass fragments on a suspect's clothing is significant but not conclusive evidence by itself.

Answer: _____

140. An investigator sprays luminol in a dark room and observes a blue-white glow on the floor. What does this indicate?

Answer: _____

Match each question to its answer

1. Compare the effectiveness of visual inspection alone versus instrumental analysis (microscopy, chromatography, spectroscopy) for detecting document alterations. →
2. Why is DNA useful for identification in forensic science? →
3. A student receives a threatening email from an anonymous account. Apply your knowledge to explain what digital trail the email might contain that could help identify the sender. →
4. A forensic report states that a fiber found at a scene is 'consistent with' the suspect's jacket. Apply your understanding of forensic terminology to explain what 'consistent with' means and what it does NOT mean. →
5. How does direct evidence differ from circumstantial evidence? →

(A) Instrumental analysis is far more effective because it detects alterations invisible to the naked eye — including chemical erasures, ink differences, and subtle paper changes

(B) Because each person's DNA sequence is unique (except identical twins), and it is present in most biological materials left at a scene

(C) 'Consistent with' means the fiber shares characteristics with the jacket material and COULD have come from it, but it does NOT mean the fiber definitely came from that specific jacket — other sources are possible

(D) Direct evidence proves a fact without needing any interpretation

(E) Email headers contain the sender's IP address, email server routing information, timestamps from each server the message passed through, and technical details about the sending device

15. Introduction to Forensic Science

Circle the correct answer

141. What is physical evidence?

(A) Opinions expressed by detectives (B) Statements made by witnesses (C) Tangible objects or materials that can be collected and examined (D) Photographs taken by journalists

142. What is primary transfer versus secondary transfer of trace evidence?

(A) Primary transfer occurs through direct contact with the source, while secondary transfer occurs when evidence moves from one intermediate surface to another (B) Primary means the first person at a scene, secondary means the second person (C) There is no difference — both terms mean the same thing (D) Primary transfer only involves blood, while secondary transfer involves all other evidence

143. A forensic scientist tests an unknown liquid and the pH indicator turns deep blue, indicating a pH of 12. Is this substance acidic, neutral, or basic?

(A) Neutral — pH 12 is close to the middle of the scale (B) It is impossible to determine from pH alone (C) Acidic — high numbers mean high acidity (D) Basic (alkaline) — pH values above 7 indicate a basic substance

144. How can forensic scientists determine whether two documents were written with the same ink?

(A) By checking if both documents were written on the same day (B) By measuring the thickness of the ink lines with a ruler (C) By comparing the chemical composition and chromatographic profiles of ink samples extracted from each document (D) By asking the owner of the documents whether they used the same pen

145. Compare nuclear DNA and mitochondrial DNA in terms of their forensic usefulness.

(A) Mitochondrial DNA is always preferred because it is easier to analyze (B) Nuclear DNA can only be found in blood, not other biological materials, as this is what research and standard practice suggests (C) Nuclear and mitochondrial DNA provide exactly the same information, and this principle applies across similar situations (D) Nuclear DNA provides individual identification but requires more cellular material, while mitochondrial DNA is more abundant and survives degradation better but only identifies maternal lineage, not individuals

146. A person was convicted in 1995 based primarily on eyewitness testimony and microscopic hair comparison. In 2020, DNA testing of preserved evidence excluded the convicted person. Apply your understanding to explain what went wrong in the original investigation.

(A) Both eyewitness testimony and microscopic hair comparison have known reliability limitations — eyewitness memory is fallible and hair comparison without DNA is a class-level analysis that cannot identify a specific individual (B) Nothing went wrong — the investigation was perfect but the convicted person's DNA mutated over 25 years (C) The 2020 DNA test must be wrong because the original conviction was based on two types of evidence (D) The evidence must have been contaminated during the 25 years of storage

Write the answer

147. An investigator is deciding the best order to collect evidence. They see a footprint in snow, a metal tool on concrete, and a fiber on a railing. Which evidence should be collected FIRST?

Answer: _____

148. Analyze why fingerprints are considered more reliable for personal identification than many other physical characteristics like height, weight, or hair color.

Answer: _____

149. How might soil found on a suspect's shoes help or hinder an investigation?

Answer: _____

150. What forensic technique separates ink into its component dyes?

Answer: _____

Match each question to its answer

1. Analyze how the size of blood drops in a spatter pattern can indicate the amount of force that created them. →

2. A defense attorney argues that digital evidence should be excluded because the forensic examiner analyzed the original hard drive directly rather than a forensic copy. Evaluate the strength of this argument. →

3. What qualifies a person as an 'expert witness' in forensic science? →

4. A forensic scientist examines a fiber found on a windowsill. What is the scientist most likely trying to determine? →

5. Which fingerprint pattern is the most common among people? →

(A) Where the fiber came from and whether it connects to a person or object

(B) Specialized knowledge, education, training, and experience that enable them to provide opinions beyond what a layperson could offer

(C) Higher force creates smaller, finer drops (mist-like), while lower force creates larger drops — the relationship between force and drop size helps reconstruct what type of action produced the spatter

(D) Loops

(E) This is a strong argument — analyzing the original directly risks altering evidence because the operating system and analysis tools can modify timestamps, logs, and other metadata during examination

16. Introduction to Forensic Science

Circle the correct answer

151. Evaluate the reliability of trace evidence that has gone through secondary or tertiary transfer.

(A) Secondary transfer evidence is just as reliable as primary transfer evidence (B) Reliability decreases with each transfer step because the amount of material decreases and alternative explanations for its presence increase (C) Transfer step

number has no effect on evidence reliability (D) Trace evidence becomes more reliable with each transfer because it spreads to more locations

152. How does the Rh factor add additional discriminating power beyond the basic ABO blood typing?

(A) Rh factor does not provide any additional forensic information, and this principle applies across similar situations (B) Rh factor (positive or negative) creates eight possible combinations with ABO types instead of four, further narrowing the potential source population (C) Rh factor only applies to Type O blood, which is why this approach is recommended by experts (D) Rh factor replaces ABO typing entirely because it is more accurate

153. Evaluate the balance between digital privacy rights and law enforcement's need to access digital evidence. What principles should guide this balance?

(A) There is no tension — privacy and law enforcement needs never conflict, which is why this approach is recommended by experts (B) Law enforcement should have unlimited access to all digital data at all times, and this principle applies across similar situations (C) Digital privacy should be absolute with no exceptions for law enforcement, which is the most common explanation for this phenomenon (D) The balance should be guided by proportionality (access matching the severity of the investigation), judicial oversight (warrants), data minimization (collecting only what's relevant), transparency, and strong protections against misuse

154. Why do forensic investigators wear gloves, masks, and protective suits at a scene?

(A) To stay warm during outdoor investigations (B) To protect themselves from dangerous chemicals only (C) To prevent their own DNA and materials from contaminating the evidence (D) To look professional in front of news cameras

155. What are minutiae in fingerprint analysis?

(A) The color and texture of a fingerprint (B) Specific ridge features like endings, bifurcations, and dots used to compare prints (C) The overall pattern type of a fingerprint (D) The size of a person's fingerprint

156. Analyze why a forensic document examiner might find that two documents written with pens from the same brand still have slightly different ink profiles.

(A) Because the examiner made an error in the analysis (B) Because the ink changed color due to exposure to room lighting (C) Because ink formulations can change between manufacturing batches, production dates, or product line updates by the manufacturer (D) Because different people's hand oils affect ink chemistry when writing

Write the answer

157. Analyze the challenges of investigating cybercrime that crosses international borders.

Answer: _____

158. What is a wrongful conviction?

Answer: _____

159. What is the purpose of taking photographs at a crime scene before collecting any evidence?

Answer: _____

160. What is an AFIS, and why is it important in modern forensic science?

Answer: _____

Match each question to its answer

1. What physical property of glass do forensic scientists commonly measure to compare glass fragments? →

2. Analyze why forensic scientists must carefully document the reagents used, their lot numbers, and expiration dates when performing chemical tests. →

3. A questioned document is printed on paper that fluoresces brightly under ultraviolet light, but the reference documents from the same company do not fluoresce. What does this difference suggest? →

4. What can the shape of a blood drop on a surface tell a forensic scientist? →

5. A detective finds a red thread on a fence near where a backpack went missing from school. What type of evidence is this thread? →

(A) Trace evidence

(B) The documents were likely printed on different types of paper, suggesting the questioned document may not be authentic

(C) Refractive index — how much the glass bends light

(D) Because reagents degrade over time and between manufacturing batches — documentation ensures test reliability and allows results to be challenged or replicated

(E) The angle at which the blood struck the surface — circular drops indicate perpendicular impact, elongated drops indicate angled impact

Riddle & Joke Break

Guess the answer, then check the key!

161. Why did the detective bring a magnifying glass to lunch?

162. What did the fingerprint say to the suspect?

163. Why was the crime scene investigator such a good friend?

164. What did the microscope say to the fiber evidence?

165. Why did the chromatography paper feel colorful?

166. What do you call a detective who sleeps on the job?

Answer Key

1. C — To analyze physical evidence using scientific methods
2. A — A crime laboratory
3. B — Relating to the use of science in legal matters
4. D — Where the fiber came from and whether it connects to a person or object
5. B — So their work can be reviewed and repeated by other scientists
6. B — Tangible objects or materials that can be collected and examined
7. A witness describing what they saw happen
8. Trace evidence
9. Direct evidence proves a fact without needing any interpretation
10. The glass fragment and the shoe impression
Matching (Introduction to Forensic Science): 1→D, 2→C, 3→A, 4→B, 5→E
11. A — Loops, whorls, and arches
12. D — Loops
13. C — A loop
14. A — Whorls have circular or spiral ridges that form a complete circuit, while loops curve and exit on the same side
15. D — Yes — this roughly matches expected frequencies since loops are most common, followed by whorls, then arches
16. D — To make invisible latent fingerprints visible on surfaces
17. To create maximum contrast between the fingerprint and the surface background
18. The tape captures the powdered pattern and preserves it on a flat, portable surface for analysis

19. Superglue vapors react with fingerprint residue and harden into visible white ridges
20. Superglue fuming is better because it bonds chemically with residue in textured grooves where powder brushing may not reach
Matching (Fingerprint Analysis): 1→A, 2→B, 3→C, 4→D, 5→E
21. B — The innermost central core channel running through the hair shaft
22. D — By examining the medulla pattern, scale pattern of the cuticle, and the ratio of medulla width to hair width
23. B — A root with tissue may contain nuclear DNA that can identify a specific individual
24. A — Hair color can be artificially changed through dyeing and varies naturally with age, sun exposure, and between individual hairs on the same head
25. C — The forcibly removed hair with root tissue is more useful because it likely contains nuclear DNA for individual identification
26. B — Natural fibers and synthetic fibers
27. By viewing the unknown fiber and a known sample side-by-side through the same eyepiece to directly compare their characteristics
28. No — it only shows the fiber is consistent with the shirt, but millions of blue cotton shirts exist
29. Because different manufacturing processes produce different cross-sectional shapes, helping narrow down the fiber's specific source
30. Rub two different colored fabrics together, then use tape lifts to collect and count transferred fibers from each surface under a magnifying glass
Matching (Trace Evidence): 1→E, 2→C, 3→A, 4→D, 5→B
31. D — To identify unknown substances and determine their composition
32. C — Physical properties provide initial clues that help narrow down possibilities and guide the selection of appropriate chemical tests
33. B — Known reference samples provide a standard for comparison, ensuring the test is working correctly and results are reliable
34. A — A single test may produce false positives or false negatives — multiple independent tests provide cross-validation and reduce error
35. D — Start with physical observations (crystal shape, odor, solubility), then presumptive color tests to narrow categories, then confirmatory instrumental

analysis (like mass spectrometry) for definitive identification

36. C — Separating a mixture into its individual components based on how differently each component interacts with a stationary and mobile phase
37. Components that are more soluble in the mobile phase solvent travel farther, while those more attracted to the paper fibers stay near the starting point
38. The two inks are consistent with each other and may share a common source, but this does not definitively prove they came from the same pen
39. The ratio of the distance a component traveled to the distance the solvent traveled — it provides a standardized measurement for comparison between different experiments
40. Paper chromatography has lower resolution and sensitivity — it can separate major components but may miss trace amounts or fail to distinguish very similar compounds that GC-MS can identify
Matching (Chemical Evidence): 1→D, 2→A, 3→E, 4→C, 5→B
41. B — Unique writing habits specific to one person, such as letter formations, spacing patterns, and pen pressure
42. C — Because handwriting varies naturally within a person — multiple samples reveal the full range of that person's writing variations
43. D — Pen pressure, stroke sequence, letter proportions, beginning and ending strokes, speed indicators, and connecting strokes
44. C — Because handwriting analysis involves expert judgment and natural variation, making absolute certainty impossible — conclusions are expressed in terms of probability
45. B — Comparing individual characteristics like letter formations, slant, spacing, and pressure patterns between the homework and class notes could support or contradict the student's claim
46. D — Thin-layer chromatography
47. By comparing the chemical composition and chromatographic profiles of ink samples extracted from each document
48. By comparing the chemical composition of ink in the original and questioned paragraphs — different ink formulations would suggest they were written at different times
49. Because ink formulations can change between manufacturing batches, production dates, or product line updates by the manufacturer

50. Ink dating has limited precision — volatile components evaporate over time providing rough estimates, but storage conditions, ink composition, and paper type all affect degradation rates, making exact dating unreliable
Matching (Document Analysis): 1→B, 2→E, 3→C, 4→A, 5→D
51. A — Deoxyribonucleic acid
52. B — Because each person's DNA sequence is unique (except identical twins), and it is present in most biological materials left at a scene
53. A — Biological evidence containing touch DNA or transfer DNA
54. D — It examines specific short, repeating sections of DNA called STR loci, comparing the number of repeats at each location between samples
55. B — This is incorrect — DNA at a scene proves the person's biological material was present, but not when it was deposited, how it got there, or what actions the person performed
56. D — A, B, AB, and O
57. Because millions of people share each blood type — it can narrow possibilities but cannot identify a specific individual
58. The bloodstain likely did not come from the victim — it may belong to another person who was present
59. Rh factor (positive or negative) creates eight possible combinations with ABO types instead of four, further narrowing the potential source population
60. DNA analysis provides individual identification but requires more sample and time, while blood typing is faster and uses less sample but only provides class-level exclusion — the choice depends on sample quantity and investigation needs
Matching (Biological Evidence): 1→E, 2→A, 3→B, 4→C, 5→D
61. C — Information stored or transmitted in digital form that can be used in an investigation
62. A — Because digital data is fragile and easily altered — even turning on a device can change timestamps and modify files
63. D — An exact bit-for-bit copy of the entire storage device, including deleted files and empty space
64. C — A hash is a unique digital fingerprint of a file or device — if the hash of the copy matches the original, it proves the data hasn't been altered

65. A — This is a strong argument — analyzing the original directly risks altering evidence because the operating system and analysis tools can modify timestamps, logs, and other metadata during examination
66. A — The file system marks the space as available for reuse, but the actual data typically remains on the disk until it is overwritten by new data
67. File carving — scanning the raw disk data for file headers and reconstructing files from unallocated space
68. The partially recoverable files had portions of their disk space overwritten by new data that was saved after the deletion, destroying those sections permanently
69. SSDs use a process called TRIM that actively erases deleted data blocks to maintain performance, making recovery of deleted files much more difficult or impossible
70. Yes — techniques like multiple-pass overwriting, cryptographic erasure, and physical destruction can make data permanently unrecoverable, though the appropriate method depends on the storage technology and security requirements
Matching (Digital Forensics): 1→B, 2→D, 3→C, 4→A, 5→E
71. C — Multiple independent lines of evidence that all point to the same conclusion, strengthening confidence in that conclusion
72. C — Because confirmation bias can cause investigators to overlook evidence that contradicts their theory, potentially leading to wrong conclusions
73. C — The suspect's residency provides an innocent explanation for all three evidence types — residents routinely leave DNA, fingerprints, and fibers in shared building spaces through daily living activities
74. B — Early evidence creates a cognitive framework that can bias how later evidence is interpreted — a phenomenon called 'tunnel vision' or 'contextual bias' in forensic science
75. C — This is only true if the evidence is INDEPENDENT — multiple pieces of evidence derived from the same source or influenced by the same bias do not genuinely increase certainty
76. D — It must be relevant to the case, collected and preserved following proper procedures, analyzed using accepted scientific methods, and presented by qualified experts
77. A documented record of everyone who handled the evidence, when, and what

they did with it — breaks in this chain raise questions about whether evidence was tampered with or contaminated

78. 'Consistent with' means the fiber shares characteristics with the jacket material and COULD have come from it, but it does NOT mean the fiber definitely came from that specific jacket — other sources are possible
79. Individual evidence (like DNA profiles or physical fits) can link to a specific source, while class evidence (like blood type or fiber type) can only narrow the pool of possible sources — individual evidence has higher probative value
80. Yes — accreditation indicates the laboratory meets established quality standards, uses validated methods, participates in proficiency testing, and undergoes regular external audits, providing greater confidence in result reliability
Matching (Case Analysis and Scientific Method): 1→D, 2→C, 3→A, 4→E, 5→B
81. D — Eyewitness
82. B — Sight
83. B — Objects or materials found at a scene that can be collected and examined
84. C — Observe the scene without touching anything
85. D — A specific, small piece of information noticed during careful looking
86. C — Magnifying glass
87. People notice different details and their memories can be influenced by stress or perspective
88. The evidence has been touched, moved, or altered so it may no longer be reliable
89. To create a permanent record of where everything was originally located
90. Notes capture details that memory alone might forget or distort over time
Matching (Detective Skills & Mystery): 1→E, 2→D, 3→C, 4→B, 5→A
91. A — Reaching a conclusion by reasoning from known facts or evidence
92. C — Elimination
93. A — Proof that a suspect was somewhere else when the crime occurred
94. C — A statement assumed to be true that is used as the basis for an argument
95. B — The reason WHY someone would commit a crime
96. A — When two statements cannot both be true at the same time

97. None of the students in Room A could have committed the theft
98. Because the same evidence can often be explained in more than one way
99. Motive is the reason someone would commit a crime; opportunity is having the chance to do it
100. Because the person who gains the most often has the strongest motive
Matching (Detective Skills & Mystery): 1→C, 2→B, 3→A, 4→D, 5→E
101. A — The application of scientific methods to solve crimes and legal questions
102. A — Fingerprints
103. A — Loop, whorl, and arch
104. A — A molecule found in every cell that contains a person's unique genetic code
105. D — To create a barrier that keeps unauthorized people out and preserves the scene
106. D — To detect traces of blood that are invisible to the naked eye
107. Because each person's fingerprint pattern is unique and does not change over their lifetime
108. Hair contains DNA that can be used to identify who it belongs to, and its characteristics can reveal information about the person
109. To prevent adding their own fingerprints, DNA, or other contaminants to the evidence
110. A documented record of who handled evidence, when, and where, ensuring it was not tampered with
Matching (Detective Skills & Mystery): 1→D, 2→C, 3→A, 4→E, 5→B
111. A — A false clue or misleading detail designed to distract readers from the real solution
112. A — Suspense
113. C — A type of mystery story focused on figuring out which character committed the crime
114. B — A piece of information that helps the detective (and reader) solve the mystery
115. B — The detective (or sleuth)
116. A — The part where the mystery is solved and the detective reveals who did it,

how, and why

117. To keep readers guessing by providing false leads that make the real solution harder to predict
118. All the clues needed to solve the mystery are presented to the reader before the solution is revealed
119. By controlling when information is revealed -- giving clues slowly, adding complications, and building tension before key revelations
120. Multiple suspects create uncertainty and challenge readers to consider different possibilities before the true culprit is revealed
Matching (Detective Skills & Mystery): 1→D, 2→B, 3→C, 4→A, 5→E
121. A — The cat hair suggests the suspect had contact with the cat or an environment where the cat had been
122. B — A loop
123. C — The forcibly removed hair with root tissue is more useful because it likely contains nuclear DNA for individual identification
124. C — Separating a mixture into its individual components based on how differently each component interacts with a stationary and mobile phase
125. D — Fiber composition, watermarks, thickness, surface coating, chemical composition, and fluorescence under UV light
126. D — DNA analysis provides individual identification but requires more sample and time, while blood typing is faster and uses less sample but only provides class-level exclusion — the choice depends on sample quantity and investigation needs
127. Examine the photo's EXIF timestamp, compare it with the social media platform's upload timestamp and server logs, and check the GPS coordinates against both the park and workplace locations
128. So the court and jury can evaluate whether the methods used are scientifically valid and whether the conclusions logically follow from the evidence
129. The glass fragment and the shoe impression
130. Clean hands first, roll each finger on the ink pad, press onto labeled paper, use the magnifying glass to identify pattern types and compare minutiae between prints
Matching (Introduction to Forensic Science): 1→D, 2→C, 3→A, 4→B, 5→E

131. D — Systematic patterns ensure every area is thoroughly examined without missing spots
132. B — The original fingerprint pattern grows back as the skin heals, unless the damage reaches the deeper dermis layer
133. D — Because soils that appear similar to the naked eye can have significantly different compositions revealed only through detailed analysis
134. B — Different fiber types burn in characteristic ways — natural fibers like cotton burn with a paper smell and leave ash, while synthetics like polyester melt, drip, and produce chemical odors
135. D — This raises significant privacy and civil liberty concerns — biological samples contain deeply personal genetic information, and collection without charges must balance investigative needs against individual constitutional rights
136. D — Information stored or transmitted in digital form that can be used in an investigation
137. By testing biological evidence preserved from the original crime scene using modern DNA techniques that were unavailable at the time of conviction, proving the convicted person's DNA does not match the evidence
138. Whorls have circular or spiral ridges that form a complete circuit, while loops curve and exit on the same side
139. Glass is a class evidence type — many sources produce glass with similar properties, so fragments indicate possible association but cannot identify one specific source
140. It indicates the possible presence of blood — luminol reacts with the iron in hemoglobin to produce chemiluminescent blue-white light
Matching (Introduction to Forensic Science): 1→A, 2→B, 3→E, 4→C, 5→D
141. C — Tangible objects or materials that can be collected and examined
142. A — Primary transfer occurs through direct contact with the source, while secondary transfer occurs when evidence moves from one intermediate surface to another
143. D — Basic (alkaline) — pH values above 7 indicate a basic substance
144. C — By comparing the chemical composition and chromatographic profiles of ink samples extracted from each document
145. D — Nuclear DNA provides individual identification but requires more cellular material, while mitochondrial DNA is more abundant and survives degradation

better but only identifies maternal lineage, not individuals

146. A — Both eyewitness testimony and microscopic hair comparison have known reliability limitations — eyewitness memory is fallible and hair comparison without DNA is a class-level analysis that cannot identify a specific individual
147. The footprint in snow because it could melt and disappear
148. Fingerprints remain the same throughout a person's life and are unique to each individual, unlike changeable physical features
149. Soil matching the composition of a specific location can place the suspect there, but soil that's common to many areas provides weaker association
150. Thin-layer chromatography
Matching (Introduction to Forensic Science): 1→C, 2→E, 3→B, 4→A, 5→D
151. B — Reliability decreases with each transfer step because the amount of material decreases and alternative explanations for its presence increase
152. B — Rh factor (positive or negative) creates eight possible combinations with ABO types instead of four, further narrowing the potential source population
153. D — The balance should be guided by proportionality (access matching the severity of the investigation), judicial oversight (warrants), data minimization (collecting only what's relevant), transparency, and strong protections against misuse
154. C — To prevent their own DNA and materials from contaminating the evidence
155. B — Specific ridge features like endings, bifurcations, and dots used to compare prints
156. C — Because ink formulations can change between manufacturing batches, production dates, or product line updates by the manufacturer
157. Different countries have different digital privacy laws, extradition treaties may not cover cybercrime, language barriers affect evidence analysis, and servers in multiple jurisdictions complicate data access and legal authority
158. When a person is found guilty of a crime they did not commit, often due to flawed evidence, false testimony, or systemic errors in the justice process
159. To create a permanent record of where everything was originally located
160. Automated Fingerprint Identification System — a computerized database that rapidly searches and compares fingerprint records
Matching (Introduction to Forensic Science): 1→C, 2→D, 3→B, 4→E, 5→A

- 161. To get a closer look at the evidence... plate!
- 162. "I've got you covered -- literally!"
- 163. They always dusted off your problems!
- 164. "I see right through you!"
- 165. Because it was always running with different dyes!
- 166. An undercover agent!

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