Medical Forensics

Exam Information

Exam number
730

Items
65

Points
73

Prerequisites
Biology

Recommended course length
One Year

National Career Cluster
Health Science
Law, Public Safety, Corrections & Security

Performance standards
Included (Optional)

Certificate available
Yes

Description

The Medical Forensics industry certification exam is a year-long course designed to create an awareness of the branch of health science relating to medical forensics. This course focuses on introductory skills and assessment in order to develop the ability to identify, analyze, and process logically using deductive reasoning and problem solving. Medical forensics involves many aspects of health science instruction including laboratory skills and safety, microscopy, toxicology, measurement, physical evidence identification, pathology, anthropology, entomology, psychology, blood spatter analysis, and career exploration.

Exam Blueprint

Standard	Percentage of exam
1. Fundamental Aspects of Medical Forensics	3%
2. Fundamental Laboratory Skills	3%
3. Medical Forensics Investigation	4%
4. Analyzing Trace Evidence (Hair & Fiber)	10%
5. Fingerprint Identification	15%
6. Death Investigation	16%
7. Blood Investigation	15%
8. Exploring Aspects of a Criminal Mind	7%
9. Exploring Physical Evidence and Remains	12%
10. Investigation of Common Poisonings & Adverse Effects of Drugs	6%
11. Importance of DNA Evidence	9%

Standard 1

Students will explore the fundamental aspects of Medical Forensics.

Objective 1 Detail the history and development of medical forensics.

1. Create a historical timeline.
2. Explore a variety of careers associated with medical forensics professions.
    a. Crime laboratory analyst
    b. Clinical laboratory technician
    c. Microbiologist
    d. Fingerprint analyst
    e. Criminalist
    f. Crime scene investigator
    g. Phlebotomist
    h. Forensic DNA analyst
    i. Medicolegal death investigator
    j. Toxicologist
    k. Physical Scientist/Life Scientist
    l. Pharmacologist
    m. Geneticist
    n. Medical examiner
    o. Forensic anthropologist
    p. Forensic entomologist
    q. Forensic nurse
    r. Forensic dentist

Objective 2 Discuss the organization of the crime laboratory and detail the functions it serves.

1. Discuss the federal programs established in the United States to investigate crimes.
    a. ATF - Alcohol, Tobacco, Firearms and Explosives
    b. FBI - Federal Bureau of Investigation
    c. U.S. Postal Inspection Service
    d. DEA - Drug Enforcement Administration
    e. DPAA - Defense POW.MIA Accounting Agency
    f. DFSC - Defense Forensics Science Center

2. Describe the organization of the Utah forensic laboratory systems.

Objective 3 Describe the importance of physical evidence and observation.

1. Categorize the types of evidence.
    a. Testimonial evidence
    b. Eyewitness
        i. Written Statements
    c. Physical evidence
        i. Individual
        ii. Class
2. Discuss how evidence is used to connect suspect, victim, and the scene.
3. Review and practice the steps of becoming an accurate observer.
    a. Observe systematically
        i. Minimize bias
        ii. Document observations
    b. Written Visual

Standard 2

Students will explore essential laboratory safety skills and fundamental skills related to microscopy and measurement.

Objective 1 Describe the appropriate use of personal protective equipment (PPE).

1. Describe how PPE protects the evidence and the lab worker.
2. Explain how to properly use PPE.
    a. Lab Coats or apron
    b. Gloves
    c. Safety glasses

Objective 2 Exhibit appropriate behavior in the lab.

1. Explain the dangers of evidence contamination through food, drink, cosmetics, lotion, eye drops, and contact lenses.
2. Follow proper disposal and clean-up procedures with respect to chemicals and laboratory equipment.
3. Demonstrate proper hand washing technique.

Objective 3 Use laboratory equipment correctly and safely.

1. Demonstrate the proper use of equipment.
    a. Micropipette
    b. Electrophoresis apparatus-DNA
    c. Microscope
    d. Balance
    e. Water bath
    f. Vernier calipers
    g. Glassware (metric units)
    h. Rulers/Measuring tapes
2. Identify the parts and functions of a compound microscope.
3. Demonstrate the ability to create a wet mount slide.

Objective 4 Follow laboratory procedures.

1. Understand the purpose of individual steps within a protocol.
2. Perform the steps of laboratory protocols accurately and in sequence.

Objective 5 Comply with policies and requirements for maintaining a lab manual/notebook/form.

1. Follow standard operating procedures for maintaining a lab manual/notebook/form.
2. Identifying information
    a. Name
    b. Date
    c. Case number/Assignment number
3. Always write in ink
4. Make corrections properly
5. Document laboratory work/activities, including:
    a. Material
    b. Procedures
    c. Data/Results
    d. Analysis
    e. Conclusion

Objective 6 Demonstrate proper handling of chemicals.

1. Communicate the rationale for laboratory labeling procedures.

2. Recognize and comply with the labeling of chemicals used in a laboratory setting for safe handling and storage (flammability, corrosiveness, biohazards, toxicity, etc.).
3. Reference and interpret the guidelines in Safety Data Sheets (SDS).

Standard 2 Performance Evaluation included below (Optional)

Standard 3

Students will describe techniques used to process a crime scene and preserve the physical evidence from the scene.

Objective 1 Describe how various medical forensics professionals process a crime scene.

1. First Responding officer
2. Crime Investigator/Detective
3. Crime Scene Investigator
4. Medicolegal Death Investigator

Objective 2 Describe proper procedures of evidence packaging.

1. Use sterile tools
2. Select the appropriate packaging for evidence
3. Write identifying information
    a. Case number
    b. Date
    c. Agency
    d. Name of Collector
4. Write simple descriptions
5. Properly seal evidence packages
6. Complete the chain of custody log

Objective 3 Identify how a crime scene and evidence may be compromised.

1. Contamination
2. Chain of custody
3. Environmental conditions
4. Preservation of the crime scene
5. Processing at the lab

Standard 3 Performance Evaluation included below (Optional)

Standard 4

Students will identify and analyze trace evidence, emphasizing hair and fiber.

Objective 1 Examine trace evidence using a microscope, and other techniques.

Objective 2 Examine and analyze the forensic aspects of hair.

1. Describe the microscopic structure of hair.
    a. Shaft
        i. Cortex
        ii. Cuticle
    b. Root
        i. Medulla
    c. Follicle
2. Describe the location of nuclear and mitochondrial DNA associated with hair.
    a. Shaft
    b. Root
3. Describe the hair growth cycle and how it relates to trace evidence.
    a. Anagen, catagen, telogen phases
    b. Chemical absorption
4. Describe how to differentiate between animal hair and human hair.

Objective 3 Examine and analyze the forensic aspects of fibers by using physical (microscopic) and chemical (burn, acid, base, acetone) testing methods.

1. Natural fibers
    a. Wool
    b. Silk
    c. Cotton
    d. Cashmere
    e. Hemp
2. Synthetic
    a. Polyester
    b. Spandex
    c. Acrylic
    d. Nylon

Standard 5

Students will explore fingerprint identification.

Objective 1 Describe fingerprint characteristics.

1. Describe the 3 fundamental principles of fingerprinting as a means of personal identification.

a. Uniqueness
b. Persistent
c. Classifiable

2. Identify the degrees of fingerprinting
    a. First level detail - patterns
    b. Second level detail - minutiae
        i. Bifurcation
        ii. Ridge ending

Objective 2 Identify and classify fingerprint and ridge patterns.

1. Classify fingerprints into 3 basic patterns.
    a. Loops
        i. Right
        ii. Left
    b. Whorls
        i. Plain
        ii. Double
        iii. Central
        iv. Accidental
    c. Arches
        i. Plain
        ii. Tented
2. Differentiate the steps of the ACE-V method of fingerprint comparison.
    a. Analysis: Assessing a print to determine if it can be used for a comparison.
    b. Comparison: Performed by an analyst who views the known and suspect prints side-by-side.
    c. Evaluation: The examiner decides if the prints are from the same source (identification or individualization), different sources (exclusion) or is inconclusive.
    d. Verification: When another examiner independently analyzes, compares and evaluates the prints to either support or refute the conclusions of the original examiner.

Objective 3 Compare and contrast latent, plastic, and visible fingerprints.

1. Develop latent fingerprints using physical and chemical processing.
2. Examine a plastic fingerprint using a mold (wax, soap, putty, etc.)
3. Create and document patent (visible) fingerprints using digital photography.

Standard 5 Performance Evaluation included below (Optional)

Standard 6

Students will investigate the characteristics of blood, blood testing, and bloodstain analysis.

Objective 1 Identify the components and chemical properties of blood.

1. List the components of blood.
    a. Plasma
    b. Erythrocytes (red blood cells)
    c. Leukocytes (white blood cells)
    d. Thrombocytes (platelets)
2. Identify the antigens and antibodies that determine ABO blood types and the Rh factor.
3. Discuss the limitations of using SBO blood types for forensic purposes.

Objective 2 Examine and analyze blood stain patterns.

1. Illustrate size, shape, appearance, distribution and location of blood spatter in a laboratory experiment.
2. Compare and contrast low, medium, and high-velocity blood spatter.
3. Examine different types of blood spatter patterns.
    a. Splatter
    b. Drip
    c. Castoff
    d. Transfer
    e. Swipe
    f. Wipe
    g. Projected
    h. Expirated
    i. Void

Objective 3 Describe proper procedures for blood stain evidence collection, presumptive testing, and preservation.

1. Describe how to collect a wet stain and a dry stain.
2. Discuss how to collect a large object in reference to blood evidence collection (i.e. sheets, blankets, clothing, etc.)
3. Perform and explain a presumptive blood test.

Standard 6 Performance Evaluation included below (Optional)

Standard 7

Students will investigate various aspects of death.

Objective 1 Describe the correct anatomical position and the role it plays in death investigation.

1. Describe anatomical position.
2. Apply directional terms related to autopsy.
    a. Superior
    b. Inferior
    c. Anterior
    d. Posterior
    e. Dorsal
    f. Ventral
    g. Medial
    h. Lateral
    i. Proximal
    j. Distal

Objective 2 Locate the body cavities and body regions and identify the major organs within each.

1. Dorsal cavity
    a. Cranial
2. Spinal
    a. Spinal Cord
3. Ventral Cavity
    a. Thoracic
4. Lungs
5. Esophagus
6. Trachea
7. Diaphragm
8. Abdominal
9. Stomach
10. Pancreas
11. Spleen
12. Liver
13. Gall Bladder
14. Small/Large Intestine
15. Kidneys
16. Pelvic
17. Urinary Bladder

Objective 3 Compare and contrast the manner and cause of death.

1. Define and list manners of death.
    a. Accidental: The victim died under the circumstances that neither he/she nor someone else brought about. The resulting death was not reasonably foreseeable.
    b. Natural: Death is caused solely by disease or natural process.
    c. Suicide: The victim knowingly engaged in an act reasonably expected to end his/her life.
    d. Homicide: Death is caused by another individual (this can refer to either a noncriminal

act or the criminal act of murder.)
   e. Undetermined: There is insufficient information about the circumstances of the death.
2. Differentiate between cause and mechanism of death.

Objective 4 Identify the steps of an autopsy procedure and discuss the role an autopsy report may play in a death investigation.

1. List the steps of an external examination.
2. Describe the proper technique to perform a Y-shaped incision
3. List the steps of an internal examination.

Objective 5 Identify the factors used to determine the approximate time since death/postmortem interval.

1. Describe the stages of decomposition.
   a. Fresh
   b. Active Decay
   c. Autolysis/Putrefaction
   d. Bloat
   e. Marbling
   f. Skin blistering
   g. Skin slippage
   h. Advanced Decay
   i. Skeletonization
   j. Saponification
   k. Mummification
2. Compare and contrast the following:
   a. Algor mortis
   b. Rigor mortis
   c. Livor mortis
3. Identify common insects associated with decomposition and diagram their life cycles.
   a. Egg
   b. Larva
   c. Pupa
   d. Adult
4. Identify various environmental factors related to time of death (temperature, humidity, cause of death, etc.)

Standard 7 Performance Evaluation included below (Optional)

Standard 8

Students will explore physical finding and characteristics of human remains.

Objective 1 Identify the basic bones of the skeleton used in forensic anthropology.

1. Skull
2. Humerus
3. Radius
4. Ulna
5. Pelvis
6. Femur
7. Tibia
8. Fibula

Objective 2 Use skeletal remains to determine the biological profile of an individual.

1. Determine the sex of an individual based on skull, jaw, brow ridge, pelvis and femur.
2. Estimate the age of an individual.

Objective 3 Identify injuries, bone diseases, and possible cause of death using bone characteristics.

1. Compare and contrast ante mortem and peri mortem bone injuries (i.e. evidence of healing).
2. Identify bone patterns indicating disease (i.e. arthritis)
3. Identify bone damage characteristics that could indicate cause of death (i.e. stab wound, bullet hole, blunt force trauma, etc.)

Objective 4 Describe how teeth are used in forensic identification

1. Name and number deciduous (baby) teeth and permanent teeth.
2. Describe the use of forensic dentistry in regard to mass disasters and body identification.

Standard 9

Students will develop an understanding of drugs, their toxicology, and their analysis.

Objective 1 Identify the classifications of legal and illegal substances.

1. Controlled substances (Schedule 1-5)
2. Regulated substances (prescription only)
3. Restricted substances (alcohol, tobacco, etc.)
4. Unrestricted (over the counter)

Objective 2 Describe the physiological effects and symptoms of drug use and overdose.

1. Stimulants
2. Depressants
3. Narcotics/Opioids
4. Hallucinogens

Objective 3 Describe current field and laboratory procedures used for measuring the level of impairment caused by consuming alcohol.

1. Standard Field Sobriety Tests (SFST)
2. Describe techniques used to measure the blood alcohol content (BAC)
    a. Through blood
    b. Through the breath

Objective 4 Describe procedures for measuring other substances within the body.

1. Blood testing
2. Hair analysis
3. Urinalysis

Standard 9 Performance Evaluation included below (Optional)

Standard 10

Students will investigate the importance of DNA evidence.

Objective 1 Identify the structure, function, and sources of DNA.

1. Describe the structure of DNA.
2. Describe the function of DNA.
3. Compare and contrast nuclear DNA and mitochondrial DNA.
4. Identify types of physical evidence that could contain DNA.

Objective 2 Describe advancements in DNA technology

1. Describe the purpose of Polymerase Chain Reaction (PCR).
2. Discuss how mitochondrial DNA relates to forensic identification.
3. Define Short Tandem Repeat (STR) and discuss how it relates to forensic identification.
4. Describe the combined DNA Index System (CODIS) of DNA identification.

5. Explore the value of investigative Genetic Genealogy (IGG)
6. Determine genetic probabilities using a Punnett square.

Medical Forensics

Performance assessments may be completed and evaluated at any time during the course. The following performance skills are to be used in connection with the associated standards and exam. To pass the performance standard the student must attain a performance standard average of 8 or higher on the rating scale. Students may be encouraged to repeat the objectives until they average 8 or higher.

Student's Name: _____

Class: _____

Performance standards rating scale

0	Limited skills	2	→	4	Moderate skills	6	→	8	High skills	10

Standard 2 – Fundamental Laboratory Skills **Score:**

- Demonstrate appropriate use of personal protective devices
  - Describe how personal protective devices protect the evidence and the lab worker.
  - Demonstrate how to properly use personal protective devices (e.g., lab coats, gloves, safety glasses. Demonstrate safe removal of gloves.
  - Demonstrate the ability to create a wet mount slide
  - Maintain an accurate lab notebook.

Standard 3 – Medical Forensics Investigation **Score:**

- Collect and properly label evidence.

Standard 5 – Fingerprint Identification **Score:**

- Develop a latent fingerprint and identify 10 ridge characteristics

Standard 6 – Blood Investigation **Score:**

- Classify blood spatter by force.
  - High
  - Medium
  - Low
  - Differentiate between the various bloodstain patterns.

Standard 7 – Death Investigation **Score:**

- Identify the steps of an autopsy procedure by animal dissection.
  - Steps of an external examination
  - Proper Y-shaped incision technique
  - Steps of an internal examination

Standard 9 – Exploring Aspects of a Criminal Mind **Score:**

- Identify the sex of an individual based on bone characteristics and measurements.
    - Skull
    - Jaw
    - Brow ridge
    - Pelvis
    - Femur

Workplace Skills

- Communication
- Problem-solving
- Teamwork
- Critical Thinking

Performance standard average score:

Evaluator Name: _____

Evaluator Title: _____

Evaluator Signature: _____

Date: _____