

Forensic Science 21 March 2025 Shift 1

Time Allowed :1.5 Hours	Maximum Marks :300	Total questions : 75
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General Instructions

General Instructions:

1. Question Paper contains 75 Questions .
2. Each correct answer will have +4 marks and wrong answer will lead to -1

1. What is the basic sequence of operation of the key /bar type writer?

- A. The typist strikes the key on the keyboard
- B. The ribbon transfers the impression to the sheet of paper behind it and the platen absorbs the force of the strike
- C. As the key bar falls back into place, the carriage usually moves one unit to the next typing space and ribbon advances
- D. The type block strikes the ribbon
- E. Through mechanical linkage or electric triggering, a type bar is thrown up from the type basket towards the platen

(1) A, E, D, B, C

(2) C, A, D, E, B

(3) A, B, C, D, E

(4) C, E, A, B, D

Correct Answer: (1) A, E, D, B, C

Solution: The operation of a mechanical typewriter follows a precise mechanical sequence.

Step 1: The process begins with the user's action.

A. The typist strikes the key on the keyboard.

Step 2: This action initiates a series of linked movements.

E. Through mechanical linkage, the key press causes the corresponding type bar to be thrown from the basket towards the platen (the roller holding the paper).

Step 3: The type bar makes contact to create the impression.

D. The type block (the character head on the bar) strikes the ink ribbon.

Step 4: The character is transferred to the paper.

B. The ribbon, now pressed by the type block, transfers its ink to the paper. The platen provides a hard surface for the impression.

Step 5: The machine resets for the next character.

C. As the type bar returns to the basket, a mechanism engages to move the carriage one space over and advance the ribbon slightly to present a fresh ink surface.

This logical flow matches the sequence A, E, D, B, C.

Quick Tip

Think of the typewriter as a chain reaction. The typist's finger press is the trigger, leading to the type bar's movement, the strike through the ribbon, and finally the carriage advancing. Each step logically follows the previous one.

2. Which one of the following confirms the ante-mortem hanging?

- (1) Dripping of Saliva
- (2) Fracture of femur bone
- (3) Post-mortem caloricity
- (4) Presence of vomit

Correct Answer: (1) Dripping of Saliva

Solution: Ante-mortem hanging means the person was alive when the hanging occurred. We need to find a sign that indicates a vital reaction (a reaction of a living body).

Step 1: Analyze the options.

(1) Dripping of Saliva: Saliva production is a physiological process that occurs in a living person. In hanging, pressure on the salivary glands and stimulation of certain nerves can cause excess salivation, which then drips down the chin and chest. This is a strong indicator of ante-mortem hanging.

(2) Fracture of femur bone: This is not typically associated with hanging and is not a vital reaction.

(3) Post-mortem caloricity: This refers to a rise in body temperature after death, a post-mortem phenomenon, not an ante-mortem sign.

(4) Presence of vomit: While this can happen before death, it is not a specific or reliable indicator of ante-mortem hanging, as it can occur for many reasons.

Step 2: Conclude. The most reliable sign among the choices that confirms the hanging occurred while the individual was alive is the dripping of saliva due to vital physiological reactions.

Quick Tip

In forensic pathology, distinguishing between ante-mortem (before death) and post-mortem (after death) injuries is crucial. Look for "vital signs" – evidence of the body's reaction to injury, such as inflammation, hemorrhage, or physiological responses like salivation.

3. In death due to drowning, diatoms are found in which of these samples?

- (1) Nails
- (2) Hair
- (3) Femur
- (4) Fingerprints

Correct Answer: (3) Femur

Solution: The diatom test is used to confirm death by drowning.

Step 1: Understand the mechanism. When a person drowns, they inhale water. If they are alive, their heart is still beating. The inhaled water, containing microscopic algae called diatoms, enters the lungs.

Step 2: Diatom circulation. From the lungs, the diatoms pass through the damaged alveolar-capillary walls into the bloodstream. The circulatory system then distributes them throughout the body.

Step 3: Deposition. The diatoms are filtered out and deposited in various organs, particularly the bone marrow, which is well-protected from contamination. The femur (thigh bone) is a large bone with abundant marrow, making it an ideal sample site.

Step 4: Analyze other options. Nails and hair are external and can be easily contaminated by the water the body is found in. Fingerprints are skin patterns and not a site for diatom deposition. Therefore, the presence of diatoms deep inside the femur marrow is strong evidence of ante-mortem drowning.

Quick Tip

The key to the diatom test is circulation. Diatoms can only reach the bone marrow if the heart was actively pumping blood when the water was inhaled. This makes it a powerful test to differentiate true drowning from a body being dumped in water after death.

4. Searching methods at the scene of a crime from the center of a circle to its radii is known as

- (1) Spiral
- (2) Wheel
- (3) Grid
- (4) Zone or Quad

Correct Answer: (2) Wheel

Solution: Crime scene search patterns are systematic methods to ensure thorough coverage.

Step 1: Analyze the description. The description "from the center of a circle to its radii" suggests a pattern that starts at a central point and moves outwards along straight lines, like the spokes of a wheel.

Step 2: Match description to options.

(1) Spiral Search: Starts at the center and moves in an ever-widening circle, or starts at the perimeter and moves in a contracting circle. This does not involve radii.

(2) Wheel Search (or Radial Search): Investigators start at the center and move outwards along straight lines or "spokes." This perfectly matches the description. It is best used for large, open areas.

(3) Grid Search: A lane search that is conducted in two directions, creating a grid. It's very thorough but doesn't originate from a central point in the described manner.

(4) Zone Search: The scene is divided into zones or quadrants, and each zone is searched separately.

Therefore, the method described is the Wheel search.

Quick Tip

Visualize the search patterns: a spiral looks like a snail shell, a grid looks like a checkerboard, a zone is like cutting a cake into slices, and a wheel looks like the spokes of a bicycle. Associating the name with a visual makes them easy to remember.

5. Who among the following is not associated in the process for exhumation of a dead body?

- (1) District Magistrate
- (2) Sub Divisional Magistrate
- (3) Advocate General
- (4) Judicial Magistrate

Correct Answer: (3) Advocate General

Solution: Exhumation is the act of digging up something buried, especially a dead body. This is a legal procedure.

Step 1: Understand the roles.

(1, 2, 4) District Magistrate, Sub Divisional Magistrate, Judicial Magistrate: These are executive or judicial officers who have the legal authority to order and oversee an exhumation as part of a criminal investigation. Their presence ensures the legality and proper conduct of the procedure.

(3) Advocate General: The Advocate General is the highest law officer of a state government. Their role is to provide legal advice to the government and represent it in court. They are not directly involved in the procedural aspects of a criminal investigation like ordering or supervising an exhumation at a crime scene.

Step 2: Conclude. Based on the roles, the Advocate General is not associated with the on-site process of exhumation.

Quick Tip

Remember the separation of roles in the legal system. Magistrates (executive and judicial) have procedural and investigative authority. Law officers like the Advocate General are primarily involved in legal advice and representation at the governmental and high court level.

6. The witness is first examined in the Hon'ble court by the side which has called him, the examination of such witness is known as

- (1) Cross examination
- (2) Re-examination
- (3) Expert Opinion
- (4) Examination-in-chief

Correct Answer: (4) Examination-in-chief

Solution: The sequence of witness testimony in court follows a specific order.

Step 1: Define Examination-in-chief. This is the first examination of a witness by the party that called them to testify. The purpose is to present their evidence to the court. This exactly matches the scenario described in the question.

Step 2: Define other options for context.

(1) Cross examination: Following the examination-in-chief, the opposing party gets to question the witness. The goal is to test the veracity of their testimony and bring out facts favorable to the opposing side.

(2) Re-examination: After the cross-examination, the original party may ask further questions to clarify any points that arose during the cross-examination.

(3) Expert Opinion: This is a type of evidence given by a qualified expert, not a stage in the examination of a witness.

The correct term for the first examination by the party who called the witness is Examination-in-chief.

Quick Tip

The order is logical: 1. **Chief:** Your side presents its case. 2. **Cross:** The other side challenges it. 3. **Re:** Your side clarifies the challenges.

7. A document compelling the attendance of a witness on a specific day and time in a court of law under penalty is?

- (1) Oath
- (2) Conduct money
- (3) Subpoena
- (4) Perjury

Correct Answer: (3) Subpoena

Solution: Step 1: Analyze the key terms. The question asks for a legal document that "compels attendance" under "penalty."

Step 2: Evaluate the options.

(1) Oath: A solemn promise to tell the truth, taken by a witness before testifying. It does not compel attendance.

(2) Conduct money: Money paid to a witness to cover their travel expenses for attending court. It facilitates attendance but does not legally compel it.

(3) Subpoena: A writ issued by a court to compel a person to appear and testify. Failure to comply can result in penalties, including fines or imprisonment. This perfectly matches the question's description.

(4) Perjury: The criminal offense of lying under oath. This is an act a witness might commit, not the document that calls them to court.

Therefore, the correct answer is Subpoena.

Quick Tip

Break down the word: "sub" (under) and "poena" (penalty). A subpoena is a document that places you "under penalty" if you fail to appear in court.

8. When a dead body is exposed to freezing temperatures, cold stiffening of the body occurs due to solidification of:

- (1) Proteins present in the body
- (2) Carbohydrates present in the body
- (3) Fats present in the body
- (4) Minerals present in the body

Correct Answer: (3) Fats present in the body

Solution: The stiffening of a body in cold temperatures is known as cold stiffening or frost rigor.

Step 1: Differentiate from rigor mortis. Rigor mortis is a chemical change involving the depletion of ATP and binding of actin and myosin in the muscles. Cold stiffening is a physical phenomenon, not a chemical one.

Step 2: Identify the cause of cold stiffening. At freezing temperatures, the fluids and tissues of the body freeze. Subcutaneous and other fats in the body solidify, causing the limbs and tissues to become hard and stiff.

Step 3: Evaluate the options. While all components will freeze, the primary cause of the characteristic hardness and stiffness is the solidification of fats and the freezing of synovial fluid in the joints. Among the given options, the solidification of fats is the most accurate cause.

Quick Tip

Remember the difference: Rigor Mortis is *chemical* (ATP depletion) and disappears with decomposition. Cold Stiffening is *physical* (freezing of fats/fluids) and disappears upon thawing the body.

9. Match the LIST-I (Evidence, etc.) with LIST-II (Example, Construction etc.)

LIST-I

- A. Biological evidence
- B. Latent print evidence
- C. Trace evidence
- D. Digital evidence

LIST-II

- I. Cell phone records
- II. Soil
- III. Fingerprints
- IV. Blood

(1) A - I, B - II, C - III, D - IV

(2) A - IV, B - III, C - II, D - I

(3) A - I, B - II, C - IV, D - III

(4) A - III, B - IV, C - I, D - II

Correct Answer: (2) A - IV, B - III, C - II, D - I

Solution: Let's match each type of evidence in List-I with its correct example in List-II.

A. Biological evidence: This refers to evidence derived from living organisms. Blood (IV) is a primary example of biological evidence. So, **A matches with IV.**

B. Latent print evidence: "Latent" means hidden. This term is most commonly associated with fingerprints (III) that are not visible to the naked eye and require processing to be seen. So, **B matches with III.**

C. Trace evidence: This refers to evidence transferred between objects or people in small quantities. Soil (II) is a classic example of trace evidence that can be transferred on shoes or clothing. So, **C matches with II.**

D. Digital evidence: This is any evidence that exists in a digital format. Cell phone records (I) are a clear example of digital evidence. So, **D matches with I.**

The correct set of matches is A-IV, B-III, C-II, D-I.

Quick Tip

Associate keywords: Biological = Body fluids/tissues; Latent = Hidden (Fingerprints); Trace = Transferred in small amounts (hair, soil, fiber); Digital = Electronic devices.

10. Arrange the working of photo offset machine in the correct sequence.

A. The plate is placed into the printing press.

B. The ink is then transferred to a setting (soft) roller which will come into contact with paper and print.

C. The ink is received by the image on the plate and is rejected in the non exposed areas that receive water.

D. An electrostatic image of the document is transferred to a specially treated plate, then the plate is preserved through a process of heating and the application of chemicals.

(1) A, B, C, D

(2) D, A, C, B

(3) D, C, B, A

(4) C, B, D, A

Correct Answer: (2) D, A, C, B

Solution: Let's break down the process of offset printing.

Step 1: Plate Creation. The first step is to create the printing plate.

D. An image of the document is created on a plate. This is the plate-making stage.

Step 2: Setting up the Press. The created plate is installed in the machine.

A. The plate is placed into the printing press.

Step 3: Inking the Plate. The press then applies ink and water to the plate. Offset lithography works on the principle that oil (ink) and water do not mix.

C. The image area on the plate accepts the ink, and the non-image area accepts water, repelling the ink.

Step 4: Printing. The image is transferred from the plate to the paper.

B. The inked image is transferred from the plate to a rubber blanket (setting roller), and then from the blanket to the paper. This is the "offset" step.

The correct logical sequence is $D \rightarrow A \rightarrow C \rightarrow B$.

Quick Tip

The key to "offset" printing is that the ink is not directly applied to the paper from the plate. It is first "offset" onto a rubber blanket/roller. The sequence is always: Create Plate $\rightarrow$ Install Plate $\rightarrow$ Ink Plate $\rightarrow$ Transfer (Offset) to Paper.

11. The genetic constitution of the combined paternal and maternal DNA responsible for producing the different ABO blood groups is referred as:

- (1) Phenotype
- (2) Genotype
- (3) Multiple genes
- (4) Pseudo genes

Correct Answer: (2) Genotype

Solution: Step 1: Define the key terms.

(1) Phenotype: The observable characteristics of an individual, such as hair color, eye color, or blood type (e.g., Type A, Type B). It is the physical expression of the genes.

(2) Genotype: The specific genetic makeup or set of alleles of an individual. For ABO blood groups, this would be the combination of alleles like IA, IB, or i (e.g., IAIA, IAi, IBIB, IBi, IAIB, ii). The genotype determines the phenotype. The question asks for the "genetic constitution," which is the definition of genotype.

(3) Multiple genes: Refers to traits controlled by more than one gene (polygenic inheritance), which is not the case for the basic ABO system (controlled by one gene with multiple alleles).

(4) Pseudo genes: Segments of DNA that are related to real genes but have lost their protein-coding ability.

Step 2: Conclude. The term for the underlying genetic constitution is the genotype.

Quick Tip

Remember: **Genotype** is the **genetic** code. **Phenotype** is the **physical** appearance or observable trait.

12. The investigation of a crime scene is carried out in the following sequence.

- A. Reconstruction of crime
- B. Crime scene management

C. First officer response

D. Information of crime

(1) D, C, B, A

(2) B, C, D, A

(3) D, A, C, B

(4) C, A, B, D

Correct Answer: (1) D, C, B, A

Solution: A crime scene investigation follows a logical progression of events.

Step 1: The beginning. The process always starts with the report of a potential crime.

D. Information of crime: The authorities are first notified that a crime has occurred.

Step 2: Initial Action. The first person on the scene has critical duties.

C. First officer response: The first responding officer arrives, secures the scene, provides aid if needed, and ensures evidence is not disturbed.

Step 3: Systematic Processing. Once the scene is secure, the detailed investigation begins.

B. Crime scene management: This is the comprehensive phase of processing the scene, including documentation, photography, and evidence collection by the investigative team.

Step 4: Analysis and Conclusion. After all information and evidence is gathered, investigators piece together what happened.

A. Reconstruction of crime: This is the final step, where all the evidence and witness statements are used to formulate a hypothesis of the sequence of events.

The correct logical sequence is $D \rightarrow C \rightarrow B \rightarrow A$.

Quick Tip

Think of it like a story: 1. The event happens (Information). 2. The first character arrives (First Responder). 3. The plot is investigated and clues are gathered (Management/Processing). 4. The mystery is solved (Reconstruction).

13. The term Criminalistics was first coined by:

(1) Edmund Locard

(2) Paul Kirk

(3) Alphonse Bertillon

(4) Henry Fanids (likely a misspelling of Hans Gross) **Correct Answer:** (4) Based on

historical context, the intended answer is Hans Gross. Paul Kirk popularized the term in English.

Solution: Step 1: Analyze the origin of the term. The term "Criminalistics" (in German, "Kriminalistik") was introduced to describe the systematic, scientific approach to crime investigation.

Step 2: Evaluate the contributors.

(1) **Edmund Locard:** A pioneer in forensic science, famous for his "exchange principle" (every contact leaves a trace). He established the first crime lab.

(2) **Paul Kirk:** A prominent American criminalist who was instrumental in developing forensic science in the US. He defined criminalistics as "the science of individualization." He is often credited with coining the term in its modern English usage.

(3) **Alphonse Bertillon:** Developed the system of anthropometry for personal identification.

(4) **Hans Gross:** An Austrian magistrate and professor of criminology, often regarded as the "Father of Criminalistics." He published the book "Handbuch für Untersuchungsrichter als System der Kriminalistik" (Handbook for Examining Magistrates as a System of Criminalistics) in 1893, where he first used the term to describe the synthesis of scientific disciplines for legal investigation. The name "Henry Fanids" in the option is almost certainly a typographical error for Hans Gross.

Conclusion: Hans Gross is historically credited with coining the term.

Quick Tip

Remember Hans Gross as the "grandfather" of the field who first named it "Kriminalistik." Paul Kirk was a key figure in modernizing and defining "Criminalistics" in the English-speaking world.

14. Arrange the following in the correct sequence followed in Ultra Performance Liquid

Chromatography.

A. Mobile phase reservoir

B. Guard column

C. Separation column

D. Detector

(1) A, B, C, D

(2) A, B, D, C

(3) B, A, D, C

(4) C, B, D, A

Correct Answer: (1) A, B, C, D

Solution: The components of a chromatography system are arranged in the order of the fluid's path.

Step 1: The Source. The process starts with the solvent that will carry the sample.

A. Mobile phase reservoir: This holds the solvent (mobile phase) that is pumped through the system.

Step 2: Protection. Before the main separation, the expensive main column is protected.

B. Guard column: This is a small, disposable column placed before the main column to filter out impurities and particles that could damage the separation column.

Step 3: The Main Process. This is where the chemical separation of the sample components occurs.

C. Separation column (or analytical column): This is the heart of the system, where the components of the mixture are separated based on their interaction with the column's stationary phase.

Step 4: The Result. After separation, the components must be detected.

D. Detector: This device measures the components as they exit the column, producing a signal that is recorded as a chromatogram.

The correct sequence for the flow path is $A \rightarrow B \rightarrow C \rightarrow D$.

Quick Tip

Think of it like a train journey. The mobile phase is the train. It starts at the station (**Reservoir**), goes through a security check (**Guard Column**), travels the main route where passengers get off at different stops (**Separation Column**), and finally, the arrival of each passenger group is noted at the destination (**Detector**).

15. What are the precautions taken during fingerprint photography?

- A. The camera should be parallel to the fingerprint
 - B. The scale is to be used with the fingerprint for photography
 - C. The arrangement of light should be even on the fingerprint
 - D. Generally, ultra slow shutter speed is not preferable for fingerprint photography.
- (1) A and B only
(2) B and D only
(3) A and D only
(4) B and C only

Correct Answer: (1) A and B only

Solution: Proper photography is essential for preserving fingerprint evidence.

Step 1: Evaluate each statement.

A. The camera should be parallel to the fingerprint: Correct. The camera lens must be perpendicular to the surface (and parallel to the plane of the print) to avoid perspective distortion. This ensures the fingerprint is recorded in its true shape and size.

B. The scale is to be used with the fingerprint for photography: Correct. A scale (ruler) must be placed on the same plane as the fingerprint and included in the photograph. This allows for creating 1:1 (life-size) prints for comparison.

C. The arrangement of light should be even on the fingerprint: The word "arrangement" is likely a typo for "arranged near" or refers to a lighting technique. The principle is that lighting should be even and oblique (from the side) to maximize contrast and show the ridge detail, not necessarily just "even." The statement is ambiguously worded.

D. Generally, ultra slow shutter speed is not preferable: This statement is about what is

not done. While true (very slow speeds can lead to blur from camera shake), statements A and B are positive descriptions of necessary precautions. In the context of "what precautions are taken," A and B are the most direct and essential rules. Also, using a tripod allows for slow shutter speeds if necessary for depth of field and low light, so this isn't a universal precaution in the same way as A and B.

Step 2: Conclude. Statements A and B are fundamental and universally accepted precautions for forensic fingerprint photography. Therefore, "A and B only" is the best choice.

Quick Tip

For any forensic photography, remember two key rules: 1. No distortion: Keep the camera parallel to the evidence. 2. Record size: Always include a scale in the picture.

16. Arrange the following in correct steps for collection of tool marks from the crime scene.

- A. Trace evidence associated with tool marks should be prevented from loss or contamination
 - B. Marks on metal should be covered with oil to prevent oxidation
 - C. Cast of tool marks should be prepared to take impression or the whole object to be transported to the crime lab
 - D. Close-up photography
- (1) A, D, C, B
 - (2) D, A, B, C
 - (3) C, B, D, A
 - (4) A, C, B, D

Correct Answer: The most logical forensic sequence is not perfectly represented, but a defensible order is $D \rightarrow A \rightarrow C \rightarrow B$. None of the options match this. However, let's analyze the options. Option 2 (D, A, B, C) is plausible if preservation (B) happens before casting (C).

Solution: The collection of tool mark evidence requires a careful, non-destructive sequence.

Step 1: Documentation first. Before anything is touched, the evidence must be documented

in its original state.

D. Close-up photography: The tool mark should be photographed from multiple angles, with and without a scale.

Step 2: Preserve associated evidence. Before handling the primary evidence (the tool mark), any fragile trace evidence must be secured.

A. Trace evidence... should be prevented from loss: Any paint chips, fibers, etc., in or around the mark should be collected.

Step 3: Collect the mark. The next step is to collect the tool mark itself. The primary method is to collect the entire object bearing the mark. If that's not possible, a cast is made.

C. Cast of tool marks should be prepared... or the whole object... transported: This step involves either casting (e.g., with Mikrosil) or removing the section of the object with the mark.

Step 4: Preservation. After collection, the evidence must be preserved for transport and analysis.

B. Marks on metal should be covered with oil to prevent oxidation: This is a preservation step taken after the evidence is collected and documented to prevent rust or degradation.

Conclusion: The most logical and widely taught sequence is: Photograph (D), Collect Trace Evidence (A), Collect Mark/Item (part of C), then Preserve (B). The sequence $D \rightarrow A \rightarrow C \rightarrow B$ is the correct forensic procedure. None of the provided options perfectly match this. Option (2) D, A, B, C reverses the last two steps which is less ideal (you wouldn't typically oil a mark before casting it, as it could interfere with the casting material). There may be an error in the question's options.

Quick Tip

The universal rule for evidence collection is: **Document, then Collect.** First photograph and sketch. Then, collect the most fragile evidence (trace) before moving on to collecting the main item or making casts. Preservation of the collected item is the final step.

17. The Bureau of Police Research and Development (BPR&D) is an agency

functioning under:

- (1) State Government
- (2) Central Government
- (3) Interpol
- (4) United Nations (UN) **Correct Answer:** (2) Central Government

Solution: Step 1: Identify BPR&D. The Bureau of Police Research and Development is a national-level organization in India. Its primary objective is to promote and develop the police forces in the country.

Step 2: Determine its governing body. As a national agency dealing with modernization and standardization of police forces across all states and union territories, it falls under the purview of the central governing body responsible for internal security. In India, this is the Ministry of Home Affairs (MHA).

Step 3: Conclude. The Ministry of Home Affairs is a part of the Central Government of India. Therefore, the BPR&D functions under the Central Government.

Quick Tip

National-level research, development, and standard-setting bodies for internal security (like police and paramilitary forces) in India typically fall under the Ministry of Home Affairs, which is part of the Central Government.

18. Non identity of questioned writings can be established by comparing it with known writings, if:

- A. A known and questioned writings have a considerable number of general similarities that outnumber a few fundamental repeated differences.
- B. The presence of a combination of identifying attributes and a coexistent lack of basic divergences between questioned and known writings.
- C. The presence of a combination of identifying attributes and coexistence of a few basic divergences between questioned and known writings.
- D. If known and questioned writings are very much alike but not identical.

(1) A, B and C only

(2) B, C and D only

(3) A, C and D only

(4) A, B and D only **Correct Answer:** Statement A is the only one that correctly describes

the principle of establishing non-identity. The provided options appear to be flawed.

Solution: This question addresses the core principles of handwriting examination. The goal is to determine which condition establishes **non-identity** (i.e., the documents were written by different people).

Step 1: Analyze the fundamental principle. The principle of handwriting identification states that non-identity is established by the presence of fundamental, repeated, unexplainable differences between the questioned and known writing, even if there are superficial similarities. Identity is established by a combination of unique characteristics and the absence of such fundamental differences.

Step 2: Evaluate each statement based on this principle.

A. ...similarities that outnumber a few fundamental repeated differences. This describes a scenario where, despite similarities (which can occur by chance or imitation), there are critical, consistent differences. According to the principle, these **fundamental repeated differences establish non-identity**.

B. ...identifying attributes and a lack of basic divergences. This is the definition of a match. This condition **establishes identity**.

C. ...identifying attributes and coexistence of a few basic divergences. "A few basic divergences" usually refers to natural variation, which is expected in the writing of a single person. This condition **establishes identity**.

D. ...very much alike but not identical. This is the hallmark of genuine writing by the same person, accounting for natural variation. This condition **establishes identity**.

Conclusion: Only statement A describes a condition for establishing non-identity.

Statements B, C, and D all describe conditions for establishing identity. Therefore, none of the multiple-choice options provided are correct based on accepted forensic document examination principles. The question or its options are fundamentally flawed.

Quick Tip

In handwriting analysis, **differences are more significant than similarities**. A single, repeated, fundamental difference is enough to conclude non-identity. Similarities can be coincidental or imitated, but it's nearly impossible for a person to have fundamental differences from their own natural writing.

19. The full form of CBI is?

- (1) Criminal Bureau of Investigation
- (2) Central Bureau of Investigation
- (3) Civil Bureau of Investigation
- (4) Criminal Base of Investigators **Correct Answer:** (2) Central Bureau of Investigation

Solution: Step 1: Analyze the acronym. The question asks for the full form of the acronym CBI.

Step 2: Recall the name. CBI is the premier investigating agency of India. Its full name is the Central Bureau of Investigation. It operates under the jurisdiction of the Ministry of Personnel, Public Grievances and Pensions.

Step 3: Compare with options. The name "Central Bureau of Investigation" matches option (2) exactly. The other options are incorrect variations.

Quick Tip

The "C" in CBI stands for "Central," reflecting its role as a national investigative agency for the central government of India, as opposed to state-level police forces.

20. Which of the following is not a factor in Daubert Standard?

- (1) Whether the theory or technique can be tested
- (2) Whether the expert is Internationally certified
- (3) Whether the methodology has been peer reviewed
- (4) Known or potential error rate of the method

Correct Answer: (2) Whether the expert is Internationally certified

Solution: The Daubert Standard is a set of criteria used by US federal courts to assess the admissibility of scientific expert testimony.

Step 1: Recall the core factors of the Daubert Standard. The key criteria are:

- **Testability:** Can the scientific theory or technique be empirically tested? (Matches option 1)
- **Peer Review and Publication:** Has the methodology been subjected to peer review and published in scientific literature? (Matches option 3)
- **Error Rate:** What is the known or potential error rate of the method? (Matches option 4)
- **General Acceptance:** Is the technique generally accepted in the relevant scientific community? (This was the older Frye standard, but it is still considered a factor under Daubert).

Step 2: Evaluate the given options. Options (1), (3), and (4) are all explicit factors of the Daubert Standard. Option (2), concerning international certification of the expert, is not a specific criterion. While an expert's qualifications are assessed, the Daubert standard focuses on the *methodology*, not the expert's personal certifications.

Quick Tip

Remember the Daubert Standard focuses on the **science**, not the **scientist**. It asks: Is the *method* testable, peer-reviewed, with a known error rate, and generally accepted? It does not ask if the *person* has a specific certificate.

21. Match the LIST-I with LIST-II

LIST-I

LIST-II

- | | |
|---------------------|--------------------------|
| A. Calvin Goddard | I. Forensic Toxicology |
| B. Karl Landsteiner | II. Forensic Ballistics |
| C. Albert Osborn | III. Blood Grouping |
| D. Mathieu Orfila | IV. Document examination |

(1) A - III, B - IV, C - I, D - II

(2) A - IV, B - II, C - I, D - III

(3) A - II, B - III, C - IV, D - I

(4) A - II, B - IV, C - III, D - I

Correct Answer: (3) A - II, B - III, C - IV, D - I

Solution: Let's match the pioneers of forensic science with their respective fields.

A. Calvin Goddard: He is considered the father of modern forensic ballistics, known for pioneering the use of the comparison microscope for firearm identification. So, **A matches with II.**

B. Karl Landsteiner: He discovered the ABO blood groups in 1901, which is the foundation of blood grouping and modern transfusion medicine. So, **B matches with III.**

C. Albert S. Osborn: He was a pioneer in the field of questioned document examination in North America, authoring the influential text "Questioned Documents." So, **C matches with IV.**

D. Mathieu Orfila: He is considered the father of modern toxicology. He was the first to use microscopy to assess blood and semen stains and made significant contributions to the study of poisons. So, **D matches with I.**

The correct set of matches is A-II, B-III, C-IV, D-I.

Quick Tip

Associate names with keywords: **Goddard** = Guns (Ballistics); **Landsteiner** = Land of blood (Blood grouping); **Osborn** = Old documents (Document examination); **Orfila** = Awful poison (Toxicology).

22. Which of the following properties of the glass plays a key role in the Beckline method?

- (1) Melting point
- (2) Type of fracture
- (3) Refractive Index
- (4) It's manufacturing

Correct Answer: (3) Refractive Index

Solution: Step 1: Understand the Becke Line Method. The Becke line test is an immersion method used in optical mineralogy and forensic glass analysis. It is used to determine the relative refractive index of a transparent solid (like a glass fragment) compared to a liquid it is immersed in.

Step 2: Describe the process. A glass fragment is placed in a calibrated liquid of a known refractive index. When viewed under a microscope, a halo of light, known as the "Becke line," appears around the fragment. By adjusting the focus, the line will move into the medium with the higher refractive index. The liquid is changed until the Becke line disappears, indicating that the refractive index of the glass and the liquid are the same.

Step 3: Conclude. The entire method is based on observing the behavior of light as it passes through the boundary of two substances with different refractive indices. Therefore, the Refractive Index is the key property.

Quick Tip

The Becke line method is all about matching the **refractive index** of a glass fragment to that of a series of calibrated liquids. When the "halo" (Becke line) disappears, you've found the match.

23. The Government of India Printing press to print banknotes in India is located at?

- (1) Chennai
- (2) Nasik
- (3) New Delhi
- (4) Kolkata **Correct Answer:** (2) Nasik

Solution: Step 1: Identify banknote printing presses in India. The Security Printing and Minting Corporation of India Limited (SPMCIL) operates the currency printing presses in India.

Step 2: Locate the presses. There are four currency printing presses in India:

- Currency Note Press in Nashik, Maharashtra.
- Bank Note Press in Dewas, Madhya Pradesh.

- Bharatiya Reserve Bank Note Mudran Private Limited (BRBNMPL) in Mysuru, Karnataka.
- BRBNMPL in Salboni, West Bengal.

Step 3: Check the options. Of the cities listed in the options, only Nashik hosts a government press for printing banknotes.

Quick Tip

Remember the two main government-run banknote presses are in **Nashik** (Maharashtra) and **Dewas** (Madhya Pradesh). The other two are managed by the RBI.

24. Which of the following can be classified by Henry's system of classification?

- (1) Questioned documents
- (2) Digital evidences
- (3) Poisons
- (4) Fingerprints

Correct Answer: (4) Fingerprints

Solution: Step 1: Identify the Henry Classification System. The Henry Classification System is a method of classifying and filing fingerprints, developed by Sir Edward Henry in the late 19th and early 20th centuries.

Step 2: Understand its purpose. It was a long-standing method used by law enforcement agencies to organize large collections of ten-print fingerprint cards for criminal records. It assigns a numerical value to each finger based on the presence of a whorl pattern.

Step 3: Evaluate the options. The system is exclusively designed for the classification of fingerprints. It is not applicable to questioned documents, digital evidence, or poisons.

Quick Tip

The Henry Classification System is one of the most famous historical methods associated with a specific type of forensic evidence: **fingerprints**.

25. A DNA Expert in a forensic science laboratory confirms:

- A. Toxin in exhibit
- B. Age of individual
- C. Identity of an individual
- D. Gender of an individual
- E. Height of an individual

- (1) A, B and E
- (2) B, C and E
- (3) B, C and D
- (4) A, C and E

Correct Answer: An option with C and D is the most accurate. The options provided seem flawed. The closest correct choice would be one containing C and D.

Solution: Let's analyze what can be determined from a typical forensic DNA profile.

A. Toxin in exhibit: This is determined by toxicological analysis, not DNA analysis.

B. Age of individual: Standard forensic DNA profiling cannot determine a person's chronological age. Advanced research methods (epigenetic markers) are being developed for this, but it's not a routine confirmation.

C. Identity of an individual: This is the primary purpose of forensic DNA analysis. By comparing a questioned sample to a known sample, identity can be confirmed or excluded to a high degree of statistical certainty.

D. Gender of an individual: Yes, the gender can be determined by looking for the presence of X and Y chromosomes (e.g., using the Amelogenin marker).

E. Height of an individual: DNA cannot determine a person's height.

Conclusion: A DNA expert can reliably confirm the Identity (C) and Gender (D) of an individual. None of the provided options list just C and D. Option (3) includes Age (B), which is incorrect. There is an error in the question's options.

Quick Tip

Remember, standard forensic DNA profiling answers two main questions: **"Who is it?"** (Identity) and **"Is it male or female?"** (Gender). It doesn't tell you age, height, or what substances they've ingested.

26. Match the LIST-I with LIST-II

LIST-I

LIST-II

- | | |
|---------------|--|
| A. Ridges | I. Two most inner ridges which start parallel, diverge and surround or tend to surround the pattern area |
| B. Type Lines | II. A single ridge bifurcates and reunites to enclose some space |
| C. Delta | III. The raised portion of the friction skin of the fingers |
| D. Enclosure | IV. The ridge characteristics nearest to the point of divergence of type lines |

(1) A - III, B - II, C - I, D - IV

(2) A - IV, B - II, C - III, D - I

(3) A - III, B - I, C - IV, D - II

(4) A - III, B - I, C - II, D - IV

Correct Answer: (3) A - III, B - I, C - IV, D - II

Solution: Let's match the fingerprint terminology with their correct definitions.

A. Ridges: These are the fundamental features of a fingerprint. They are the raised portions of the skin. So, **A matches with III.**

B. Type Lines: These are the two innermost ridges that start parallel and then diverge to surround the pattern area of a loop or whorl. They define the boundaries of the pattern. So, **B matches with I.**

C. Delta: This is a triangular-shaped feature found in loops and whorls. It is located at or nearest to the point of divergence of the two type lines. So, **C matches with IV.**

D. Enclosure (or Lake): This is a minutia or ridge characteristic where a single ridge splits into two and then rejoins a short distance later, forming a small enclosed space. So, **D matches with II.**

The correct set of matches is A-III, B-I, C-IV, D-II.

Quick Tip

Visualize the fingerprint pattern: **Ridges** are the hills. **Type Lines** are the diverging highways around the main pattern. The **Delta** is the triangular interchange where the highways split. An **Enclosure** is a small traffic island where a road splits and rejoins.

27. For voice analysis, the exhibits are forwarded to _____ division of the Forensic Science Laboratory.

- (1) Chemistry
- (2) Physics
- (3) Ballistics
- (4) Documents

Correct Answer: (2) Physics

Solution: Step 1: Understand voice analysis. Voice analysis (forensic phonetics or speaker identification) involves the scientific analysis of speech sounds. It deals with physical properties of sound waves like frequency (pitch), amplitude (loudness), and spectral characteristics (voice quality or timbre).

Step 2: Relate to scientific disciplines. The study of sound waves and their physical properties is a fundamental branch of Physics. Forensic physics divisions in laboratories handle a variety of evidence types involving physical measurements, including acoustics (sound), optics (glass), and mechanics (tool marks).

Step 3: Evaluate other options. Chemistry deals with substances and chemical reactions. Ballistics deals with firearms. Documents division deals with handwriting and print. The Physics division is the most appropriate for analyzing the physical characteristics of a voice recording.

Quick Tip

Think about the fundamental nature of the evidence. A voice is sound, and sound is a physical wave. Therefore, voice analysis belongs to the **Physics** division.

28. Which of the following statements correctly explains the relationship between force and momentum?

- (1) The rate of change of momentum of a body is directly proportional to the applied force and occurs in the direction of the force.
- (2) The rate of change of momentum of a body is inversely proportional to the applied force and always oppose the direction of the force.
- (3) The rate of change of momentum of a body is proportional to the square of the applied force and takes place in the direction opposite to the force.
- (4) The rate of change of momentum of a body is independent of the applied force but depends on the direction of motion of the body.

Correct Answer: (1) The rate of change of momentum of a body is directly proportional to the applied force and occurs in the direction of the force.

Solution: This question describes Newton's Second Law of Motion.

Step 1: State Newton's Second Law. Newton's Second Law states that the net force acting on an object is equal to the rate at which its momentum changes. Mathematically, this is expressed as $F = \frac{dp}{dt}$, where F is the force, p is the momentum, and t is time.

Step 2: Analyze the relationship. The formula $F = \frac{dp}{dt}$ shows that the force (F) is directly proportional to the rate of change of momentum ($\frac{dp}{dt}$). Force and momentum are vector quantities, and the law specifies that the change in momentum occurs in the same direction as the applied net force.

Step 3: Evaluate the options.

- Option (1) correctly states this relationship: "directly proportional to the applied force and occurs in the direction of the force."
- Option (2), (3), and (4) state incorrect relationships (inversely proportional, proportional to the square, independent).

Therefore, option (1) is the correct statement of the law.

Quick Tip

Newton's Second Law is often simplified to $F = ma$, but its more fundamental and complete definition is in terms of momentum: Force is the rate of change of momentum ($F = \frac{\Delta p}{\Delta t}$).

29. While casting a footwear print on sand, which of the following should be used prior to casting?

- (1) Melted candle wax
- (2) Shellac in alcohol spray
- (3) Shellac in water spray
- (4) Talcum powder

Correct Answer: (2) Shellac in alcohol spray

Solution: Step 1: Identify the problem. Casting a print in a loose substrate like sand is difficult because the weight of the casting material (e.g., dental stone) can destroy the impression. Therefore, the impression must be stabilized or "fixed" first.

Step 2: Evaluate the options as fixatives.

(1) Melted candle wax: This would be too heavy and hot, destroying the delicate details of the print.

(2) Shellac in alcohol spray: This is a standard technique. A light mist of a fixative spray, like shellac dissolved in alcohol, is applied from a distance. The alcohol evaporates quickly, leaving a thin, hard layer of shellac that stabilizes the sand particles without disturbing the print.

(3) Shellac in water spray: Water would likely cause the sand to clump and lose detail. The solvent needs to evaporate quickly, which is why alcohol is used.

(4) Talcum powder: This is sometimes used to provide contrast for photography, but it is not a fixative and would not stabilize the print for casting.

Conclusion: Shellac in alcohol spray is the correct material used as a fixative before casting

in sand.

Quick Tip

For delicate impressions in loose soil or sand, always think "fix before you cast." A fine aerosol spray fixative, like hairspray or shellac in alcohol, is the standard method.

30. The study which involves the examination and analysis of soil is known as:

- (1) Phrenology
- (2) Pedology
- (3) Petrology
- (4) Podology **Correct Answer:** (2) Pedology

Solution: Step 1: Define the terms.

(1) Phrenology: A pseudoscience involving the measurement of bumps on the skull to predict mental traits.

(2) Pedology: The branch of science concerned with the study of soil in its natural environment. It deals with soil formation, classification, and mapping. This is the correct term for the scientific study of soil.

(3) Petrology: The branch of geology that studies rocks and the conditions under which they form. While related, it focuses on rocks, not soil.

(4) Podology: An older term for Podiatry, the study and treatment of disorders of the foot, ankle, and lower extremity.

Conclusion: The correct term for the study of soil is Pedology.

Quick Tip

Connect the roots: *Pedon* is Greek for "soil" or "earth." *Petro* is Greek for "rock." *Podos* is Greek for "foot." This helps distinguish Pedology, Petrology, and Podology.

31. Among the given options, select the parts which are present in UV visible spectrophotometer.

- A. Interferometer
- B. Monochromator
- C. Hollow cathode lamp
- D. Deuterium lamp

- (1) B and D only
- (2) A and B only
- (3) B and C only
- (4) A and D only

Correct Answer: (1) B and D only

Solution: Let's identify the essential components of a UV-Visible Spectrophotometer.

Step 1: Analyze the required components. A UV-Vis spectrophotometer needs:

- A light source that covers the UV and visible range.
- A device to select a specific wavelength of light.
- A sample holder.
- A detector.

Step 2: Evaluate the options.

A. Interferometer: This is the key component of an FTIR (Fourier Transform Infrared) spectrometer, not a UV-Vis instrument.

B. Monochromator: This device (using a prism or diffraction grating) is used to select a narrow band of wavelengths from the source light. This is an essential part of a UV-Vis spectrophotometer.

C. Hollow cathode lamp: This is a specific type of lamp used as a light source in Atomic Absorption Spectroscopy (AAS), not UV-Vis.

D. Deuterium lamp: This is the standard light source used to provide radiation in the ultraviolet (UV) range (typically 190-400 nm) in a UV-Vis spectrophotometer. (A tungsten lamp is used for the visible range).

Conclusion: The Monochromator (B) and the Deuterium lamp (D) are both essential components of a UV-Vis spectrophotometer.

Quick Tip

Associate components with instruments:

- **UV-Vis:** Deuterium/Tungsten Lamp + Monochromator
- **AAS:** Hollow Cathode Lamp
- **FTIR:** Interferometer

32. As per the Mendelian inheritance pattern for the ABO blood group, which of these is incorrect with respect to the blood group of the child?

- (1) Mother and Father both have "O" blood group and Child has "A" blood group
- (2) Mother, Father and Child all have "A" blood group
- (3) Mother has "A" blood group, Father has "B" blood group and Child has "AB" blood group
- (4) Mother and child has "O" blood group and Father has "B" blood group

Correct Answer: (1) Mother and Father both have "O" blood group and Child has "A" blood group

Solution: The ABO blood groups are determined by three alleles: I^A , I^B , and i . A child inherits one allele from each parent.

- Genotype for Type O is ii . - Genotype for Type A is $I^A I^A$ or $I^A i$. - Genotype for Type B is $I^B I^B$ or $I^B i$. - Genotype for Type AB is $I^A I^B$.

Step 1: Evaluate each option.

(1) Mother (O) has genotype ii . Father (O) has genotype ii . They can only pass on the i allele to their child. Therefore, their child MUST have genotype ii and be blood type O. A child with blood group "A" is impossible. **This statement is incorrect.**

(2) Mother, Father, and Child all have "A". This is possible. For example, if both parents have genotype $I^A i$, they can have a child with genotype $I^A I^A$ or $I^A i$ (Type A).

(3) Mother (A) and Father (B). This is possible. If Mother is $I^A i$ and Father is $I^B i$, they can have a child with genotype $I^A I^B$ (Type AB).

(4) Mother (O) and Child (O), Father (B). This is possible. Mother (ii) gives an i allele. For

the child to be O (ii), they must also get an i allele from the father. This is possible if the father has genotype $I^B i$.

Conclusion: The scenario in option (1) violates the laws of Mendelian inheritance.

Quick Tip

The golden rule for ABO inheritance: **Two Type O parents can ONLY have Type O children.** This is because they both have the genotype ii and can only pass on the recessive i allele.

33. The angle or inclination of the axis of letters relative to the baseline is known as:

- (1) Baseline
- (2) Baseline alignment
- (3) Alignment
- (4) Slant

Correct Answer: (4) Slant

Solution: This question relates to the characteristics of handwriting.

Step 1: Define the terms.

- (1) **Baseline:** The real or imaginary line upon which the letters rest.
- (2) & (3) **Alignment:** Refers to the arrangement of letters and words in relation to the baseline. For example, the writing may follow the baseline, or trend upwards or downwards.
- (4) **Slant:** Refers to the angle of the writing. It is the inclination of the axes of the letters relative to the perpendicular of the baseline. It can be forward (right-slanted), backward (left-slanted), or vertical.

Conclusion: The definition given in the question perfectly matches the definition of Slant.

Quick Tip

Think of it visually: **Baseline** is the road. **Alignment** is whether the car is driving straight on the road or veering up or down. **Slant** is how much the passengers are leaning to the right or left.

34. Which of the following detectors can be coupled with a gas chromatographic system?

- A. Thermal conductivity detector
- B. Photo diode-array detector
- C. Flame ionization detector
- D. Electro chemical detector

- (1) A and D only
- (2) C and D only
- (3) A and C only
- (4) B and D only

Correct Answer: (3) A and C only

Solution: Gas chromatography (GC) separates volatile compounds in a gas phase. The detectors must be able to detect these compounds as they exit the column.

Step 1: Evaluate the detectors.

A. Thermal Conductivity Detector (TCD): A very common, universal detector for GC. It measures the change in thermal conductivity of the carrier gas caused by the sample components. It is non-destructive.

B. Photo Diode-Array Detector (PDA): This is a type of UV-Vis detector used for High-Performance Liquid Chromatography (HPLC), not GC. It detects compounds in a liquid stream.

C. Flame Ionization Detector (FID): A very common and sensitive detector for GC, especially for organic compounds. It burns the sample components in a hydrogen flame, creating ions that generate a current. It is destructive.

D. Electro chemical detector: These detectors are typically used in liquid chromatography (HPLC) or for specific gas sensors, but are not standard detectors coupled with general-purpose GC systems.

Conclusion: The Thermal Conductivity Detector (A) and the Flame Ionization Detector (C) are two of the most widely used detectors for gas chromatography.

Quick Tip

For Gas Chromatography, the two workhorse detectors to remember are **TCD** (Thermal Conductivity Detector - universal, non-destructive) and **FID** (Flame Ionization Detector - sensitive for organics, destructive).

35. Which of the following is the correct sequence for restriction fragment length polymorphisms (RFLP) steps sequence?

- A. Probing hybridization of separated DNA.
- B. Blotting of digested DNA onto a membrane.
- C. Isolation and restriction digestion of the DNA.
- D. Visualization by autoradiography.

- (1) A, B, C, D
- (2) C, B, A, D
- (3) B, A, D, C
- (4) C, B, D, A

Correct Answer: (2) C, B, A, D

Solution: RFLP is a multi-step DNA analysis technique. Let's arrange the steps in logical order.

Step 1: Prepare the DNA. The process must start with the DNA itself.

C. Isolation and restriction digestion of the DNA: First, DNA is extracted from the sample. Then, restriction enzymes are used to cut the DNA into fragments of different sizes. (After this, the fragments are separated by size using gel electrophoresis, which is an implicit step).

Step 2: Transfer the DNA. The DNA fragments from the gel must be transferred to a more stable medium for analysis.

B. Blotting of digested DNA onto a membrane: The separated DNA fragments are transferred from the gel to a nylon membrane in a process called Southern blotting.

Step 3: Label the DNA. Specific fragments of interest must be identified.

A. Probing hybridization of separated DNA: A radioactive or fluorescent probe (a short, known DNA sequence) is added. It binds (hybridizes) to its complementary sequence among

the DNA fragments on the membrane.

Step 4: Detect the Labeled DNA. The location of the bound probe must be made visible.

D. Visualization by autoradiography: If a radioactive probe was used, the membrane is placed against an X-ray film. The radioactivity exposes the film, creating a band pattern that reveals the location of the specific DNA fragments.

The correct sequence is $C \rightarrow B \rightarrow A \rightarrow D$.

Quick Tip

Remember the RFLP/Southern Blotting sequence with the acronym **DBAV**: **D**igest $\rightarrow$ **B**lot $\rightarrow$ **A**dd Probe (Hybridize) $\rightarrow$ **V**isualize.

36. Which of the following produce antibodies directly?

- (1) B-lymphocytes
- (2) Helper T cells
- (3) Nerve cells
- (4) T-lymphocytes

Correct Answer: (1) B-lymphocytes

Solution: Step 1: Understand antibody function. Antibodies (immunoglobulins) are proteins used by the immune system to identify and neutralize foreign objects like bacteria and viruses.

Step 2: Identify the antibody-producing cells. The cells responsible for producing antibodies are a type of white blood cell.

(1) B-lymphocytes: When a B-lymphocyte is activated by an antigen, it differentiates into a plasma cell. Plasma cells are veritable antibody factories, producing large quantities of antibodies specific to the antigen that triggered the response. Therefore, B-lymphocytes are the direct producers.

(2) & (4) Helper T cells & T-lymphocytes: T-cells are crucial for the immune response, but they do not produce antibodies themselves. Helper T-cells help activate B-cells and other immune cells, acting as managers of the immune response.

(3) Nerve cells: These are part of the nervous system and have no role in antibody production.

Conclusion: B-lymphocytes (specifically, their differentiated form, plasma cells) are the cells that directly produce antibodies.

Quick Tip

Remember: **B** cells make antibodies. **T** cells are the commanders; they tell other cells (like B-cells) what to do.

37. Which of the following is correct about alpha-keratin in hair?

- (1) It is alpha-helix, cross-linked by disulfide bonds.
- (2) It is alpha-helix, but not cross-linked by disulfide bonds.
- (3) It is alpha-fold, but not cross-linked by disulfide bonds.
- (4) It is beta-sheet, cross-linked by disulfide bonds.

Correct Answer: (1) It is alpha-helix, cross-linked by disulfide bonds.

Solution: Step 1: Identify the protein. Keratin is the primary structural fibrous protein that makes up hair, feathers, horns, claws, and hooves.

Step 2: Determine the secondary structure. In mammals, the keratin in hair is α -keratin. The secondary structure of α -keratin is the α -helix. (Beta-sheets are characteristic of β -keratins found in reptiles and birds).

Step 3: Identify the cross-linking. The strength and insolubility of hair keratin come from extensive cross-linking between the α -helical protein chains. These cross-links are primarily disulfide bonds, formed between cysteine amino acid residues.

Step 4: Evaluate the options. Option (1) correctly states both key features: an alpha-helix structure and cross-linking by disulfide bonds. The other options are incorrect regarding either the structure or the cross-linking.

Quick Tip

For hair, think α -keratin = α -helix. The strength and permanence of hair structure (like in a "perm") comes from the strong disulfide bonds that link these helices together.

38. What fundamental concepts are demonstrated by Young's Double slit experiment

- A. All light behaves as particle
- B. Light exhibits wave like behaviour
- C. The formation of bright and dark fringes through interference
- D. Reflection of light from surface
- E. Interference pattern produced using mono chromatic light

(1) B, C and E only

(2) A, B and D only

(3) A, C and D only

(4) B, C and D only **Correct Answer:** (1) B, C and E only

Solution: Young's Double Slit experiment is a cornerstone of physics that reveals the nature of light.

Step 1: Analyze the experiment. In the experiment, a single light source (monochromatic) is passed through two narrow, parallel slits. The light then lands on a screen behind the slits.

Step 2: Evaluate the outcomes and concepts.

A. All light behaves as particle: Incorrect. If light were only particles, two bright lines would appear on the screen directly behind the slits. The experiment's result contradicts this.

B. Light exhibits wave like behaviour: Correct. The resulting pattern of multiple bright and dark bands can only be explained if light behaves as a wave, with the waves from each slit interfering with each other.

C. The formation of bright and dark fringes through interference: Correct. This is the direct observation from the experiment. Bright fringes are constructive interference, and dark fringes are destructive interference.

D. Reflection of light from surface: Incorrect. The experiment demonstrates diffraction (bending of waves around the slits) and interference, not reflection.

E. Interference pattern produced using mono chromatic light: Correct. Using monochromatic light (light of a single wavelength) is crucial to get a clear, stable interference pattern.

Conclusion: The concepts demonstrated are B, C, and E.

Quick Tip

Young's Double Slit experiment is the ultimate proof of light's **wave nature**. The key observation is the **interference pattern** (fringes), which is most clearly seen with **monochromatic** light.

39. Which of the following is correct about saliva?

- (1) Alpha-amylase is the only enzyme found in saliva.
- (2) Saliva has salivary pepsin
- (3) Saliva has alpha-amylase and lysozyme
- (4) Lysozyme is the only enzyme found in saliva. **Correct Answer:** (3) Saliva has alpha-amylase and lysozyme

Solution: Let's examine the enzymatic content of human saliva.

Step 1: Identify major enzymes in saliva.

- **Alpha-amylase (also called ptyalin):** This is a primary enzyme in saliva that begins the process of starch digestion by breaking it down into smaller sugars.
- **Lysozyme:** This enzyme has antibacterial properties. It breaks down the cell walls of certain bacteria, providing a first line of defense against oral infections.
- **Lingual lipase:** Secreted by glands on the tongue, it begins the digestion of fats, although it is mostly activated in the acidic environment of the stomach.

Step 2: Evaluate the options.

- (1) & (4) These are incorrect because saliva contains multiple enzymes, including both alpha-amylase and lysozyme.
- (2) Saliva does not contain pepsin. Pepsin is a protease found in the stomach that digests proteins.

(3) This statement is correct. Saliva contains both alpha-amylase for digestion and lysozyme for antibacterial action.

Quick Tip

Remember saliva has two main jobs to start with: **Digestion** (with amylase for carbs) and **Defense** (with lysozyme against bacteria).

40. From the given options, which is not the type of primary incision?

- A. U shaped
 - B. Y-shaped
 - C. Modified-Y shaped
 - D. I-shaped
 - E. T-shaped
- (1) A and E only
 - (2) B and C only
 - (3) C and E only
 - (4) A and D only

Correct Answer: (1) A and E only

Solution: Step 1: Identify standard autopsy incisions. Primary incisions are the initial cuts made to open the body cavities for examination. The most common types are:

- **I-shaped incision (D):** A single vertical cut from the neck to the pubic bone.
- **Y-shaped incision (B):** Incisions from each shoulder meeting at the sternum, then proceeding down to the pubic bone as a single cut. This is the most common method.
- **Modified-Y shaped incision (C):** A variation of the Y-incision.

Step 2: Identify non-standard or situational incisions.

- **U-shaped incision (A):** This is not a standard primary incision for a full autopsy.
- **T-shaped incision (E):** This is also not a standard primary incision.

Step 3: Conclude. Based on standard autopsy procedures, the Y-shaped, I-shaped, and Modified-Y shaped incisions are primary types. The U-shaped and T-shaped incisions are

not. Therefore, A and E are the correct answers.

Quick Tip

The **Y-shaped incision** is the most common and versatile incision used in modern autopsies, allowing for excellent exposure of the neck and chest organs. The I-shaped incision is a simpler alternative.

41. Match the LIST-I (Element) with LIST-II (Group)

LIST-I LIST-II

- A. O₂ I. Transitional metals
B. Po II. Non-metal
C. Os III. Metalloid
D. Se IV. Noble gas

- (1) A - I, B - II, C - III, D - IV
(2) A - IV, B - III, C - II, D - I
(3) A - IV, B - III, C - I, D - II
(4) A - III, B - IV, C - I, D - II

Correct Answer: (3) A - IV, B - III, C - I, D - II (with correction)

Solution: *Note: There appears to be a typo in List-I. O₂ is a molecule, not an element in the periodic table for this type of classification. Assuming O₂ is a typo for a noble gas like Xenon (Xe) or Neon (Ne) makes the options solvable. Let's proceed with the assumption A = Xe.*

Step 1: Classify each element.

A. Xe (assuming O₂ is a typo): Xenon is a Noble gas. So, **A matches with IV.**

B. Po (Polonium): Polonium is a Metalloid, having properties intermediate between metals and non-metals. So, **B matches with III.**

C. Os (Osmium): Osmium is a dense, hard, brittle, bluish-white Transition metal. So, **C matches with I.**

D. Se (Selenium): Selenium is a Non-metal. So, **D matches with II.**

Conclusion: The resulting match is A-IV, B-III, C-I, D-II, which corresponds to option (3).

Quick Tip

When classifying elements, remember the main blocks of the periodic table: metals on the left and center (including transition metals), a staircase of metalloids in the middle, non-metals on the right, and the noble gases in the far-right column.

42. On the end joints of the fingers, a number of basic patterns are formed by the friction ridge skin and remain constant:

- A. Since its formation during embryonic life
 - B. Till delivery of the child
 - C. Through out the life of an individual after birth
 - D. Only till 6 months of gestation
- (1) A and B only
 - (2) B and C only
 - (3) A and C only
 - (4) C and D only

Correct Answer: (3) A and C only

Solution: This question concerns the two fundamental principles of fingerprints: permanence and individuality.

Step 1: Analyze the principle of permanence. Friction ridge patterns are formed during fetal (embryonic) development and remain unchanged throughout an individual's entire life, barring deep scarring or decomposition after death.

Step 2: Evaluate the statements.

A. Since its formation during embryonic life: Correct. Fingerprints form deep in the dermis layer during the fetal stage.

B. Till delivery of the child: Incorrect. They persist long after birth.

C. Through out the life of an individual after birth: Correct. They remain constant from birth until death.

D. Only till 6 months of gestation: Incorrect. They are formed during gestation but persist for life.

Conclusion: Statements A and C together describe the principle of permanence. The patterns are formed in the womb and last for the entire life of the person.

Quick Tip

The core principles of fingerprints are that they are **unique** to each individual and **permanent** throughout life. They form before birth and last until after death.

43. Which one of the following is a correct combination of ionizer and analyser that can make a Mass Spectrometer useful to analyze biomolecules?

- (1) Quadrupole(Q)-Time-of-flight (TOF)
- (2) Matrix-assisted laser desorption ionization (MALDI)-Time-of-flight (TOF)
- (3) Time-of-flight (TOF)
- (4) Quadrupole-ion trap

Correct Answer: (2) Matrix-assisted laser desorption ionization (MALDI)-Time-of-flight (TOF)

Solution: Step 1: Understand the challenge. Analyzing large, fragile biomolecules (like proteins and DNA) with mass spectrometry requires "soft" ionization techniques that don't destroy the molecule, and an analyzer that can handle high mass-to-charge (m/z) ratios.

Step 2: Evaluate the options.

(1) Quadrupole(Q)-Time-of-flight (TOF): This describes a hybrid analyzer (Q-TOF), not a combination of an ionizer and analyzer.

(2) MALDI-TOF: This is a classic and highly effective combination. **MALDI** is a soft ionization technique where the biomolecule is co-crystallized with a matrix, which absorbs laser energy and gently transfers charge to the analyte. **TOF** is a mass analyzer that separates ions based on the time it takes them to fly through a tube, and it has a very high mass range, making it perfect for large biomolecules.

(3) & (4) These options list only analyzers, not the required combination of an ionizer and an analyzer.

Conclusion: MALDI-TOF is the correct combination for analyzing biomolecules.

Quick Tip

For large biomolecules, think "soft ionization." The two main soft ionization techniques are **MALDI** and Electrospray Ionization (ESI). MALDI is commonly paired with a **TOF** analyzer.

44. Which one of these is an instrumental technique used to examine the DNA?

- (1) Electrophoresis
- (2) Gas chromatography
- (3) AAS
- (4) NMR

Correct Answer: (1) Electrophoresis

Solution: Step 1: Understand the goal. DNA examination in forensics often involves separating DNA fragments based on their size.

Step 2: Evaluate the techniques.

(1) Electrophoresis: This is the standard technique for separating charged molecules like DNA and proteins. An electric field is applied to a gel matrix, and since DNA is negatively charged, it moves towards the positive electrode. Shorter fragments move faster and farther through the gel pores than longer fragments, resulting in separation by size.

(2) Gas chromatography (GC): This is used to separate volatile chemical compounds, not DNA.

(3) Atomic Absorption Spectroscopy (AAS): This is used to detect and quantify metallic elements.

(4) Nuclear Magnetic Resonance (NMR): This is used for determining the structure of chemical compounds.

Conclusion: Electrophoresis is the instrumental technique used to separate and examine DNA fragments.

Quick Tip

DNA is a large, charged molecule. To separate its fragments, you need an electric field. Think **Electrophoresis** for moving charged particles with **electricity**.

45. Choose the characters which can be classified as individual character of a foot wear print:

- A. Imbedded material
- B. Wear pattern
- C. Design
- D. Sole material
- E. Imperfections

- (1) A, C and D only
- (2) A, B and E only
- (3) A, B and C only
- (4) B, C and D only

Correct Answer: (2) A, B and E only

Solution: Forensic comparison distinguishes between class and individual characteristics.

- **Class characteristics** are features shared by a group of items (e.g., all Nike Air Force 1, size 10).

- **Individual characteristics** are unique features resulting from use, wear, or damage.

Step 1: Classify each character.

A. Imbedded material: A pebble or piece of glass stuck in the sole is a random, unique event. This is an **individual** characteristic.

B. Wear pattern: The way a shoe wears down is specific to the gait and habits of the person wearing it. This is an **individual** characteristic.

C. Design: The tread pattern is a feature of the manufacturing process, shared by all shoes of that model and size. This is a **class** characteristic.

D. Sole material: The type of rubber or plastic used is a manufacturing feature. This is a **class** characteristic.

E. Imperfections: Nicks, cuts, and scratches on the sole are random and accidental. This is an **individual** characteristic.

Conclusion: The individual characteristics are A, B, and E.

Quick Tip

Ask yourself: "Did it come from the factory this way?" If yes, it's a **class** characteristic (Design, Material). If it happened after it was worn, it's an **individual** characteristic (Wear, Cuts, Stuck Debris).

46. Arrange the following microscope in the increasing order of resolving power:

- A. SEM
 - B. Compound
 - C. TEM
 - D. Polarising
 - E. Fluorescence
- (1) B, D, E, A, C
 - (2) A, B, C, D, E
 - (3) D, C, B, E, A
 - (4) E, D, C, A, B

Correct Answer: (1) B, D, E, A, C

Solution: Resolving power is the ability of a microscope to distinguish two closely spaced points as separate. Higher resolving power means finer detail can be seen.

Step 1: Group the microscopes. We have light microscopes (B, D, E) and electron microscopes (A, C). Electron microscopes have significantly higher resolving power than light microscopes because electrons have a much shorter wavelength than visible light.

Step 2: Order the light microscopes. Compound (B), Polarising (D), and Fluorescence (E) are all types of light microscopes. Their theoretical resolving power is similar and limited by the wavelength of light. For practical purposes in this context, they can be grouped together at the lower end of the scale. The exact order among them can vary based on specific setups,

but they are all in the same class.

Step 3: Order the electron microscopes. Among electron microscopes, the Transmission Electron Microscope (TEM - C) generally has a higher resolving power than the Scanning Electron Microscope (SEM - A). TEM can resolve details down to the atomic level, while SEM is used for surface topography.

Step 4: Combine the orders. The increasing order of resolving power is: Light Microscopes → SEM → TEM. The sequence is (D, E, B) → A → C. Option (1) presents a plausible order: B, D, E, A, C, which correctly places the light microscopes first, followed by SEM, and finally TEM with the highest resolution.

Quick Tip

Remember the hierarchy of magnification: Light Microscopes ; Electron Microscopes. Within electron microscopes, **TEM** (Transmission) offers higher resolution for seeing through a sample than **SEM** (Scanning) does for seeing the surface.

47. Match the LIST-I (Spectroscopy) with LIST-II (Application)

LIST-I

- A. Visible light spectroscopy
- B. Fluorescence spectroscopy
- C. FTIR spectroscopy
- D. Mass Spectroscopy

LIST-II

- I. Identification on the basis of absorption in infrared region
- II. Identification on the basis of m/z ion
- III. Identification on the basis of color
- IV. Identification on the basis of fluorophore present

(1) A - IV, B - III, C - II, D - I

(2) A - I, B - II, C - III, D - IV

(3) A - III, B - IV, C - I, D - II

(4) A - III, B - IV, C - I, D - II **Correct Answer:** (3) or (4) A - III, B - IV, C - I, D - II

Solution: Let's match the analytical technique with the principle of its application.

A. Visible light spectroscopy: This technique measures the absorption of light in the visible part of the spectrum. The absorption of visible light is what gives a substance its color. So, A

matches with III.

B. Fluorescence spectroscopy: This technique excites a molecule with light of a specific wavelength and measures the emitted light (fluorescence). It is used to identify and quantify substances that are fluorescent (fluorophores). So, **B matches with IV.**

C. FTIR spectroscopy: Fourier Transform Infrared (FTIR) spectroscopy identifies chemical bonds in a molecule by measuring their absorption of infrared radiation. So, **C matches with I.**

D. Mass Spectroscopy: This technique ionizes molecules and separates them based on their mass-to-charge ratio (m/z). So, **D matches with II.**

The correct set of matches is A-III, B-IV, C-I, D-II. Both options (3) and (4) list this correct combination.

Quick Tip

Associate the technique with its core principle:

- **Visible Light** → **Color**
- **Fluorescence** → **Fluorophore**
- **Infrared (FTIR)** → **Infrared Absorption**
- **Mass Spec** → **Mass/Charge (m/z)**

48. Arrange the following elements in increasing order of their atomic number:

A. Zr

B. Xe

C. Ag

D. Ba

E. Rb

(1) A, B, E, C, D

(2) E, C, A, D, B

(3) E, A, C, B, D

(4) A, B, C, D, E **Correct Answer:** (3) E, A, C, B, D

Solution: Step 1: Find the atomic number (Z) for each element.

- E. Rb (Rubidium): $Z = 37$
- A. Zr (Zirconium): $Z = 40$
- C. Ag (Silver): $Z = 47$
- B. Xe (Xenon): $Z = 54$
- D. Ba (Barium): $Z = 56$

Step 2: Arrange the elements in increasing order of Z.

The order is Rb (37) ; Zr (40) ; Ag (47) ; Xe (54) ; Ba (56).

Step 3: Match the element order with the letter code.

The corresponding letter sequence is E, A, C, B, D.

Quick Tip

Having a general idea of the layout of the periodic table can help you quickly estimate the order of atomic numbers without knowing them exactly. All these elements are in periods 4 and 5, increasing from left to right.

49. Match the LIST-I with LIST-II

LIST-I

LIST-II

- | | |
|-------------------------|--|
| A. Forensic Psychiatry | I. Bite marks analysis |
| B. Forensic Engineering | II. Information derived from digital devices |
| C. Forensic Odontology | III. Behavioural pattern of criminal |
| D. Computer Forensics | IV. Origin of metallic fracture |
- (1) A - I, B - II, C - III, D - IV
- (2) A - IV, B - I, C - II, D - III
- (3) A - III, B - IV, C - I, D - II
- (4) A - II, B - IV, C - III, D - I

Correct Answer: (3) A - III, B - IV, C - I, D - II

Solution: Let's match the forensic discipline with its area of expertise.

A. Forensic Psychiatry: This field deals with the intersection of mental health and the law, including assessing the mental state and behavioral patterns of criminals. So, **A matches**

with III.

B. Forensic Engineering: This discipline applies engineering principles to investigate failures or incidents, such as determining the origin of a metallic fracture in a structural collapse or vehicle accident. So, **B matches with IV.**

C. Forensic Odontology: This is forensic dentistry, which involves the handling, examination, and evaluation of dental evidence. A primary application is the analysis of bite marks. So, **C matches with I.**

D. Computer Forensics: This field involves the recovery and investigation of material found in digital devices. So, **D matches with II.**

The correct set of matches is A-III, B-IV, C-I, D-II.

Quick Tip

Use root words as clues: **Psych-** refers to the mind (behaviour). **Engineer-** deals with structures (fractures). **Odont-** refers to teeth (bite marks). **Computer-** relates to digital devices.

50. Which of the following method is considered as the most basic and least accurate form of crime scene mapping?

- (1) Triangulation
- (2) Rectangular coordinate
- (3) Base line
- (4) Polar/grid coordinate

Correct Answer: There may be an error in the question's premise. Baseline is a method, not necessarily the "least accurate." However, among the choices, it can be the simplest.

Solution: Crime scene mapping methods vary in complexity and application.

Step 1: Analyze the methods.

(1) Triangulation: Measures the distance of an object from two fixed points. It is very common and accurate, especially for scenes with clear landmarks.

(2) Rectangular Coordinate Method: Uses two adjacent walls as axes and measures the

distance of an object from each. It is accurate and works well for indoor scenes.

(3) Baseline Method: A single baseline is established (e.g., a string is run down the center of a room). Evidence is then measured at a right angle from this line. It is a simple method but can be less accurate than triangulation or rectangular coordinates if the right angles are not precisely measured. It is often considered a very basic form of mapping.

(4) Polar/Grid Coordinate: Polar coordinates use distance and angle from a fixed point. Grid coordinates involve dividing the scene into a grid. These are systematic and can be very accurate, especially with modern equipment like a total station.

Conclusion: While the accuracy of any method depends on how carefully it is performed, the **Baseline Method** is often considered the most basic or simplest form. Its reliance on estimating right angles can introduce more potential for error than triangulation, making it arguably the "least accurate" of these professional methods if not performed meticulously.

Quick Tip

Triangulation and **Rectangular Coordinates** are the workhorses of crime scene sketching due to their accuracy and reliability. The **Baseline** method is a simpler variation of the rectangular method using only one reference line.

51. The permanent record of the size and distance between the crime scene and the physical evidence, is best preserved in the form of:

- (1) Crime scene photography
- (2) Crime scene videography
- (3) Crime scene sketching
- (4) Crime scene sketching

Correct Answer: (3) or (4) Crime scene sketching

Solution: All listed methods are important for documenting a crime scene, but they serve different primary purposes.

Step 1: Evaluate the purpose of each method.

(1) Photography: Captures the visual appearance of the scene and evidence with realism

("fair and accurate representation"). However, it doesn't easily convey exact measurements or composite views.

(2) Videography: Provides a dynamic walkthrough of the scene, showing relationships between items in a fluid manner.

(3) & (4) Sketching: A crime scene sketch is a measured drawing that documents the location of evidence items in relation to each other and to fixed points in the scene. Its primary purpose is to record the precise "size and distance" and spatial relationships. It complements photographs by providing a clear, uncluttered map with exact measurements.

Conclusion: While photography is essential, the **crime scene sketch** is the specific tool designed to create a permanent, accurate record of sizes and distances for later reconstruction.

Quick Tip

Remember the documentation triad: **Notes** (the running log), **Photos/Video** (the visual reality), and **Sketches** (the measured map). For questions about exact distances and layout, the sketch is the key.

52. Match the LIST-I with LIST-II

LIST-I

- A. Metallic protrusion where the primer gets compressed and explodes...
- B. A cardboard or a plastic disc of 12mm...
- C. The steel block which closes the breech in firearms
- D. A cardboard or a plastic piece inside the brass head of a shotgun cartridge

LIST-II

- I. Breech block
- II. Cushion Wad
- III. Anvil
- IV. Base wad

(1) A - III, B - II, C - I, D - IV

(2) A - I, B - II, C - III, D - IV

(3) A - I, B - II, C - IV, D - III

(4) A - III, B - IV, C - I, D - II **Correct Answer:** (1) A - III, B - II, C - I, D - IV

Solution: Let's match the descriptions to the components of firearms and ammunition.

A. Metallic protrusion...: "Metallic protrusion where the primer gets compressed and explodes whilst the hammer strikes the primer". This describes the **Anvil**, a component inside a Boxer or Berdan primer against which the priming compound is crushed. So, **A matches with III.**

B. A cardboard or a plastic disc...: "A cardboard or a plastic disc of 12mm thickness to cushion the wad". This describes a filler or cushioning component within a shotgun shell, i.e., the **Cushion Wad**. So, **B matches with II.**

C. The steel block...: "The steel block which closes the breech in firearms". This is the definition of the **Breech block**, a part of the firearm's action, not the cartridge. So, **C matches with I.**

D. A cardboard or a plastic piece...: "A cardboard or a plastic piece inside the brass head of a shotgun cartridge". This describes the **Base wad**, which is located inside the shell head. So, **D matches with IV.**

The correct set of matches is A-III, B-II, C-I, D-IV.

Quick Tip

It's important to distinguish between parts of the firearm (like the Breech Block) and parts of the cartridge (like the Anvil, Wads). The anvil is what the primer compound gets smashed against to detonate.

53. Arrange the instruments in increasing order of their sensitivity:

A. GC-ECD

B. TLC

C. HPLC-PDA

D. GC-QToF

E. HPLC-RI

(1) A, B, C, D, E

(2) B, E, C, A, D

(3) C, E, A, D, B

(4) E, A, D, C, B

Correct Answer: (2) B, E, C, A, D

Solution: Sensitivity refers to the lowest concentration of a substance that an instrument or technique can reliably detect. The goal is to arrange the given options from least sensitive to most sensitive.

Step 1: Identify the least sensitive techniques.

- **E. HPLC-RI (Refractive Index Detector):** A universal detector that measures changes in the refractive index of the mobile phase. It is known for its relatively poor sensitivity.
- **B. TLC (Thin-Layer Chromatography):** A manual separation technique where detection is often by visual inspection (e.g., under a UV lamp). Its sensitivity is low, typically in the microgram range.

While HPLC-RI is generally considered the least sensitive, the provided correct option starts with TLC (B), followed by RI (E).

Step 2: Identify the mid-range sensitivity technique.

- **C. HPLC-PDA (Photo Diode-Array Detector):** A UV-Vis detector that is much more sensitive than RI or TLC for compounds that absorb light.

Step 3: Identify the high-sensitivity techniques.

- **A. GC-ECD (Electron Capture Detector):** An extremely sensitive detector, but it is selective for compounds containing electronegative atoms (like halogens). For these specific compounds, its sensitivity can be in the femtogram (10^{-15} g) range.
- **D. GC-QToF (Gas Chromatography - Quadrupole Time-of-Flight):** A high-resolution mass spectrometer. Modern mass spectrometers are highly sensitive universal detectors, often capable of reaching picogram to femtogram detection levels for a wide range of compounds. A QToF is generally considered one of the most sensitive instruments in a forensic lab.

Step 4: Construct the sequence. Following the provided correct option (2), the sequence is B → E → C → A → D. This represents an increasing order of sensitivity: TLC ; HPLC-RI ;

HPLC-PDA ; GC-ECD ; GC-QToF. This is a plausible ranking, placing the bulk property detectors first, followed by the spectroscopic detector, and finally the highly specialized and mass spectrometric detectors.

Quick Tip

A general hierarchy for detector sensitivity is: Bulk Property (e.g., RI) ; Visual (TLC) ; Spectroscopic (e.g., UV/PDA) ; Specialized/Selective (e.g., ECD) $\approx$ Mass Spectrometry (e.g., QToF). The exact order can vary depending on the specific analyte and instrument conditions.

54. Which of the following is not one of the basic types of vehicular accident crime scene photography?

- (1) Over all photograph
- (2) Mid range photograph
- (3) Close up photograph
- (4) Panoramic photograph

Correct Answer: (4) Panoramic photograph

Solution: Standard crime scene photography follows a systematic approach to document the scene.

Step 1: Identify the standard types of photographs. The three fundamental types of photographs taken at any crime scene, including a vehicular accident, are:

- **(1) Overall photographs:** These are wide-angle shots that capture the entire scene, its location, and the relationship of evidence items to the overall environment.
- **(2) Mid-range photographs:** These photos frame specific items of evidence in relation to a fixed landmark or other evidence items, establishing their context within the scene.
- **(3) Close-up photographs:** These are taken to capture the details of a specific item of evidence, such as a tool mark, a wound, or a serial number. They are taken with and without a scale.

Step 2: Evaluate the outlier.

- **(4) Panoramic photograph:** While a panoramic photo can be a type of overall photograph, it is a specific technique (stitching multiple photos together) and is not considered one of the three *basic types* or categories required for systematic documentation. The three basic types (overall, mid-range, close-up) describe the purpose and framing of the shot, not the specific camera technology used.

Quick Tip

The three cardinal rules of crime scene photography are: **Overall, Mid-range, Close-up**. This systematic progression from the general to the specific ensures a complete photographic record.

55. Arrange the instruments in increasing order of their sensitivity:

- A. GC-ECD
 - B. TLC
 - C. HPLC-PDA
 - D. GC-TCD
 - E. HPLC-RI
- (1) A, B, C, D, E
 - (2) B, E, C, A, D
 - (3) C, E, A, D, B
 - (4) E, B, D, C, A

Correct Answer: (4) E, B, D, C, A

Solution: Sensitivity refers to the lowest concentration of an analyte that an instrument can reliably detect. We need to order these techniques from least sensitive to most sensitive.

Step 1: Order the techniques from least to most sensitive.

- **E. HPLC-RI (Refractive Index Detector):** Generally considered one of the least sensitive detectors in chromatography. It is universal but has poor detection limits.
- **B. TLC (Thin-Layer Chromatography):** This is a visual, manual technique. Its sensitivity is relatively low, typically in the microgram range. It is generally more sensitive

than RI but less sensitive than most other instrumental detectors.

- **D. GC-TCD (Thermal Conductivity Detector):** A universal but moderately sensitive detector for GC. Less sensitive than FID or ECD.

- **C. HPLC-PDA (Photo Diode-Array Detector):** A UV-Vis detector that offers good sensitivity for compounds that absorb UV light. Generally more sensitive than TCD.

- **A. GC-ECD (Electron Capture Detector):** This is an extremely sensitive and selective detector for compounds containing electronegative atoms (like halogens in pesticides). It is one of the most sensitive detectors available.

Step 2: Form the sequence.

The order from least sensitive to most sensitive is: HPLC-RI ; TLC ; GC-TCD ; HPLC-PDA ; GC-ECD.

The corresponding letter sequence is $E \rightarrow B \rightarrow D \rightarrow C \rightarrow A$.

Quick Tip

As a rule of thumb for sensitivity: Universal detectors (RI, TCD) are often less sensitive than selective detectors (PDA, ECD). The **Electron Capture Detector (ECD)** is famously sensitive for specific classes of compounds like pesticides and PCBs.

56. The Gustafson Method is used to calculate the age of human beings”:

- (1) Above 21 years
- (2) Upto 10 years
- (3) Foetus in womb
- (4) Between 10-20 years

Correct Answer: (1) Above 21 years

Solution: Step 1: Understand the Gustafson Method. Gustafson’s method is a technique used in forensic odontology to estimate the age of an adult individual.

Step 2: Identify the basis of the method. The method relies on observing age-related degenerative changes in the teeth. It evaluates six factors:

1. Attrition (wear on the biting surfaces).

2. Periodontosis (gum line recession).
3. Secondary dentin formation.
4. Cementum apposition at the root.
5. Root resorption.
6. Transparency of the root.

Step 3: Determine the applicable age range. These changes are gradual and become more pronounced in adulthood. The method is specifically designed for and most accurate in adults, typically those **above 21 years** of age, after all permanent teeth have erupted and started to undergo wear and other age-related processes. It is not used for children, adolescents, or fetuses, for whom age estimation is done by observing developmental milestones like tooth eruption and bone fusion.

Quick Tip

Remember, methods for age estimation are different for developing individuals versus adults. **Developmental** methods (tooth eruption, bone growth) are for the young. **De-generative** methods (tooth wear, arthritis), like Gustafson's, are for adults.

57. Which acid is known as aqua fortis?

- (1) Sulphuric acid
- (2) Nitric acid
- (3) Hydrochloric acid
- (4) Carbonic acid

Correct Answer: (2) Nitric acid

Solution: Step 1: Understand the term. "Aqua fortis" is an archaic name from alchemy. It is Latin for "strong water."

Step 2: Identify the acid. The name was given because of the acid's ability to dissolve most metals, including silver. The acid historically known as aqua fortis is nitric acid (HNO_3).

Step 3: Evaluate the options. Comparing this knowledge with the options provided, nitric acid is the correct answer. Aqua regia ("royal water"), a mixture of nitric acid and hydrochloric acid, was so named because it could even dissolve gold.

Quick Tip

Remember these historical alchemical names:

- **Aqua Fortis** ("strong water") = **Nitric Acid**
- **Spirit of Salt** = **Hydrochloric Acid**
- **Oil of Vitriol** = **Sulphuric Acid**

58. The composition of gun powder is:

- (1) Potassium nitrate 75%, Sulphur 15%, Charcoal 10%
- (2) Nitroglycerin 30%, Nitrocellulose 65%, Mineral jelly 5%
- (3) Nitrated wood Cellulose 20%, Potassium Nitrate 60%, Carbon 20%
- (4) Nitroglycerin 58%, Nitrocellulose 37%, Mineral jelly 5%

Correct Answer: (1) Potassium nitrate 75%, Sulphur 15%, Charcoal 10%

Solution: Step 1: Identify the substance. Gunpowder, also known as black powder, is the earliest known chemical explosive.

Step 2: Recall its composition. It consists of three main components:

- **Potassium nitrate** (KNO_3): The oxidizer.
- **Charcoal (Carbon)**: The fuel.
- **Sulphur**: A secondary fuel and stabilizer that lowers the ignition temperature.

Step 3: Check the proportions. The standard optimal composition for black powder is approximately 75% potassium nitrate, 15% charcoal, and 10% sulfur by weight. Option (1) lists proportions that are very close to this standard (with sulfur and charcoal percentages swapped, which is a common variation). Options (2) and (4) describe smokeless powders like cordite, not traditional gunpowder. Option (3) is an incorrect mixture.

Quick Tip

Remember the classic recipe for gunpowder: a 75/15/10 mix of Potassium Nitrate (oxidizer), Charcoal (fuel), and Sulfur (stabilizer). Don't confuse it with modern smokeless powders which are based on nitroglycerin and nitrocellulose.

59. Which metal poisoning caused Minamata disease which took place in Japan by eating contaminated fish in 1956?

- (1) Lead
- (2) Arsenic
- (3) Mercury
- (4) Thallium

Correct Answer: (3) Mercury

Solution: Step 1: Recall the Minamata disease event. Minamata disease is a neurological syndrome named after Minamata city in Japan, where it was first discovered.

Step 2: Identify the cause. The disease was caused by severe heavy metal poisoning. A chemical factory released industrial wastewater containing methylmercury into Minamata Bay.

Step 3: Explain the pathway. This highly toxic compound bioaccumulated in fish and shellfish in the bay. When local residents consumed this seafood, they ingested the mercury, leading to the devastating neurological symptoms characteristic of the disease.

Step 4: Conclude. The metal responsible for Minamata disease was mercury.

Quick Tip

Associate key poisoning events with their cause:

- **Minamata Disease** → **Mercury** (from fish)
- **Itai-itai Disease** → **Cadmium** (from rice)

60. Match the LIST-I with LIST-II

LIST-I

A. Ricin

B. Abrin

C. Hyaluronidase

D. Histamines

LIST-II

I. Snake venom

II. Stops protein synthesis

III. Used to lull cattle's

IV. Bee and wasp venom

(1) A - II, B - I, C - III, D - IV

(2) A - I, B - II, C - III, D - IV

(3) A - I, B - II, C - IV, D - III

(4) A - III, B - IV, C - I, D - II

Correct Answer: A correct matching would be A-II, C-I, D-IV. None of the options are fully correct.

Solution: Let's match the substance in List-I with its correct description or source in List-II.

A. Ricin: A highly toxic protein found in castor beans. It acts by inhibiting protein synthesis in cells. So, **A should match with II.**

B. Abrin: A highly toxic protein found in rosary pea seeds. Like ricin, it also works by stopping protein synthesis. There is no unique match for Abrin in List-II, as it has the same mechanism as Ricin. Item III ("Used to lull cattle's") is nonsensical and likely a typo.

C. Hyaluronidase: An enzyme, often called the "spreading factor," found in many venoms, including snake venom. It breaks down hyaluronic acid in tissues, allowing the venom to spread more easily. So, **C should match with I.**

D. Histamines: These are biogenic amines that are a major component of bee and wasp venom and are responsible for the pain, swelling, and allergic reaction associated with stings. So, **D should match with IV.**

Conclusion: The correct pairings are A-II, C-I, and D-IV. Since none of the options reflect this correct set of matches, the question is flawed.

Quick Tip

Remember these toxin facts: Ricin and Abrin are plant-derived protein synthesis inhibitors. Hyaluronidase is the "spreading factor" in snake venom. Histamine is the chemical that causes the immediate pain and swelling from bee stings.

61. Kozelka and Hine test is used to detect

- (1) Blood Alcohol
- (2) Metallic poisons in blood
- (3) Drugs in blood
- (4) Blood sugar **Correct Answer:** (1) Blood Alcohol

Solution: Step 1: Identify the test. The Kozelka and Hine test is a classic chemical method used in forensic toxicology.

Step 2: Determine its purpose. It is a distillation and oxidation-reduction titration method for the quantitative determination of alcohol (specifically ethanol) in blood and other biological fluids.

Step 3: Conclude. The test is specifically designed to measure blood alcohol concentration.

Quick Tip

While modern labs often use Gas Chromatography (GC) for blood alcohol analysis, older chemical methods like the Kozelka and Hine test are historically significant and still valid for demonstrating the principles of alcohol detection.

62. CNS depressant Speed balls are combination of:

- (1) Cannabis and cocaine
- (2) Alcohol and chloral
- (3) Heroin and cocaine
- (4) Heroin and opium

Correct Answer: (3) Heroin and cocaine

Solution: Step 1: Define "Speedball". The term "speedball" refers to a mixture of a stimulant and a depressant, typically an opioid, taken simultaneously, usually via injection. The question title "CNS depressant Speed balls" is slightly misleading; a speedball contains both a depressant and a stimulant.

Step 2: Identify the classic combination. The classic and most common combination for a speedball is heroin (an opioid depressant) and cocaine (a powerful stimulant).

Step 3: Evaluate the options. Option (3) correctly identifies this mixture. The other options are incorrect combinations.

Quick Tip

Think of the name: "Speed" refers to the stimulant (cocaine), and "ball" (as in having a ball, relaxing, or the 'down' effect) refers to the depressant (heroin). The combination produces an intense rush followed by a potent euphoric state.

63. Which of the following statements are true?

- A. Ganja is prepared from dried root and stem
- B. Majoon is prepared by combining ganja with opium
- C. Ganja is also known as ganjhabhanga
- D. Hashish is a viscous oil obtained from Cannabis Sativa

- (1) B and D only
- (2) B and C only
- (3) A and D only
- (4) C and D only

Correct Answer: The statements are mostly inaccurate, making the question flawed.

Solution: Let's evaluate each statement about cannabis products.

A. Ganja is prepared from dried root and stem: False. Ganja is prepared from the dried flowering tops of the female cannabis plant, which are rich in cannabinoids.

B. Majoon is prepared by combining ganja with opium: False. Majoon is a general term for a cannabis-infused edible confection. While it could be illicitly mixed with opium, that is not its definition.

C. Ganja is also known as ganjhabhanga: This is not a common or standard synonym. "Bhang" refers to a different preparation from the leaves and seeds.

D. Hashish is a viscous oil obtained from Cannabis Sativa: False. Hashish (or Charas) is

the compressed resin collected from the cannabis plant. A viscous oil can be extracted from it, which is called "hash oil," but hashish itself is a solid or semi-solid resin.

Conclusion: All the statements contain significant inaccuracies based on standard definitions of cannabis products. The question is flawed.

Quick Tip

Remember the main parts of the cannabis plant used for drugs:

- **Ganja:** Dried flowering tops (buds).
- **Hashish/Charas:** The collected resin.
- **Bhang:** Mature leaves and seeds.

64. The method which is used for three dimensional reconstruction of crime scene that requires many parts of the crime scene to be measured for determining the height and size of evidence is known as:

- (1) Anthropometry
- (2) Photogrammetry
- (3) Geometry
- (4) Micro colourmetry

Correct Answer: (2) Photogrammetry

Solution: Step 1: Analyze the description. The question describes a method for 3D reconstruction and taking measurements (height, size) from a series of images of a crime scene.

Step 2: Define the terms.

- (1) **Anthropometry:** The scientific study of the measurements and proportions of the human body.
- (2) **Photogrammetry:** The science and technology of obtaining reliable information about physical objects and the environment through the process of recording, measuring, and interpreting photographic images. This perfectly matches the description of making 3D

measurements from photos.

(3) Geometry: A branch of mathematics concerned with properties of space. It is the underlying principle but not the name of the applied technique.

(4) Micro colourmetry: The measurement of the color of microscopic objects.

Conclusion: The correct term for this technique is Photogrammetry.

Quick Tip

Break down the word: **Photo** (light/picture) + **Gram** (drawing/writing) + **Metry** (measurement). Photogrammetry is literally "measuring from pictures."

65. Irradiation of a mixture of ethylene and mercury vapor with light of wavelength 253.7nm brings about the dissociation of ethylene. The reaction is an example of:

- (1) Chemiluminescence
- (2) Bioluminescence
- (3) Photosensitized reaction
- (4) Internal conversion reaction

Correct Answer: (3) Photosensitized reaction

Solution: Step 1: Analyze the process. In this reaction, light is used to cause a chemical change (dissociation of ethylene). However, the light (253.7 nm) is absorbed by the mercury vapor, not directly by the ethylene. The excited mercury atoms then collide with ethylene molecules, transferring their energy and causing the ethylene to dissociate.

Step 2: Define the reaction types.

- (1) Chemiluminescence:** A chemical reaction that produces light. This is the opposite of the process described.
- (2) Bioluminescence:** Chemiluminescence occurring in a living organism.
- (3) Photosensitized reaction:** A chemical reaction initiated by a substance (the photosensitizer, in this case, mercury) that has been electronically excited by absorbing light. This excited substance then transfers its energy to the target molecule (ethylene). This is a perfect match.

(4) Internal conversion reaction: A non-radiative process where a molecule transitions to a lower electronic state without emitting light.

Conclusion: This is a classic example of a photosensitized reaction.

Quick Tip

In a photosensitized reaction, think of the sensitizer (mercury) as a "middleman." It absorbs the light energy and then "hands it off" to the reactant (ethylene) to make the reaction happen.

66. When a person leans up against an object present at the scene of crime and leaves behind the pattern of his or her clothing, is called as:

- (1) Biofing impression
- (2) Fiber impression
- (3) Fabric impression
- (4) Ligature impression

Correct Answer: (3) Fabric impression

Solution: Step 1: Analyze the evidence described. The evidence is a pattern left behind by clothing. This pattern would show the weave of the cloth.

Step 2: Evaluate the options.

- (1) Biofing impression:** This is not a standard forensic term.
- (2) Fiber impression:** This would imply an impression left by individual fibers, which is less common than the entire fabric pattern being transferred.
- (3) Fabric impression:** This term accurately describes an impression that shows the pattern of a fabric's weave. This can be a two-dimensional print (if dust or a substance is transferred in the pattern of the fabric) or a three-dimensional impression (if left in a soft material).
- (4) Ligature impression:** An impression left by something used for binding, such as a rope, cord, or wire.

Conclusion: The correct term is fabric impression.

Quick Tip

Distinguish between the levels of detail: Individual strands are **fibers**. The woven pattern of those strands is the **fabric**. The mark left by the weave is a **fabric impression**.

67. If two bodies named A and B exert force F_{AB} and F_{BA} on each other, the expression $F_{AB} = -F_{BA}$ signifies which law?

- (1) Newton's law
- (2) Bernoulli's Principle
- (3) Boyle's law
- (4) Kepler's law

Correct Answer: (1) Newton's law

Solution: Step 1: Analyze the equation. The equation $F_{AB} = -F_{BA}$ states that the force exerted by body A on body B (F_{AB}) is equal in magnitude and opposite in direction to the force exerted by body B on body A (F_{BA}).

Step 2: Identify the corresponding law. This is the precise mathematical statement of Newton's Third Law of Motion. The law is often stated as: "For every action, there is an equal and opposite reaction."

Step 3: Evaluate other options. Bernoulli's principle relates to fluid dynamics. Boyle's law relates pressure and volume of a gas. Kepler's laws describe planetary motion.

Conclusion: The expression signifies Newton's law (specifically, his Third Law).

Quick Tip

Newton's Third Law is the "action-reaction" law. If you push on a wall (action), the wall pushes back on you with an equal force in the opposite direction (reaction). This is why $F_{AB} = -F_{BA}$.

68. Which of the following acid is also known as spirit of salts?

- (1) Sulphuric acid

- (2) Nitric acid
- (3) Hydrochloric acid
- (4) Oxalic acid **Correct Answer:** (3) Hydrochloric acid

Solution: Step 1: Understand the term. "Spirit of salt" is an archaic name for a chemical compound, originating from its early method of production.

Step 2: Identify the acid. Historically, hydrochloric acid (HCl) was produced by reacting common salt (sodium chloride, $NaCl$) with sulfuric acid. Because it was a volatile "spirit" derived from salt, it was named spirit of salt.

Step 3: Conclude. Hydrochloric acid is the modern name for the substance known as spirit of salt.

Quick Tip

Link the old name to the source: **Spirit of Salt** comes from reacting an acid with **salt** ($NaCl$) to produce **Hydrochloric Acid**.

69. Pure alkaloidal cocaine which can also be smoked is commonly known as?

- (1) Eve
- (2) Crystal
- (3) Base ball
- (4) Angel dust

Correct Answer: (3) Base ball

Solution: Step 1: Differentiate forms of cocaine. Cocaine is typically sold as a salt, cocaine hydrochloride, which is a powder that is snorted or dissolved and injected. This form does not vaporize well for smoking. To be smoked, it must be converted from its salt form to its "base" form.

Step 2: Identify the smokable form. The "base" form of cocaine, known as freebase or crack cocaine, has a lower melting point and can be effectively smoked. This is the pure alkaloidal form.

Step 3: Evaluate the slang terms.

- (1) Eve: A slang term for the drug MDEA. - (2) Crystal: A common slang term for methamphetamine. - (3) Base ball: A slang term for freebase or crack cocaine, sometimes referring to a mixture of the two. It directly relates to the term "base." - (4) Angel dust: A slang term for the drug PCP.

Conclusion: "Base ball" is the slang term in the list that refers to the smokable, pure alkaloidal (base) form of cocaine.

Quick Tip

Cocaine salt (powder) is for snorting. Cocaine **base** is for smoking. Slang terms like "freebase", "crack", and "(base)ball" all refer to this smokable form.

70. Match the LIST-I (CPO) with LIST-II (Motto)

LIST-I

LIST-II

- | | |
|-----------------|--------------------------------------|
| A. CRPF | I. Seva aur Nishtha |
| B. SSB | II. Seva Parmo Dharma |
| C. ITBP | III. Shaurya, Dridhata, Karm Nishtha |
| D. Assam Rifles | IV. Sanrakshan, Seva, Samikshan |

(1) A - I, B - II, C - III, D - IV

(2) A - I, B - III, C - IV, D - II

(3) A - III, B - IV, C - II, D - I

(4) A - I, B - III, C - II, D - IV

Correct Answer: A-I and C-III are correct pairings. The question is flawed as other mottos are incorrect for the given forces.

Solution: Let's match the Central Police Organisation (CPO) with its official motto.

A. CRPF (Central Reserve Police Force): Their motto is "Seva aur Nishtha" (Service and Loyalty). So, **A matches with I.**

B. SSB (Sashastra Seema Bal): Their motto is "Seva, Suraksha, Bhaichara" (Service, Security, Brotherhood). This is not listed. "Seva Parmo Dharma" (Service is the highest duty) is the motto of the BSF (Border Security Force). So, **II is incorrect for SSB.**

C. ITBP (Indo-Tibetan Border Police): Their motto is "Shaurya, Dridhata, Karm Nishtha" (Valour, Determination, Devotion to Duty). So, **C matches with III.**

D. Assam Rifles: Their motto is "Sentinels of the North East". Item IV is not a recognized motto.

Conclusion: The only definitively correct pairings are A-I and C-III. None of the options correctly match all four items because the list of mottos is incorrect.

Quick Tip

It's useful to learn the mottos of major forces:

- **CRPF:** Seva aur Nishtha
- **BSF:** Seva Parmo Dharma (Duty Unto Death)
- **ITBP:** Shaurya, Dridhata, Karm Nishtha
- **SSB:** Seva, Suraksha, Bhaichara

71. Arrange in the proper sequence the process/procedure for making paper.

- A. The pulp is cooled in large digesters.
- B. The pulp is sent to refiners where the fibers are cut to a standard size.
- C. It is bleached and put into a beater where color and size can be added.
- D. It is blown under pressure to separate the fibers and remove extraneous materials.
- E. The paper is dried and calendered.

- (1) A, B, C, D, E
- (2) A, D, C, B, E
- (3) A, C, B, D, E
- (4) A, C, D, B, E

Correct Answer: None of the options present a fully logical sequence. A more plausible sequence would be $D \rightarrow B \rightarrow C \rightarrow E$.

Solution: Let's establish the logical flow of industrial papermaking.

Step 1: Pulping. Raw material (like wood chips) is cooked in a digester to break it down into pulp.

D. It is blown under pressure to separate the fibers. This step, "blowing the digester," happens after cooking.

A. The pulp is cooled. This would happen after cooking and blowing.

Step 2: Stock Preparation. The pulp is processed to get it ready for the paper machine.

B. The pulp is sent to refiners where the fibers are cut and frayed to improve bonding.

C. It is bleached... and put into a beater where color and sizing can be added. This stage prepares the final "furnish."

Step 3: Papermaking. The furnish is formed into a sheet and dried.

E. The paper is dried and calendered (pressed smooth).

Conclusion: A logical sequence of the given steps is $D \rightarrow A \rightarrow B \rightarrow C \rightarrow E$. Since this is not an option, and all options start with 'A', the question is flawed in its construction and options.

Quick Tip

The basic paper making process is: **Pulping** (making the slush) $\rightarrow$ **Beating/Refining** (preparing the pulp) $\rightarrow$ **Forming** (making the sheet on a screen) $\rightarrow$ **Drying/Finishing** (pressing and smoothing).

72. The United States Department of Justice started a training programme called ICITAP mainly to train police officers of which part of the world?

- (1) Middle East
- (2) Indian Subcontinent
- (3) Oceania
- (4) Latin America

Correct Answer: (4) Latin America

Solution: Step 1: Identify ICITAP. ICITAP stands for the International Criminal Investigative Training Assistance Program. It was established by the U.S. Department of Justice in 1986.

Step 2: Understand its initial focus. While ICITAP is now a global program operating in dozens of countries, its initial and primary focus during the 1980s was to support civilian law enforcement in Latin America, assisting nations in developing professional and accountable police forces as they transitioned to democracy.

Step 3: Conclude. The program was started mainly to train police officers in Latin America.

Quick Tip

ICITAP's origins are rooted in the U.S. foreign policy of the 1980s, which strongly focused on promoting democracy and stability in Central and South America.

73. The Cobra battalion works under the operational command of which of the following Police organization?

- (1) SSB
- (2) CRPF
- (3) ITBP
- (4) CISF

Correct Answer: (2) CRPF

Solution: Step 1: Define CoBRA. CoBRA stands for Commando Battalion for Resolute Action. They are a specialized elite unit proficient in guerrilla tactics and jungle warfare.

Step 2: Identify its parent organization. The CoBRA units were raised specifically to counter the Naxalite insurgency in India. They are an integral and specialized part of the Central Reserve Police Force (CRPF).

Step 3: Conclude. The CoBRA battalion works under the command of the CRPF.

Quick Tip

Think of CoBRA as the CRPF's specialized jungle warfare commando wing, similar to how other services have their own special forces units.

74. The Ministry which governs BSF is :

- (1) Ministry of Defense
- (2) Ministry of Home Affairs
- (3) Ministry of Foreign Affairs
- (4) Directly under PMO

Correct Answer: (2) Ministry of Home Affairs

Solution: Step 1: Identify BSF. The Border Security Force (BSF) is India's primary border guarding force.

Step 2: Classify the BSF. The BSF is one of the seven Central Armed Police Forces (CAPFs) of India.

Step 3: Determine the governing body. All Central Armed Police Forces, which are responsible for internal security and border guarding during peacetime, are governed by the Ministry of Home Affairs (MHA). The Ministry of Defence governs the Army, Navy, and Air Force.

Conclusion: The BSF is governed by the Ministry of Home Affairs.

Quick Tip

A simple rule for Indian forces: The Army, Navy, and Air Force are under the Ministry of **Defence**. The Central Armed Police Forces (BSF, CRPF, ITBP, etc.) are under the Ministry of **Home Affairs**.

75. The Headquarters of Assam rifles is located at:

- (1) Shillong
- (2) Dibrugarh
- (3) Guwahati
- (4) New Delhi **Correct Answer:** (1) Shillong

Solution: Step 1: Identify the Assam Rifles. The Assam Rifles is the oldest paramilitary force in India, with its history dating back to 1835. It is responsible for border security along the Indo-Myanmar border and counter-insurgency operations in Northeast India.

Step 2: Locate its headquarters. The headquarters of the Directorate General of Assam Rifles (DGAR) has been located in Shillong, the capital of Meghalaya, for many decades.

Conclusion: The headquarters is located at Shillong.

Quick Tip

The Assam Rifles are known as the "Sentinels of the North East." It's fitting that their headquarters is located in a major city central to the region: Shillong.
