

# **APPENDIX K**

## **KSAs Assessed by the AFTE Practical Examination**

# Firearms Practical Examination

## Knowledges

7. Knowledge of scientific methodologies for the preservation of evidence.
14. Knowledge of how to properly document evidence and analytical results (through notes, sketches, photography, reports, etc.).
21. Knowledge of testing procedures commonly used to examine evidence, the expected results from each, and when to apply each.
24. Knowledge of quality assurances and quality control procedures and how they are maintained by Firearm and Toolmark Examiners.
25. Knowledge of sequential priorities for conducting scientific tests so as not to destroy evidence or contaminate test results.
26. Knowledge of definitions of class, sub-class, and individual characteristics and the differences between them.
27. Knowledge of the sources of class, sub-class, and individual characteristics.
28. Knowledge of how and when to use photographic equipment (such as camera types, lenses, film types, filters, proper camera settings, depth of field, proper illumination, and determination of film exposure times).
29. Knowledge of how and when to use various microscopy equipment; such as stereo binocular, comparison, compound (including polarizing), scanning electron microscope, video microscope.
30. Knowledge of how and when to use microscopy enhancement techniques (such as magnesium smoke).
32. Knowledge of how and when to use photomicrography equipment and its components (such as digital photography, video cameras, camera-to-microscope adapters), determination of effective magnification on printed photographs, determination of proper exposure times.
33. Knowledge of when and how to properly use measuring equipment (such as filar micrometer eyepieces, stage micrometers, dial micrometers and calipers, vernier micrometers and calipers, gauges and balances, rulers, tape measures, levels, angle finders, protractors, etc.).
59. Knowledge of how and when to use fume hoods.
116. Knowledge of the interactive nature of the tool/toolmark process and the transference of class, sub-class, and individual characteristics.
119. Knowledge of the principles of preparing test marks and the effects of test materials in the production of testfired cartridge components and toolmarks for comparison.
138. Knowledge of the proper use of safety equipment and materials (such as protective clothing, eye and ear protective devices, and disinfectants).
140. Knowledge of safety procedures associated with the use of laboratory equipment.
152. Knowledge of the ethical standards maintained by the scientific community (in general).
153. Knowledge of the ethical standards maintained by forensic science organizations (including the American Society of Crime Laboratory Directors and the Association of Firearms and Toolmark Examiners).

## **Skills**

2. Skill in carefully and properly handling physical evidence without loss, contamination, or changes to the evidence that could result in loss of information.
11. Skill in properly packaging and storing evidence.
16. Skill in properly mounting and illuminating specimens.
20. Skill in setting up and using various types of microscopes (includes setting the appropriate illumination).
21. Skill in magnesium smoking techniques to reduce surface reflectance when using microscopes.
22. Skill in using chronograph and other measuring devices (e.g., micrometers, depth gauges, headspace gauges, balances, rulers, calipers, etc.).
51. Skill in identifying various marks on ammunition components as having been produced by a particular part of a firearm.

## **Abilities**

1. Ability to recognize the evidence potential of an item.
11. Ability to adhere to an examination protocol for both firearms and toolmark cases.
12. Ability to use logic to analyze and identify strengths and weaknesses of different approaches.
13. Ability to use scientific methodology, statistics, and logic in solving forensic problems.
14. Ability to perform routine maintenance on laboratory equipment and machines (includes calibrating instruments).
15. Ability to determine when enhancement techniques are needed when examining evidence.
18. Ability to operate basic laboratory equipment.
20. Ability to make detailed calculations accurately.
21. Ability to recognize discrepancies or inconsistencies in analytical findings and determine their cause and significance.
23. Ability to recognize the limitations of tests and interpretations.
30. Ability to recognize the effect that firearms and ammunition manufacturing processes, the design of firearms, and design of firearms accessories have on markings imparted to bullets and casings and to interpret them accordingly.
31. Ability to recognize different manufacturing methods and, based upon this, to properly interpret potential for class, sub-class, and individual characteristics.
33. Ability to recognize and discriminate common rifling profiles.
34. Ability to distinguish “action” markings from those caused during firing.
47. Ability to determine the source and uniqueness of various striated and/or static marks on bullets and cartridges.
48. Ability to recognize and properly align reproducible striae arrays sufficient for identification purposes.
49. Ability to recognize, determine the source of, and differentiate between class, sub-class, and individual characteristics on bullets, cartridges, cartridge cases, and in non-firearm related toolmarks.
53. Ability to distinguish between the quality and quantity of matching striae in a true identity and that observed in known non-matches.
71. Ability to make determinations in toolmark comparisons (both firearm and non-firearm toolmarks) regarding: identifications, exclusions, and inconclusives.
84. Ability to record scientific observations and the results of scientific tests.
86. Ability to maintain clear and comprehensive case notes.
88. Ability to read and understand information and ideas presented in writing.
89. Ability to properly document evidence items, examinations, and comparisons.
94. Ability to recognize unsafe conditions.
95. Ability to employ safe work practices.
96. Ability to render conditions safe.

# **Gunshot Residue Practical Examination**

## **Component 1: Shotgun Dispersion Patterns**

### **Knowledges**

4. Knowledge of shooting-scene reconstruction techniques.
7. Knowledge of scientific methodologies for the preservation of evidence.
14. Knowledge of how to properly document evidence and analytical results (through notes, sketches, photography, reports, etc.).
21. Knowledge of testing procedures commonly used to examine evidence, the expected results from each, and when to apply each.
22. Knowledge of experimental design methodologies for conducting scientific experiments and investigations.
23. Knowledge of how each scientific test affects the evidence being examined.
24. Knowledge of quality assurances and quality control procedures and how they are maintained by Firearm and Toolmark Examiners.
33. Knowledge of when and how to properly use measuring equipment (such as filar micrometer eyepieces, stage micrometers, dial micrometers and calipers, vernier micrometers and calipers, gauges and balances, rulers, tape measures, levels, angle finders, protractors, etc.).
67. Knowledge of how and when to use examination tables.
90. Knowledge of shotshell: design, construction and nomenclature; shot sizes and composition (hardened lead, plated steel, etc.); wad design and types of filler (buffering) materials.
102. Knowledge of bullet holes/bullet impact sites and ricochet marks.
111. Knowledge of pellet patterns and how they are used in distance determination.
112. Knowledge of which firearms, ammunition, and test pattern surfaces to use for the purpose of distance determination.
140. Knowledge of safety procedures associated with the use of laboratory equipment.
152. Knowledge of the ethical standards maintained by the scientific community (in general).
153. Knowledge of the ethical standards maintained by forensic science organizations (including the American Society of Crime Laboratory Directors and the Association of Firearms and Toolmark Examiners).

### **Skills**

2. Skill in carefully and properly handling physical evidence without loss, contamination, or changes to the evidence that could result in loss of information.
11. Skill in properly packaging and storing evidence.
13. Skill in correctly measuring test and evidence patterns.
22. Skill in using chronograph and other measuring devices (e.g., micrometers, depth gauges, headspace gauges, balances, rulers, calipers, etc.).

## **Abilities**

- 11. Ability to adhere to an examination protocol for both firearms and toolmark cases.
- 13. Ability to use scientific methodology, statistics, and logic in solving forensic problems.
- 18. Ability to operate basic laboratory equipment.
- 20. Ability to make detailed calculations accurately.
- 21. Ability to recognize discrepancies or inconsistencies in analytical findings and determine their cause and significance.
- 23. Ability to recognize the limitations of tests and interpretations.
- 63. Ability to determine directionality of a bullet's course, as affected/unaffected by intervening objects, and estimate the bullet's trajectory (flight path) where possible.
- 69. Ability to compare and interpret test and evidence gunshot discharge patterns.
- 84. Ability to record scientific observations and the results of scientific tests.
- 86. Ability to maintain clear and comprehensive case notes.
- 89. Ability to properly document evidence items, examinations, and comparisons.
- 94. Ability to recognize unsafe conditions.
- 95. Ability to employ safe work practices.
- 106. Ability to maintain and practice high ethical standards in the performance of one's job duties.

# **Gunshot Residue Practical Examination**

## **Component 2: Distance Determination**

### **Knowledges**

3. Knowledge of which tools or instruments are most appropriate for the recovery of evidence.
6. Knowledge of legal requirements for the preservation of evidence.
7. Knowledge of scientific methodologies for the preservation of evidence.
9. Knowledge of which tools, instruments, and containers are most appropriate for the preservation of evidence.
10. Knowledge of the proper storage conditions for evidence collected.
12. Knowledge of basic Chain of Custody rules.
13. Knowledge of the effects that interfering factors (such as substrate, time, activity, temperature, weather, etc.) have upon various types of evidence, and ways to prevent their effects.
14. Knowledge of how to properly document evidence and analytical results (through notes, sketches, photography, reports, etc.).
15. Knowledge of the techniques and procedures used to properly mark evidence (when appropriate).
16. Knowledge of the proper mechanics of the English language (grammar, punctuation, spelling, and composition).
17. Knowledge of the proper methodologies for the written documentation of scientific results.
20. Knowledge of various photographic techniques and their application for documenting evidence and analytical results, and for preparing courtroom exhibits.
21. Knowledge of testing procedures commonly used to examine evidence, the expected results from each, and when to apply each.
23. Knowledge of how each scientific test affects the evidence being examined.
24. Knowledge of quality assurances and quality control procedures and how they are maintained by Firearm and Toolmark Examiners.
25. Knowledge of sequential priorities for conducting scientific tests so as not to destroy evidence or contaminate test results.
28. Knowledge of how and when to use photographic equipment (such as camera types, lenses, film types, filters, proper camera settings, depth of field, proper illumination, and determination of film exposure times).
29. Knowledge of how and when to use various microscopy equipment; such as stereo binocular, comparison, compound (including polarizing), scanning electron microscope, video microscope.
30. Knowledge of how and when to use microscopy enhancement techniques (such as magnesium smoke).
32. Knowledge of how and when to use photomicrography equipment and its components (such as digital photography, video cameras, camera-to-microscope adapters), determination of effective magnification on printed photographs, determination of proper exposure times.
33. Knowledge of when and how to properly use measuring equipment (such as filar micrometer eyepieces, stage micrometers, dial micrometers and calipers, vernier micrometers and calipers, gauges and balances, rulers, tape measures, levels, angle finders, protractors, etc.).
37. Knowledge of how and when to use chemical laboratory equipment (such as glassware, burners, pipettes, etc.).
38. Knowledge of how and when to use various vises, clamps, and restraining devices.
41. Knowledge of how and when to use various cleaning solutions.
46. Knowledge of how and when to use different probes (such as wood, fiberglass, metal, etc.) for bullet holes.
51. Knowledge of how and when to use magnifying glasses of various powers.
52. Knowledge of how and when to use chemical reagents.
57. Knowledge of how and when to use various small handtools (such as screwdrivers, hammers, pliers, etc.).
59. Knowledge of how and when to use fume hoods.

67. Knowledge of how and when to use examination tables.
82. Knowledge of the different materials that may be present in the bore of a firearm.
83. Knowledge of the types of trace materials that may be present on firearms.
84. Knowledge of methods for determining if and how often a firearm has been fired since it was last cleaned.
85. Knowledge of propellants: physical forms and associated purposes of small arms propellants; black gun powder and Pyrodex; nitrocellulose propellants, both single and double base.
86. Knowledge of projectiles: design (ogive shape, base shape, cannelure types, forming processes); construction and composition (lead alloy compositions, jacketing materials and styles, etc.).
91. Knowledge of primers: design, color, staking.
92. Knowledge of ammunition components.
93. Knowledge of ammunition manufacturing methods.
95. Knowledge of the principles of ammunition reloading.
97. Knowledge of proper ammunition selection.
102. Knowledge of bullet holes/bullet impact sites and ricochet marks.
106. Knowledge of chemical tests used in the examination of bullet holes, bullet impact site, and ricochet marks.
107. Knowledge of how and when to perform microscopic examinations for the purpose of distance determination.
109. Knowledge of how and when to perform chemical tests (such as: sodium rhodizonate and Griess) for the purpose of distance determination.
110. Knowledge of stippling patterns/powder patterns on a surface and how they are used in distance determination.
112. Knowledge of which firearms, ammunition, and test pattern surfaces to use for the purpose of distance determination.
113. Knowledge of bullet hole characterization for caliber size determination (within limitations) when performing distance determination.
120. Knowledge of firearms-generated discharge products: how deposited; primer constituents, propellant residues, bullet metal and bullet lubricants.
122. Knowledge of different interpretations for any given gunshot residue analytical results.
129. Knowledge of correct word usage and pronunciation.
132. Knowledge of the potential hazardous properties of toxic and reactive chemicals.
133. Knowledge of the potential hazardous properties of gunshot residues.
134. Knowledge of the proper methods for the handling and disposing of hazardous materials.
138. Knowledge of the proper use of safety equipment and materials (such as protective clothing, eye and ear protective devices, and disinfectants).
140. Knowledge of safety procedures associated with the use of laboratory equipment.
142. Knowledge of which journals, newsletters and professional publications report information applicable to Firearm and Toolmark Examiners.
152. Knowledge of the ethical standards maintained by the scientific community (in general).
153. Knowledge of the ethical standards maintained by forensic science organizations (including the American Society of Crime Laboratory Directors and the Association of Firearms and Toolmark Examiners).

## **Skills**

2. Skill in carefully and properly handling physical evidence without loss, contamination, or changes to the evidence that could result in loss of information.
11. Skill in properly packaging and storing evidence.
13. Skill in correctly measuring test and evidence patterns.
15. Skill in taking suitable photographs of subjects (specimens) through the optics of the microscope (involves the selection of appropriate film, filters, light source, illumination technique, and exposure times).

16. Skill in properly mounting and illuminating specimens.
20. Skill in setting up and using various types of microscopes (includes setting the appropriate illumination).
22. Skill in using chronograph and other measuring devices (e.g., micrometers, depth gauges, headspace gauges, balances, rulers, calipers, etc.).
24. Skill in disinfecting evidence and surface areas using appropriate materials.
25. Skill in using various handheld tools used for the recovery of evidence (including handtools, surgical tools, vises and clamps, probes, etc.).
26. Skill in measuring and/or mixing various liquids and chemical compounds.
27. Skill in reading meters (including sound meters, exposure meters, etc.).
28. Skill in operating common laboratory equipment, instruments, and machines (such as pumps, mixers, ultrasonic baths, IR and UV light equipment, etc.).
52. Skill in recovering gunshot residues from clothing, fired cartridge cases, gun barrels, etc., and preparing them for examination and comparison.
53. Skill in using various visualization methods for gunshot residue deposits on clothing and other surfaces.

## **Abilities**

1. Ability to recognize the evidence potential of an item.
2. Ability to recognize and safeguard non-firearms evidence, such as trace materials.
3. Ability to recognize bullet impact sites at crime scenes.
6. Ability to interpret the value, meaning, and relationship of various items of evidence at crime scenes for the purpose of reconstructing what events occurred.
7. Ability to establish and maintain a proper chain of custody.
8. Ability to maintain a complete inventory of evidence from a particular case.
9. Ability to design a testing protocol (based on size of sample and type of evidence) that will provide the most useful information, while avoiding procedures that are redundant or will interfere with subsequent tests.
10. Ability to evaluate examination requests, while considering the totality of the case.
11. Ability to adhere to an examination protocol for both firearms and toolmark cases.
12. Ability to use logic to analyze and identify strengths and weaknesses of different approaches.
13. Ability to use scientific methodology, statistics, and logic in solving forensic problems.
15. Ability to determine when enhancement techniques are needed when examining evidence.
18. Ability to operate basic laboratory equipment.
21. Ability to recognize discrepancies or inconsistencies in analytical findings and determine their cause and significance.
23. Ability to recognize the limitations of tests and interpretations.
45. Ability to compare unfired propellant samples from disassembled cartridges.
62. Ability to identify holes and/or defects in various objects as bullet-caused, through physical and/or chemical means (e.g., lead containing "bullet wipe," "bullet splash," copper/lead transfers in bullet graze or ricochet marks).
67. Ability to recognize bullet impact sites at shooting scenes.
69. Ability to compare and interpret test and evidence gunshot discharge patterns.
70. Ability to accurately record the appearance of bullet holes.
75. Ability to visualize, document and measure gunshot residue deposits on clothing and other surfaces, and to prepare representative gunshot residue test patterns with the evidence firearm and appropriate ammunition, and to estimate the muzzle to target distance from the comparison of evidence and test patterns.
76. Ability to perform relevant chemical tests for the purpose of distance determination.
77. Ability to identify the physical form and type of small arms propellant recovered from a gun, victim's clothing, etc. (e.g., flattened ball powder, perforated disc, flake powder, etc.).
78. Ability to evaluate the appropriateness of testing for primer derived gunshot residue on various substrates.

79. Ability to evaluate the possibility/likelihood of contamination by various means (environmental, transference, dispersion due to firearms discharges in confined spaces, etc.).
80. Ability to recognize various primer mixtures available in modern rimfire and centerfire ammunition of both domestic and foreign manufacture.
81. Ability to test for gunshot residues on various substrates (such as glass, cloth, painted metal, etc.).
82. Ability to recognize the various physical and chemical forms of propellants, their purpose in various cartridges and their value as physical evidence.
83. Ability to interpret results of comparative examinations of gunshot residues.
84. Ability to record scientific observations and the results of scientific tests.
85. Ability to write coherently and concisely for the intended audience.
86. Ability to maintain clear and comprehensive case notes.
87. Ability to write comprehensive reports that put test results in proper perspective.
88. Ability to read and understand information and ideas presented in writing.
89. Ability to properly document evidence items, examinations, and comparisons.
94. Ability to recognize unsafe conditions.
95. Ability to employ safe work practices.
96. Ability to render conditions safe.
98. Ability to remain current about, and take advantage of, new technologies.
99. Ability to interpret and present technical results and their significance in lay terms.
105. Ability to advocate only the propriety of the casework that was performed, and not the position of either the prosecution or the defense.
106. Ability to maintain and practice high ethical standards in the performance of one's job duties.

## **Toolmark Practical Examination**

### **Knowledges**

7. Knowledge of scientific methodologies for the preservation of evidence.
10. Knowledge of the proper storage conditions for evidence collected.
14. Knowledge of how to properly document evidence and analytical results (through notes, sketches, photography, reports, etc.).
20. Knowledge of various photographic techniques and their application for documenting evidence and analytical results, and for preparing courtroom exhibits.
21. Knowledge of testing procedures commonly used to examine evidence, the expected results from each, and when to apply each.
22. Knowledge of experimental design methodologies for conducting scientific experiments and investigations.
23. Knowledge of how each scientific test affects the evidence being examined.
24. Knowledge of quality assurances and quality control procedures and how they are maintained by Firearm and Toolmark Examiners.
26. Knowledge of definitions of class, sub-class, and individual characteristics and the differences between them.
27. Knowledge of the sources of class, sub-class, and individual characteristics.
28. Knowledge of how and when to use photographic equipment (such as camera types, lenses, film types, filters, proper camera settings, depth of field, proper illumination, and determination of film exposure times).
29. Knowledge of how and when to use various microscopy equipment; such as stereo binocular, comparison, compound (including polarizing), scanning electron microscope, video microscope.
30. Knowledge of how and when to use microscopy enhancement techniques (such as magnesium smoke).
31. Knowledge of how to prepare casts and use of casting materials.
33. Knowledge of when and how to properly use measuring equipment (such as filar micrometer eyepieces, stage micrometers, dial micrometers and calipers, vernier micrometers and calipers, gauges and balances, rulers, tape measures, levels, angle finders, protractors, etc.).
57. Knowledge of how and when to use various small handtools (such as screwdrivers, hammers, pliers, etc.).
67. Knowledge of how and when to use examination tables.
114. Knowledge of proper use of tools and materials for testmarks.
116. Knowledge of the interactive nature of the tool/toolmark process and the transference of class, sub-class, and individual characteristics.
117. Knowledge of impressed (static) vs. striated (dynamic) toolmarks.
118. Knowledge of the best agreement possible in situations of known non-matches when comparing toolmarks.
119. Knowledge of the principles of preparing test marks and the effects of test materials in the production of testfired cartridge components and toolmarks for comparison.
138. Knowledge of the proper use of safety equipment and materials (such as protective clothing, eye and ear protective devices, and disinfectants).
140. Knowledge of safety procedures associated with the use of laboratory equipment.
141. Knowledge of safety procedures associated with the use of handtools, woodworking machinery, and metalworking machinery.
152. Knowledge of the ethical standards maintained by the scientific community (in general).
153. Knowledge of the ethical standards maintained by forensic science organizations (including the American Society of Crime Laboratory Directors and the Association of Firearms and Toolmark Examiners).

## **Skills**

2. Skill in carefully and properly handling physical evidence without loss, contamination, or changes to the evidence that could result in loss of information.
11. Skill in properly packaging and storing evidence.
13. Skill in correctly measuring test and evidence patterns.
15. Skill in taking suitable photographs of subjects (specimens) through the optics of the microscope (involves the selection of appropriate film, filters, light source, illumination technique, and exposure times).
16. Skill in properly mounting and illuminating specimens.
20. Skill in setting up and using various types of microscopes (includes setting the appropriate illumination).
21. Skill in magnesium smoking techniques to reduce surface reflectance when using microscopes.
29. Skill in preparing suitable test marks.

## **Abilities**

1. Ability to recognize the evidence potential of an item.
7. Ability to establish and maintain a proper chain of custody.
8. Ability to maintain a complete inventory of evidence from a particular case.
9. Ability to design a testing protocol (based on size of sample and type of evidence) that will provide the most useful information, while avoiding procedures that are redundant or will interfere with subsequent tests.
11. Ability to adhere to an examination protocol for both firearms and toolmark cases.
13. Ability to use scientific methodology, statistics, and logic in solving forensic problems.
15. Ability to determine when enhancement techniques are needed when examining evidence.
17. Ability to select proper casting material and technique.
21. Ability to recognize discrepancies or inconsistencies in analytical findings and determine their cause and significance.
23. Ability to recognize the limitations of tests and interpretations.
31. Ability to recognize different manufacturing methods and, based upon this, to properly interpret potential for class, sub-class, and individual characteristics.
71. Ability to make determinations in toolmark comparisons (both firearm and non-firearm toolmarks) regarding: identifications, exclusions, and inconclusives.
72. Ability to recognize patterns (profiles, etc.) produced by various tool working surfaces.
73. Ability to recognize sources of class, sub-class, and individual characteristics on any given tool.
74. Ability to recognize toolmarks as being class, sub-class, or individual in nature.
84. Ability to record scientific observations and the results of scientific tests.
86. Ability to maintain clear and comprehensive case notes.
89. Ability to properly document evidence items, examinations, and comparisons.
94. Ability to recognize unsafe conditions.
95. Ability to employ safe work practices.
106. Ability to maintain and practice high ethical standards in the performance of one's job duties.