

Association of Firearm and Toolmark Examiners

Occupational Analysis And Certification Examination Development

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Report Prepared

by

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Association of Firearm and Toolmark Examiners

Report of Occupational Analysis and Certification Examination Development

Introduction

In January of 1998, the Association of Firearm and Toolmark Examiners (AFTE) entered into a contract with Cooperative Personnel Services (CPS) to develop a series of content-valid certification examinations in three different competency areas: firearm, gunshot residue, and toolmark evidence examination and identification. Each certification examination developed under this contract consisted of a written examination and a practical examination. Two versions of the written and practical certification examinations in each competency area were developed. The purpose of this report is to document the steps taken by CPS and AFTE to develop content-valid certification examinations for the Association of Firearm and Toolmark Examiners. The occupational analysis and test development procedures described in this report were performed to ensure that the resulting AFTE certification examinations are in compliance with applicable professional and legal standards, such as: the Civil Rights Act of 1991; the Americans with Disabilities Act (ADA); Age Discrimination Legislation; the *Uniform Guidelines for Employee Selection Procedures*; the *Principles for the Validation and Use of Personnel Selection Procedures*; and the *Standards for Educational and Psychological Testing*.

About Cooperative Personnel Services (CPS)

CPS has provided testing and human resource management services to public agencies in California for more than 60 years and to agencies throughout the U.S. and Canada for more than 14 years. Founded in 1935 as a local government services unit of the California State Personnel Board, CPS became a joint-powers agency in 1985. Today, as a self-supporting public agency, CPS offers a full range of human resource and related management consulting services to government and nonprofit agencies in the U.S. and Canada, with particular emphasis on occupational testing. CPS currently has more than 1,000 clients throughout the U.S. and Canada, distributes more than 100,000 tests per year, and administers another 150,000 tests per year. Most of CPS's clients are state or local agencies who work with CPS testing consultants to conduct occupational analysis studies, develop, produce, and administer tests, and perform validation studies for employment and licensing/certification testing. CPS has developed and gathered validity evidence for tests for numerous trade occupations such as electrician, plumber, electrical and plumbing inspector, building inspector, and for a range of non-trade occupations including police and fire occupations. Other clients work with CPS in the development and management of large licensure, certification, and competency testing programs for Paramedics, Doctors of Chiropractic, Notary Publics, Qualified Medical Evaluators, Court Interpreters, Radiologists, and Environmental Health Specialists.

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Certification Examination Development

Table of Contents

Introduction	i
About Cooperative Personnel Services (CPS)	i
AFTE Occupational Analysis	1
Development of the AFTE Job Analysis Questionnaire	1
Results of the AFTE Job Analysis Questionnaire	3
KSA Factor Analysis	4
Linking the Significant KSA Factors to the Significant Task Statements	4
AFTE Factor Analysis Results	5
AFTE Examination Plan Development	6
AFTE Written Examination Plans	6
AFTE Practical Examination Plans	8
AFTE Written Test Development	9
Written Test Development Training	9
Written Test Item Development Procedures	9
AFTE Item Review/Angoff Committee	10
Selection of Items for the AFTE Written Tests	11
Passpoint Setting Methodology	12
Pilot Test Administration of the AFTE Written Examinations	12
Table 1: Results of the AFTE Pilot Written Tests	13
Development of Future AFTE Written Examination Items	14
AFTE Practical Test Development	16
Linkage Between the KSAs and Practical Examination Content	17
Pilot Testing and Evaluation of the AFTE Practical Examinations	17
Examination Security	19
Content Validity of the AFTE Certification Examinations	20

AFTE Appeals Procedures	21
Appeals to the AFTE Written Examinations	21
Appeals to the AFTE Practical Examinations	21
Retention of Certification Examination Records	22
 Certification of AFTE Members	 23
 Conclusions	 24
 References	 25

List of Appendices

- Appendix A:** Job Description of the Firearm and Toolmark Examiner Classification
- Appendix B:** AFTE Job Analysis Questionnaire
- Appendix C:** Results of the AFTE Job Analysis Questionnaire
- Appendix D:** KSA Factor Analysis Groupings
- Appendix E:** Task Statement/KSA Linkages
- Appendix F:** KSAs Linked to the AFTE Written Examinations
- Appendix G:** Angoff Rating Instructions
- Appendix H:** KSA and Angoff Ratings for the AFTE Written Examination Items
- Appendix I:** Written Examination Proctor Instructions
- Appendix J:** Written Examination Comment Form
- Appendix K:** KSAs Assessed by the AFTE Practical Examinations
- Appendix L:** Practical Examination Comment Forms
- Appendix M:** AFTE Test Security Agreement Forms
- Appendix N:** Content Analysis of the AFTE Written Examinations

AFTE Occupational Analysis

The primary purpose for conducting an occupational analysis is to determine the job content areas that should be represented in the content of the certification examination. Generally, certification examinations are used to ensure that the candidates have a mastery of the various knowledge, skills, and abilities (KSAs) associated with their profession. When developing a certification examination, it is best to use a content validation strategy. By using a content validation strategy, the Test Developer can determine the domain of significant KSAs needed to successfully perform the job. By adequately sampling this domain, the Test Developer can develop assessment instruments that ensure that the passing candidates have achieved mastery of the significant KSAs.

The first step in the content validation strategy is to develop a comprehensive inventory of the job content (i.e., the tasks performed on the job). The second step is to define those KSAs that a person must possess to successfully perform each of the job duties. It is these KSAs that will comprise the content of the assessment instruments. In the occupational analysis process, each of the job tasks and KSAs are rated by Subject Matter Experts (SMEs) to determine their significance towards successful performance on the job. After determining the significant KSAs, the Test Developer must ensure that the KSAs are adequately represented in the content of the assessment instruments before the instruments will be considered content valid.

In addition, for an assessment instrument to be considered content valid, the Test Developer must demonstrate the relationship between the test content and the content of the actual job. This is accomplished through a series of “linkages.” The first step is to demonstrate the relationship between the content of the job (i.e., the job tasks) and the KSAs needed to perform each task. The second step is to demonstrate the relationship between the KSAs and the content of the assessment instrument. Thus, the job content is linked to the KSAs, and the KSAs are then linked to the test content. Hence, the purpose of conducting a job analysis is to: (1) determine the content areas that must be assessed through the examination process; and (2) to document the job-relatedness of the resulting assessment instrument. The procedures CPS used to ensure the content validity of the AFTE certification examinations are described below.

Development of the AFTE Job Analysis Questionnaire

CPS Consultants reviewed existing occupational analysis materials to compile a preliminary list of AFTE Task Statements and KSA Statements. Source material included: (1) the draft Job Description for the Firearm and Toolmark Examiner classification, as supplied by the AFTE Certification Committee; (2) drafts of critical task statements and KSA statements, as supplied by the AFTE Certification Committee; (3) the 1988 Criminalist Occupational Analysis Report, as prepared by the California Association of Criminalists and Cooperative Personnel Services; and (4) the May 6, 1994 report detailing the results of Firearm and Toolmark Examiner Occupational Analysis Survey, compiled by the California Association of Criminalists. A preliminary Job Description for the Firearm

and Toolmark Examiner classification was then developed by CPS Consultants to ensure that all of the major content areas were included in the study. This preliminary Job Description is included in Appendix A of this report. The Job Description of the Firearm and Toolmark Examiner classification was developed through an extensive review and editing process by CPS Consultants and the AFTE Certification Committee (to obtain a list of the AFTE Certification Committee members, the reader is encouraged to contact the chairperson of the AFTE Certification Committee).

Additional occupational materials were compiled by CPS Consultants for the purpose of developing comprehensive lists of Task Statements and KSA Statements. These lists were then reviewed and edited by AFTE SMEs. Many of the task and KSA statements were combined, some were deleted, and many more were added. The finalized task and KSA statements were then formatted by CPS into the AFTE Job Analysis Questionnaire. The AFTE Job Analysis Questionnaire is included as Appendix B of this report. CPS also developed customized scannable item response sheets on which the SMEs could record their responses to the AFTE Job Analysis Questionnaire.

The AFTE Job Analysis Questionnaire contained 61 Task Statements. The Task Statements were rated on two separate scales: (1) Frequency of Performance, and (2) Importance to Successful Performance of the Job. The following rating scales were used:

FREQUENCY: Rate each Task Statement on the average frequency the task was performed during the last 12 months.

- A** This task was **NOT PERFORMED** during the last 12 months.
- B** This task was performed **LESS THAN ONCE EACH MONTH** during the last 12 months.
- C** This task was performed **AT LEAST ONCE EACH MONTH** during the last 12 months.
- D** This task was performed **AT LEAST ONCE EACH WEEK** during the last 12 months.
- E** This task was performed **AT LEAST ONCE EACH DAY** during the last 12 months.

IMPORTANCE: Rate each task for how important or critical it is to the overall performance of the job. Do not consider how often you perform this task. Rate the importance of each task even if you have not performed the task during the past 12 months.

- 1** This task has **NO IMPACT** on overall job performance.
- 2** This task has a **MODERATE IMPACT** on overall job performance.
- 3** This task has a **HIGH IMPACT** on and is **ESSENTIAL** to overall job performance.
- 4** This task has an **EXTREME IMPACT** on and is **CRITICAL** to overall job performance.

The AFTE Job Analysis Questionnaire also contained 153 Knowledge Statements, 53 Skills Statements, and 106 Ability Statements. The KSA Statements were rated on two separate scales: (1) Importance to Successful Performance of the Job, and (2) the degree of competency in this KSA that is Expected at Certification. The actual rating scales used were as follows:

IMPORTANCE: Rate each KSA Statement in relation to its importance for successfully performing the job duties of a Firearm and Toolmark Examiner.

- A** This KSA is **NOT NEEDED** to successfully perform the job.
- B** This KSA is **SLIGHTLY IMPORTANT** for successfully performing the job.
- C** This KSA is **IMPORTANT** for successfully performing the job.
- D** This KSA is **VERY IMPORTANT** for successfully performing the job.
- E** This KSA is **CRITICALLY IMPORTANT** for successfully performing the job.

COMPETENCY LEVEL EXPECTED AT CERTIFICATION: Rate each KSA Statement as to what level of competency you believe is needed at the time of initial certification to perform the Firearm and Toolmark Examiner job duties.

- 1** Competency in this KSA is **NOT ESSENTIAL** at the time of certification.
- 2** **SOME COMPETENCY** in this KSA is **ESSENTIAL** at the time of certification.
- 3** **A HIGH DEGREE OF COMPETENCY** in this KSA is **ESSENTIAL** at the time of certification.
- 4** **FULL COMPETENCE** in this KSA is **ESSENTIAL** at the time of certification.

Results of the AFTE Job Analysis Questionnaire

The AFTE Job Analysis Questionnaire was sent out by AFTE to all 643 of its members. The membership was allotted approximately three weeks in which to complete the workbooks and mail the response sheets back to CPS. A total of 203 usable response sheets (31.6 percent of the entire AFTE membership) were received by CPS (10 of the response sheets received by CPS were not complete and, thereby, eliminated from the analysis). Those rating scales that were represented by alphabetical characters were quantified for the analysis (A=1, B=2, C=3, D=4, E=5). The results of the AFTE Job Analysis Questionnaire (sample sizes, mean ratings and standard deviations) are included in Appendix C of this report.

Means and standard deviations were calculated for each of the Task and KSA rating scales. The standard deviations of the ratings were examined to identify those rating scales with distributions that did not approximate a normal curve distribution (e.g., bi-modal score distributions). Any “not-normal” rating distributions would have required special analysis to ascertain the reasons why the rating distribution was not normal. However, no unusual rating distributions were found among the Task or KSA ratings.

The mean scores of the task statement frequency ratings and importance ratings were examined. All tasks that did not receive a mean score of at least 2.0 on the frequency scale and a mean score of 2.0 on the importance scale were considered non-significant, and eliminated from further analytical considerations. A score of 2.0 (or less) on the frequency scale meant the task was performed less than once a month on average, and a score of 2.0 (or less) on the importance scale meant the task had less than a moderate impact on overall job performance. Of the 61 task statements rated in the job analysis questionnaire, 14 were eliminated, and 47 were retained for further analysis.

The mean scores of the KSA ratings were examined. All KSA statements that did not receive a mean score of at least 2.0 on the Importance scale and a mean score of 2.0 on the Competency Level Expected at Certification scale were considered non-significant, and eliminated from future analytical considerations. A score of less than 2.0 on the Importance scale meant the KSA was less than slightly important for successful performance of the job. A score of less than 2.0 on the Competency Level Expected at Certification scale meant that only a small amount of competency in that KSA was needed by the worker at the time of certification. Of the 153 Knowledge Statements rated in the job analysis questionnaire, 29 were eliminated, and 124 were retained for further analysis. Of the 53 Skills Statements rated in the job analysis questionnaire, 9 were eliminated, and 44 were retained for further analysis. Of the 106 Ability Statements rated in the job analysis questionnaire, 0 were eliminated, and all 106 were retained for further analysis.

KSA Factor Analysis

A factor analysis procedure was then performed on the significant KSA statements using the scores from the Importance Rating Scale. A factor analysis is a statistical procedure that examines the intercorrelations among the items on a particular rating scale. Items that are highly correlated with each other are combined into groups. CPS Consultants examined the groups of items to determine the commonalities in their content that would cause the highly similar ratings. From the factor analysis, 14 Knowledge factors were identified, 8 Skills factors were identified, and 14 Ability factors were identified (listed on Page 6). (Note: the order of the KSA factors listed above is based on the strength of the intercorrelations between the items in each factor. The order does not represent the relative importance of the factors). The KSA statements which loaded onto each factor are listed in Appendix D.

Linking the Significant KSA Factors to the Significant Task Statements

On April 14th and 15th, 1998, eight AFTE Subject Matter Experts (all members of the AFTE Certification Committee) met with CPS staff in Sacramento, California for the purpose of linking the significant task statements to the KSA factor groupings. The linkage procedure involves examining each task statement and coming to a group consensus on whether each individual KSA factor is needed to successfully perform that task. This linkage is necessary for the documentation of the job-relatedness of the resulting written and performance examinations. Because of the success of the factor analysis procedure (described above), CPS Consultants had the AFTE SMEs link the significant task statements with the KSA factors (as opposed to linking the tasks to the individual KSA statements). A total of 1,692 possible KSA factor-Task Statement linkages were examined by the eight-member Subject Matter Expert panel. (Note: if the individual KSAs were used in the linkage process, then the SMEs would have been required to perform 13,348 linkages). The results of the Task-KSA linkages are included in Appendix E of this report.

AFTE Factor Analysis Results

Knowledge Factors

- Factor 1: Laboratory Equipment
- Factor 2: Firearms/Ammunition
- Factor 3: Collection and Preservation of Evidence
- Factor 4: Ballistics
- Factor 5: Safe Work Practices
- Factor 6: Distance Determination
- Factor 7: Firearm Design and Identification
- Factor 8: Documentation of Physical Evidence and Analytical Results
- Factor 9: Professional Development
- Factor 10: Toolmark Identification
- Factor 11: Firearm-Related Tools
- Factor 12: Examination of Evidence
- Factor 13: Maintaining Professional Ethical Standards of Conduct
- Factor 14: Tools/Equipment

Skills Factors

- Factor 1: Collection of Evidence
- Factor 2: Serial Number Restoration Techniques
- Factor 3: Firearms
- Factor 4: Firearm-Related Tools
- Factor 5: Gunshot Residues
- Factor 6: Firearm Safety
- Factor 7: Laboratory Techniques
- Factor 8: Laboratory Equipment

Abilities Factors

- Factor 1: Ballistics
- Factor 2: Firearm/Ammunition Analysis
- Factor 3: Examination and Documentation of Evidence
- Factor 4: Gunshot Residues
- Factor 5: Ammunition Components
- Factor 6: Firearm Design
- Factor 7: Collection of Evidence
- Factor 8: Matters and Procedures of Evidence Examination
- Factor 9: Dissemination of Evidence and Analytical Results
- Factor 10: Safe Work Practices
- Factor 11: Testifying in Legal Proceedings
- Factor 12: Professional Development
- Factor 13: Toolmark Identification
- Factor 14: Preservation of Evidence

AFTE Examination Plan Development

The primary purpose of the Examination Plan is to specify the content of the examination. To ensure that an assessment instrument is content valid, the Test Developer must develop an Examination Plan which documents that the significant KSAs are adequately sampled by the assessment instrument. Qualitatively this refers to the identification of those KSAs that will be assessed by the certification examination. Quantitatively, the Examination Plan must specify the percentage of the examination's content (i.e., the weights) which will assess each specific KSA area.

AFTE Written Examination Plans

To develop the examination plans for the AFTE written examinations, CPS Consultants utilized the results of the KSA factor analyses. CPS Consultants reviewed the factors, and combined those with similar content; the result of which were the following eight examination content areas listed below (in parenthesis are the original KSA factors that comprise each content area). Note: skills are not typically measured in a written examination, and have not been included in this section. The candidates' skills will be assessed through the practical examinations.

- 1. Collection and Preservation of Evidence**
(Knowledge Factor 3, and Ability Factors 7 and 14)
- 2. Examination of Firearm Evidence:** includes: Firearm/Ammunition, Firearm Design and Identification, Laboratory Tools and Equipment, and Ballistics
(Knowledge Factors 1, 2, 4, 7, 11, 12, 14, and Ability Factors 1, 2, 3, 5, and 6)
- 3. Examination of Gunshot Residue Evidence:** GSR and Distance Determination
(Knowledge Factors 6 and 12, and Ability Factors 3 and 4)
- 4. Examination of Toolmark Evidence**
(Knowledge Factors 10 and 12, and Ability Factors 3 and 13)
- 5. Documentation of Physical Evidence & Analytical Results**
(Knowledge Factor 3, and Ability Factor 9)
- 6. Safe Work Practices**
(Knowledge Factor 5, Skill Factor 6, and Ability Factor 10)
- 7. Professional Development**
(Knowledge Factor 9, and Ability Factors 11 and 12)
- 8. Maintaining Professional Ethical Standards of Conduct**
(Knowledge Factor 13)

In April of 1998, the eight AFTE Subject Matter Experts from the AFTE Certification Committee reviewed all of the significant KSA statements to determine which assessment instrument(s), (i.e., the written examinations and/or practical examinations), would best assess each KSA. The result of this process was the development of a list of KSAs for each of the three AFTE written examination competency areas. CPS Test Development Consultants then reviewed this list, and eliminated those KSAs that would be difficult to assess in a multiple choice examination format (e.g., ability to

recognize bullet impact sites at crime scene, and the ability to identify a cast bullet as having come from a particular bullet mold). The KSAs linked to each AFTE written examination are included in Appendix F of this report. Most of the KSAs were included on more than one of the examination lists.

Through this linkage process, CPS consultants were able to determine the number of KSAs that are associated with each of the examination content areas for the AFTE written examinations. CPS Consultants then divided the number of KSAs in each examination's content area by the total number of KSAs that were linked to that particular examination, the result of which was the weight assigned to that content area. This process treats all of the significant KSAs equally by assigning them equal representation in the examinations. Such a procedure is commonly used in mastery testing situations (e.g., certification examinations), where the goal is to assess the widest range of KSAs as possible. The AFTE written examination plans are listed below (note: the percentages for each of the content areas have been rounded to the nearest whole number):

AFTE Firearm Written Examination

Collection and Preservation of Evidence: (13 %)
Examination of Firearm Evidence: (60 %)
Examination of Gunshot Residue Evidence: (6 %)
Examination of Toolmark Evidence: (4 %)
Documentation of Physical Evidence and Analytical Results: (4 %)
Safe Work Practices: (7 %)
Professional Development: (4 %)
Maintaining Professional Ethical Standards of Conduct: (2 %)

AFTE Gunshot Residue Written Examination

Collection and Preservation of Evidence: (16 %)
Examination of Firearm Evidence: (10 %)
Examination of Gunshot Residue Evidence: (39 %)
Examination of Toolmark Evidence: (0 %)
Documentation of Physical Evidence and Analytical Results: (5 %)
Safe Work Practices: (9 %)
Professional Development: (6 %)
Maintaining Professional Ethical Standards of Conduct: (3 %)

AFTE Toolmark Written Examination

Collection and Preservation of Evidence: (21 %)
Examination of Firearm Evidence: (14 %)
Examination of Gunshot Residue Evidence: (0 %)
Examination of Toolmark Evidence: (39 %)
Documentation of Physical Evidence and Analytical Results: (6 %)
Safe Work Practices: (8 %)
Professional Development: (9 %)
Maintaining Professional Ethical Standards of Conduct: (3 %)

CPS Consultants recommend that any new AFTE written examinations include a minimum of 100 multiple choice test items. The inclusion of at least 100 items will allow for adequate sampling of all the significant KSAs, and it will increase the probability that the overall test statistics will yield professionally-acceptable results. The percentages of test questions assessing each content area have been rounded off to sum to 100 percent. CPS recommends that the actual items included in future AFTE written examinations reflect the above percentages as much as possible. Note: While the above-listed percentages represent the ideal make-up of the AFTE written examinations, the actual number of items in the AFTE written examination content areas will be largely dependent upon the number of usable written test items in each of the competency areas developed by AFTE. Additionally, there exists some overlap in the content of the AFTE competency areas (e.g., many of the items refer to more than one KSA) which will have an effect upon the final composition of the AFTE written examinations.

AFTE Practical Examination Plans

The examination plans for the AFTE practical examinations were developed by the AFTE Certification Committee in June of 1998 in a meeting held in Sacramento at CPS. During this meeting, the Certification Committee determined the content, format, scoring dimensions, and administration procedures for the three AFTE practical examinations. It was the consensus of the group that the practical examinations should reflect the type of work activities that are most commonly performed on the job. By determining the content of the AFTE practical examinations, the AFTE Certification Committee was, in essence, also developing the examination plans for the AFTE practical examinations.

AFTE Written Test Development

The KSAs were ranked by the AFTE Certification Committee according to the ratings they received through the AFTE Job Analysis Questionnaire. These ranked lists were then distributed to the item writers with instructions as to which KSAs to emphasize when researching the job-related materials for potential test questions. The goal of this procedure was to ensure that the most significant KSAs were represented in the resulting AFTE written and performance examination, with as little overlap between the KSAs as possible.

Written Test Development Training

On April 15th, 1998, the eight Subject Matter Experts from the AFTE Certification Committee participated in a half-day workshop on *Developing Multiple Choice Test Questions*. The workshop was facilitated by CPS Test Development Consultants and was geared towards assisting the participants in training other AFTE member SMEs to write multiple choice test questions for the three AFTE competency areas. Workshop topics included: how to develop various types of multiple choice items; developing the various components of multiple choice items; item sensitivity review procedures; item writing clues and errors; test development validity issues; item writing strategies; and how to properly edit multiple choice items. During the workshop, participants were administered a number of item writing and item editing exercises. All participants were given copies of CPS' *ABCs of Item Writing and Review* to distribute to their item writers.

Written Test Item Development Procedures

All AFTE written test items were developed using the four-alternative multiple-choice format. This format was chosen because it: (1) is one of the best formats for differentiating between good and poor test candidates; (2) affords a lot of statistical power for analysis; (3) is highly recognizable and readily acceptable by most test candidates; (4) can be objectively scored, and machine scored; and (5) has a lower chance score (25 %) than other types of written item formats (such as true/false or three-alternative multiple choice questions).

Item Writers were recruited by the AFTE Certification Committee members. Over 80 AFTE members were asked to participate in the item writing process. When selecting item writers, AFTE attempted to obtain SMEs with a wide range of experience, as well as geographical representation. Each potential AFTE item writer was provided with a copy of CPS' *"The ABCs of Item Writing and Review,"* as well as given individualized instruction (for those SMEs who requested it). Item writers were each assigned a limited number of specific KSAs on which to develop multiple choice items. This limited the amount of knowledge (or potential advantage) any one SME could have regarding the AFTE written examinations.

For each test item, SMEs were required to document: (1) a reference that could be used to verify the correct response, and (2) the KSAs that the test item assessed. Items written by the AFTE SMEs were mailed directly to CPS, where they were reviewed and edited by CPS Test Development Consultants. This procedure ensured that no AFTE members (i.e., potential examination candidates) had access to items other than the items they had personally written. SMEs were allowed to keep no copies (either on paper or in electronic format) of the items they developed. Item writers were asked to send all examination materials (including scratch paper) to CPS, or to destroy the materials in a secure manner. CPS Test Development Consultants reviewed the items for content, clarity, form, and relevance. Items were also reviewed to minimize the number of duplicate items that were entered into the AFTE item bank. A total of 1,000 items were entered into CPS's computerized item bank. Once entered, the AFTE test items were then subjected to CPS's strict item review procedures to ensure that the items were properly formatted and entered into the computer.

AFTE Item Review/Angoff Committee

In March of 1999, a panel of twelve AFTE SMEs was assembled in Sacramento to review the AFTE written items. When selecting the panel members, AFTE attempted to obtain SMEs with a wide range of experience, as well as geographical representation. The AFTE written test items were reviewed and edited in a group discussion forum. The SMEs reviewed each item for clarity, relevance, and to ensure that the keyed response was the correct answer. The SMEs were not supplied with the correct answer when initially reviewing the test items (although this information was available upon request). Reference materials were available to the SMEs so that they could verify the keyed responses. The SMEs also reviewed the distractors to ensure: (1) they were distinctly incorrect, and (2) they were logical alternatives to the question being posed. Any problems with test items that the SMEs could not resolve were documented in the item bank (in the item "Comments" field) to alert the Test Developer not to select these items into specific tests. In the item review process, the SMEs were also asked to judge whether each item was relevant for inclusion in the Firearm, Toolmark, and/or Gunshot Residue examinations. If at least 50 percent of the SMEs marked an item as relevant for a particular examination, then that item was flagged in the computer as being eligible for inclusion into that particular examination. (Note: 64 of the 1,000 AFTE items were not reviewed because they were incomplete (e.g., missing KSAs or references).

In licensure and certification testing it is a common practice to use a criterion-referenced approach to setting the passpoint (cutoff score) for an examination. This approach provides a defensible rationale for identifying a cutoff score. The main rationale behind criterion-referenced cutoff scores is that a line must be drawn to identify those candidates who can demonstrate sufficient knowledge to be certified. To establish the passpoint for the AFTE written examinations, CPS used the Angoff method. The Angoff method defines the cutoff score as the most likely score a minimally competent applicant is likely to achieve. Candidates scoring below this level are believed to lack sufficient knowledge, skills, or abilities to be certified. For each test item, SMEs are asked to estimate the probability that a minimally-competent applicant will get the answer correct. To accomplish this, the SMEs are asked to estimate what percentage of minimally acceptable candidates would achieve a

correct response to each test item. These percentages are then averaged for all the items in a particular examination to determine the minimally acceptable score, or passing score, for that test.

The SMEs each assigned the test items a difficulty rating using the Angoff method. The Test Review Committee members were provided formal training on how to assign the Angoff ratings. The Angoff Rating Instructions are included in Appendix G. Using the Angoff method, SMEs were asked to estimate how many of the “Minimally-Acceptable Candidates” (out of a group of 100) would be expected to obtain the correct response for each test question. According to AFTE, a Minimally-Acceptable Candidate is one who has completed the applicable training in the occupation and possesses a minimum of five years of experience in his/her discipline. SMEs were instructed to assign each item an Angoff rating between 25 (representing the chance score of a four-alternative multiple choice item) and 100 (indicating that all test candidates should be expected to get the item correct). AFTE SMEs were required to assign an Angoff rating to each item (independent of the other raters).

After the SMEs rated the first AFTE item, the CPS Consultant conducted a group discussion on the criteria used by each SME to rate the item. Through this discussion, the CPS Consultant verified that each of the Panel Members understood the rating process and was correctly marking their responses on the Angoff Response Sheet. Significant differences (greater than 15 points) between the SMEs on particular items were discussed in a group forum. The purpose of these discussions was to have the SMEs explain the criteria they used when rating the items, so as to ensure the other SMEs considered all pertinent aspects of the item when making their ratings. The SMEs were then given an opportunity to change their ratings based on these discussions. However, the SMEs were not required to change their ratings at any time during the rating process. This process continued for the first 25 AFTE items. The SMEs were then allowed to rate each of the AFTE items independently. Throughout the Angoff process, CPS Consultants monitored the SME ratings to identify those items with large score dispersions (i.e., over 15 points) for group discussion. The Angoff ratings were averaged over the 12 SMEs to compute an overall Angoff rating for each item.

Selection of Items for the AFTE Written Tests

Two versions of the Firearm, Toolmark, and Gunshot Residue written examinations were assembled by CPS Test Development Consultants (a total of six written examinations, in all). Each test version consisted of 100 items, 20 of which were classified as “anchor items” and included in both versions of the examination. Anchor items allow the CPS Test Consultant to “equate” the examinations to determine if they are of equal difficulty. (Note: the equating procedure is performed after the tests versions have acquired a large number of statistical history and, as such, will not be examined in this report). Therefore, a total of 180 items were selected for each of the three examination competency areas. There was some item overlap between the three competency areas in those areas pertinent to all three examinations (e.g., collection and preservation of evidence, ethical conduct, and testifying in court).

A number of different criteria were used by the CPS Consultant to select the items into the test

versions. First, the item KSAs were reviewed to ensure that a high proportion of the significant KSAs (as identified in the examination plans) were represented in the written tests. The CPS Consultant also reviewed the item content to minimize the number of items with similar content being included in the same examination version. The CPS Consultant also reviewed the item Angoff ratings to ensure that alternate versions of the same test were of equal difficulty. The KSAs and Angoff ratings assigned to those items selected for the AFTE written examinations are included in Appendix H. As much as possible, the CPS Consultant also attempted to balance the Angoff ratings between the three different test content areas. By doing so, it would allow the CPS Consultant to set similar passpoints for all three of the AFTE written examinations. The average Angoff ratings for the AFTE Written Tests were as follows:

<u>Test</u>	<u>Version</u>	<u>Average Angoff Rating</u>
Firearm	A	71.26
Firearm	B	71.30
Gunshot Residue	A	71.26
Gunshot Residue	B	71.26
Toolmark	A	71.98
Toolmark	B	71.98

Passpoint Setting Methodology

CPS Consultants recommended that the passpoints for the AFTE written examinations be set at 70. The CPS Consultants felt that the passpoints should be set slightly lower than the Angoff rating in order to compensate for any rater error that may have occurred during the Angoff rating process. Additionally, CPS Consultants believed that the 70% passpoints are appropriate for the AFTE written examinations, given that they are only one component in the AFTE certification process (the practical test being the other).

Pilot Test Administration of the AFTE Written Examinations

The AFTE written examinations were administered to various AFTE members at the annual AFTE Training Seminar, in July of 1999. The written examinations were administered by members of the AFTE Certification Committee. The proctor instructions describing how the AFTE written examinations were administered are included in Appendix I. After completing an AFTE written examination, candidates were able to record their opinions about the examination questions on the “Examination Comment Form.” A copy of the Examination Comment Form is included in Appendix J.

The written examination materials were then sent to CPS for scoring and analysis. CPS Consultants scored the AFTE written pilot tests, and performed statistical item analysis (computing: p-values; bi-serial correlations; and distractor analyses) to identify miskeys and malfunctioning distractors. Based

on the statistical analyses, CPS identified those items that were either potential “miskeys” or had more than one correct response. These items, as well as the item comments that were made by the candidates on the “Examination Comment Form,” were then reviewed by select members of the AFTE Certification Committee. Upon review, the members of the Certification Committee made their recommendations of item edits to CPS. While performing this review, the AFTE reviewers did not have access to any of the individual candidate scores while performing their edits. The written examinations were then rescored. The test results of the AFTE pilot written examinations are included in Table 1.

Table 1
Results of the AFTE Pilot Written Examinations

Test	Version	N	Mean	SD ¹	Reliability	SEM ²
Firearm	A	16	79.38	9.75	0.88	3.38
Firearm	B	15	83.07	7.32	0.81	3.19
GSR	A	12	87.50	6.57	0.82	2.81
GSR	B	10	85.00	8.68	0.89	2.83
Toolmark	A	9	84.33	6.30	0.79	2.89
Toolmark	B	8	85.12	4.94	0.65	2.91

Upon reviewing the AFTE written pilot test results, the CPS Consultants’ greatest concern is the that the mean ratings (or difficulty levels) indicate the examinations may be too easy. The mean ratings for most of the written tests were an average of 12.56 points higher than the Angoff ratings for each examination. However, the sample sizes are far too low to make any generalizations regarding how the tests will ultimately perform. The elevated mean scores could be an indication that those candidates who participated in the pilot tests were, on the whole, some of the more knowledgeable AFTE members. The item edits made by the members of the AFTE Certification Committee (described above) as well as edits made prior to the administration of the written tests at the AFTE Training Seminar (to be held in June 2000), should have the effect of making the items more difficult for future test administrations. Regardless of the causes, the mean scores for the AFTE written examinations should be closely monitored to determine if the AFTE written examinations need additional edits to make them more difficult.

¹ SD = Standard Deviation. The Standard Deviation is a measure of score dispersion; higher standard deviations indicate the scores are more widely spread.

² SEM = Standard Error of Measurement. The Standard Error of Measurement is a measure of how accurate the examination is at assessing the candidate scores. Generally, small SEMs are associated with more reliable examinations.

Although the sample sizes for each of the written examinations are too low to draw any definitive conclusions, it would appear that the AFTE written examinations: (1) are reliable; and (2) that the alternate versions (Version A and Version B) of each written test are comparable. An examination's reliability coefficient is an indication of how well an examination consistently measures a particular candidate attribute (or KSA). In other words, if an examination were given today and then re-administered to the same group of candidates one year later, a reliable examination would yield similar results for both exam administrations. Reliability coefficients above .70 are considered to be an indication of a reliable examination for examinations with sample sizes greater than 100. Generally, tests with smaller sample sizes will have smaller reliability coefficients. However, as evidenced by the statistics in Table 1, the reliability coefficients for the AFTE written examinations are extremely high (especially considering the low sample sizes). The sample sizes for these examinations are too low to make any generalizations regarding the size of the examinations' standard deviations and standard error of measurements.

The mean scores and standard error of measurement (SEM) for the different written examinations appear to be comparable, even given the small sample sizes. Evaluation of the anchor items for each of the test versions also yields comparable results. These initial statistical results would suggest that the different versions of the tests are equally difficult, and might be able to be used interchangeably. Although the initial test administration results are very encouraging, larger sample sizes ($N \geq 30$) must be obtained for all test versions before any generalizations can be made regarding the written examinations' statistical soundness.

Development of Future AFTE Written Examination Items

Future AFTE written examination items should be developed using the same procedures described in this report. First, the items should be developed by qualified SMEs (i.e., those AFTE members that have already passed the certification examination for which the test item is intended). Next, the new test items should be reviewed by Test Development Consultants to ensure the items are clearly written and properly formatted. The new test items should then be reviewed by members of the AFTE Certification Committee to ensure: relevance (i.e., whether the test questions are relevant to the subject areas); clarity (i.e., whether the test questions are understandable as written); that the keyed responses are the only correct answers; and that there is minimal overlap between the content of the test questions in any particular examination version. Finally, the new test items should be reviewed and rated by a properly-trained Angoff committee of 8 - 12 AFTE members. Once the items have been assembled into new test versions, the Test Development Consultant should compute the average Angoff rating for the test version so as to recommend and set the appropriate examination passpoint. Additional suggestions for future AFTE written examinations are included on page 8 of this report.

To ensure an impartial test process, the written examinations would best be scored by an agency independent of AFTE. Additionally, the existing AFTE written tests should be statistically evaluated periodically to ensure the items, and test as a whole, are performing properly. The following item

statistics should be calculated: item p-values (difficulty analysis); and item distractor analyses (biserial and/or point-biserial correlations). Additionally, the following test statistics should also be calculated: test means; test standard deviations; and standard error of measurements. The purpose of the statistical analyses is to ensure that the written examinations are accurately and reliably assessing the appropriate KSAs.

AFTE Practical Test Development

In June of 1998, the AFTE Certification Committee convened in Sacramento to discuss the content, format, and administration procedures for the three AFTE Practical Tests. It was determined by the Certification Committee that two alternate versions of each of the practical examinations should be developed, with each version having two separate components. After much discussion, the AFTE Certification Committee decided that the AFTE Practical Examinations would consist of the following test components:

Firearm Practical Examination:

Version 1:

Component 1: 9mm Bullet Comparison

Component 2: 9mm Cartridge Case Comparison

Version 2:

Component 1: 45 ACP Bullet Comparison

Component 2: 45 ACP Cartridge Case Comparison

Gunshot Residue Practical Examination:

Version 1:

Component 1: 9mm Distance Determination

Component 2: 12 Gauge Shot Dispersion Comparison

Version 2:

Component 1: 45 ACP Distance Determination

Component 2: 20 Gauge Shot Dispersion Comparison

Toolmark Practical Examination:

Version 1:

Component 1: Diagonal Plier Striated Mark Comparison

Component 2: Number Stamp Impression Comparison

Version 2:

Component 1: Nipper Plier Striated Mark Comparison

Component 2: Plier Jaw Impression Comparison

For each test component, the AFTE Certification Committee also determined: the numbers and types of physical materials needed (e.g., unknowns, standards, and shot dispersion patterns); the test instructions and administration procedures; the suggested time limits; the scoring criteria; and the Certification Committee member who would develop the physical components. The Committee also developed an appeals process by which the test candidates can (and cannot) appeal the results of their Practical Examinations.

Linkage Between the KSAs and Practical Examination Content

The Certification Committee member who developed the physical materials for a particular test component was also asked to determine which significant KSAs were assessed by the test component. As stated earlier, these linkages are needed to demonstrate the relationship between the test content and the actual duties performed on the job, thus, demonstrating the “job-relatedness” and content validity of the AFTE Practical Examinations. The linkages between the AFTE Practical Examination test components and the KSAs are included in Appendix K.

Pilot Testing and Evaluation of the AFTE Practical Examinations

Prior to arriving at the March 1999 Angoff meeting in Sacramento, the twelve Angoff Panel members were each sent one version of each of the three AFTE practical examinations (six were sent Version 1 of each examination, and six were sent Version 2). The SMEs were allowed to take the AFTE Practical examinations in their own laboratories, using their own equipment. Immediately after completing each AFTE practical examination, the Angoff Panel members were asked to complete an AFTE Practical Examination Comment Form for each test component. Copies of the Comment Forms are included in Appendix L. In the Comment Forms, the Angoff Panel members were asked to respond to the following questions:

Time Limits:

1. Is there too much or not enough time for a competent examiner to complete the exercise?

Test Instructions:

1. Were the test instructions clear and easy to understand?
2. Did the test instructions have all the information you needed to begin the exercise?

Examination Materials:

1. Were the examination materials clearly labeled or marked?
2. Were the examination materials representative of what is actually performed on the job?
3. Were the examination materials appropriately prepared for the exercise?
4. How could the examination materials be improved for this exercise?

Exercise Difficulty Levels:

1. Is the test exercise either too easy or too difficult? Please explain your response.

Scoring Criteria:

1. Was the scoring criteria used for this exercise clear and easy to understand?
2. Is the scoring criteria fair to all candidates?

Worksheets:

1. Were the exercise response worksheets clear and easy to understand?
2. Do the exercise response worksheets allow the candidate to accurately and thoroughly record his/her responses?

Packaging:

1. Were the examination materials appropriately packaged for this exercise?
2. Were the packaging requirements appropriate for this examination?

Proctors:

1. Are proctors needed to administer this examination exercise?

Overall:

1. Is this exercise assessing the appropriate job knowledge, skills, and abilities?

When the Angoff Panel convened in Sacramento, the SMEs spent a full day discussing their responses to the above-listed questions. Many minor modifications to the AFTE Practical Examinations were proposed, such as: packaging the evidence in resealable bags; changes to the Examination Instructions and Candidate Response Sheets; and suggestions on how to best mark the evidence. The Angoff Panel also determined that it would be beneficial to have a proctor administer the AFTE Practical Examinations (although exact details of this have not been determined at this time). Some of the more significant recommendations by the Angoff Panel members included: developing a more distinct set of shot shell dispersion patterns; and ways to make the Toolmark Practical Examinations more difficult (the Angoff Panel felt that the toolmark test components were too easy). The overwhelming consensus of the AFTE Item Review Committee was that the AFTE Practical Examinations were highly job-related, and that they accurately assessed the appropriate KSAs. The AFTE Practical Examinations will be modified according to the recommendations made by the Angoff Panel members. The completed changes to the AFTE Practical Examinations will then be reviewed by a post-Angoff committee (consisting of one member from the Certification Committee and one member of the original Angoff Panel) to ensure that the modifications reflect the KSAs they are intended to assess, and accurately reflect the opinions of the Angoff Panel.

Examination Security

From the onset of this test development project, the Association of Firearm and Toolmark Examiners Certification Committee has taken very stringent precautions to ensure examination security. AFTE's primary examination security concern was the fact that candidates that were writing some of the examination items would actually be taking the AFTE certification examinations. To counteract this, the AFTE item writers were each assigned a limited number of specific KSAs on which to develop multiple-choice items. This limited the amount of knowledge (or potential advantage) any one SME could have regarding the AFTE written examinations. Items written by the AFTE SMEs were mailed directly to CPS, where they were reviewed and edited by CPS Test Development Consultants. This procedure ensured that no AFTE members (i.e., potential examination candidates) had access to items other than the items they had personally written. SMEs were allowed to keep no copies (either on paper or in electronic format) of the items they developed. Item writers were asked to send all examination materials (including scratch paper) to CPS, or to destroy the materials in a secure manner.

Test Security Agreements were obtained from everyone associated with the AFTE written and practical examination development processes, including: members of the AFTE Certification Committee, Angoff Panel members, and written examination item writers. Test Security Agreements were also obtained during the test administration process from examination proctors and test candidates. Copies of the AFTE Test Security Agreements are included in Appendix M. Violations of the AFTE Test Security Agreements could result in various disciplinary actions, including expulsion from AFTE.

Content Validity of the AFTE Certification Examinations

For an assessment instrument to be considered content valid, the Test Developer must demonstrate the relationship between the test content and the content of the actual job. For the AFTE Certification Examinations, this was accomplished through a series of “linkages.” CPS Consultants demonstrated the relationship (or “linkage”) between the content of the job (i.e., the job tasks) and the KSAs needed to perform those tasks (see Appendix E). CPS Consultants then demonstrated the relationship between the KSAs and the content of the AFTE written examinations (see Appendix H) and the AFTE practical examinations (see Appendix K). All of the items included in the AFTE written examinations were rated “as appropriate for that particular examination” by a majority of the members of the Angoff Committee. The content of the AFTE written examinations (as expressed in percentages of items linked to the examination content areas) is summarized in Appendix N. CPS Consultants feel that the content of the current AFTE written examinations (Versions A and B) are sufficiently similar to the proposed percentages expressed in the examination plans, as to attest to the examinations’ content validity. Passpoints for the AFTE written examination were set using the Angoff method for determining the “minimally-qualified” candidate, based on the AFTE standard of five-years of examiner experience.

As with the vast majority of certification examination, the AFTE Certification Examinations were not designed to maximally differentiate between the candidates. Certification and licensing examinations are generally used to ensure that the candidates have achieved a minimum competency level of the various knowledge, skills, and abilities associated with their profession. By using a content validation strategy, CPS Test Development Consultants have determined the domain of significant KSAs needed to successfully perform the job. By adequately sampling this domain, CPS Consultants have developed assessment instruments that ensure that the passing candidates have achieved mastery of the significant KSAs.

AFTE Appeals Procedures

AFTE will convene an Appeals Panel whose sole purpose will be to review any appeals to the AFTE written and practical examination components. Some of the specific appeal procedures are documented below:

Appeals to the AFTE Written Examinations

Applicants who failed any written examination will have thirty (30) calendar days from the date the results are received by the applicant to appeal the results. All of the questions on the AFTE written examinations have been reviewed by a panel of AFTE members and each has been determined to be properly worded, applicable (relevant) and the correct answer to each has been confirmed. Therefore, no appeal as to the clarity, applicability (relevancy) or correctness of the keyed response will be allowed. The Appeal Panel will, however, review answer sheets for entry errors. All notifications will be by certified mail, return receipt requested. The Chairman of the AFTE Appeals Panel will review the applicant's scoring sheet (not the examination booklet) and re-score the exam. Any discrepancies will be noted and confirmed by another member of the Appeal Panel. If the scoring changes are in the applicant's favor and the new score puts the applicant above the pass/fail score, it will be noted and the applicant will be notified that the written exam will be considered passed. Otherwise, the applicant will be notified that the appeal failed to change the outcome of the original scoring. The appeal process will take no longer than thirty (30) calendar days from the date the letter of appeal is delivered to the Chairman. The decision of the Appeal Panel is final.

Appeals to the AFTE Practical Examinations

The appeal of a practical examination must also be directed in writing to the Chair of the Appeal Panel within thirty (30) calendar days of the date the applicant was notified of the results. The Chairman will first review any notes, sketches and/or photographs made by the applicant during the practical exam. If there are photographs, the Chairman will attempt to verify that the specimens depicted in the photos are in fact the specimens provided to the applicant for the test and examined during the test. The Chairman will independently evaluate the correctness of the applicant's responses that are in dispute by reexamining the unknown and standard (known) specimens. The Chairman will then forward the examination package to a second member of the Appeal Panel for an independent review to be conducted in the same fashion. The second member will not be the person who originally prepared the exam. The examination package will then be sent to the member of the Certification Committee who prepared that portion of the test. That person will review and evaluate the entire package for a third independent review. If at least two of the three reviewers agree that there was sufficient basis for the conclusion(s) reached by the applicant during the examination, the applicant's answer(s) will be considered correct. If the result of this review process puts the applicant above the pass/fail score, the applicant will be notified that he/she passed that portion of the exam. Otherwise, the applicant will be notified that the appeal process failed to change the outcome of the original scoring. This notification will be by certified mail, return receipt requested.

The appeal process will take no longer than 60 calendar days from the date the appeal letter is delivered to the Chairman. The decision of the Appeal Panel is final.

Retention of Certification Examination Records

It will be the policy of AFTE to destroy all candidate test materials (worksheets, photos, etc.) for all those who pass an examination. For those applicants who fail, their test materials (worksheets, photos, etc.) will be retained only for thirty calendar days from the date the applicants have received notices of their results unless an applicant files an appeal. For those applicants who appeal, their test materials will be kept for the duration of the appeal. After the appeal and review process is final, the review records and candidate test materials (worksheets, photos, etc.) will be destroyed but a notation will be made that an appeal was made, the date of the appeal, and the results of the appeal. AFTE will only keep a record of an applicant's application(s), date of testing, the number and/or letter designation of the test version/component administered, whether or not the applicant passed, and the date and result of any appeal. For those who failed an examination, all records of their failing will be removed once the applicant has re-tested and passed.

Note: the AFTE Examination Appeals Procedures and Retention of Certification Examination Records procedures described above were developed in this draft form (6/11/99) by the AFTE Certification Committee with input from CPS Consultants. The Examination Appeals Procedures and Retention of Certification Examination Records procedures are currently pending approval by the AFTE Board of Directors. CPS neither approves or disapproves of the AFTE Examination Appeals Procedures and takes no responsibility for any legal actions that are the direct result of their use or misuse. The AFTE Examination Appeals Procedures are included in this technical report so as to provide a informational resource to the reader on the AFTE test administration process.

Certification of AFTE Members

Certification examinations are generally scored on a pass/not pass basis, and the AFTE Certification Examinations are no different. To become AFTE certified, candidates must successfully achieve a passing score on both the written and practical examination. The AFTE Board of Directors determined that candidates must pass the written examination before they would be allowed to take the associated practical examination. Should a candidate pass the written examination and fail the practical examination, the candidate would only have to retake the practical examination in order to become certified. Candidates will only be allowed to retake those examination components that they have failed after six months have elapsed from the date they were administered the original examination. Additionally, the AFTE Certification Committee has established procedures by which candidates can challenge the results of both the written and practical examinations (described above). The AFTE certification is valid for five years from the date on the certification document issued by AFTE. As the AFTE Certification Program is currently structured, members will have to successfully pass the AFTE written and practical examinations once every five years in order to become re-certified. This provision may be amended in the future; allowing for members to become recertified by accumulating credits for job-related activities, such as: attending professional conferences and seminars, publishing journal articles, and attending approved job-related courses.

Conclusions

Cooperative Personnel Services has assisted the Association of Firearm and Toolmark Examiners in the development of a series of content-valid certification examinations in three different competency areas: firearm evidence examination and identification, gunshot residue evidence examination and identification, and toolmark evidence examination and identification. Each certification examination developed under this contract consists of a written examination and a practical examination. Two versions of the written and practical certification examinations were developed in each competency area. The primary purpose of the AFTE examinations is to certify that Examiners possess the required knowledge, skills, and abilities necessary to successfully perform essential duties within each of the competency areas.

The AFTE Certification Examinations were developed using a content validation strategy. The occupational analysis and test development procedures described in this report were developed in accordance with professionally-acceptable methodologies, and the resulting AFTE certification examinations are in compliance with applicable professional and legal standards, such as: the Civil Rights Act of 1991; the Americans with Disabilities Act (ADA); Age Discrimination Legislation; the *Uniform Guidelines for Employee Selection Procedures*; the *Standards for Educational and Psychological Testing*; and the *Principles for the Validation and Use of Personnel Selection Procedures*. The purpose of this report is to document the steps taken by CPS and AFTE to develop the content-valid certification examinations for the Association of Firearm and Toolmark Examiners.

CPS Consultants are confident that the AFTE Certification Examinations described in this report are consistent with state and federal legislation governing content-valid certification examinations, and that the AFTE Certification Examinations accurately reflect the depth and breadth of knowledge, skills, and abilities needed to successfully perform the Firearm and Toolmark Examiner job duties.

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APPENDIX A

Job Description of the Firearm and Toolmark Examiner Classification

Firearm and Toolmark Examiner

Job Description

The primary job duties of the Firearm and Toolmark Examiner are to identify, collect, preserve, examine, and interpret the physical evidence associated with specific criminal acts. Physical evidence is any tangible entity associated with an event under investigation (crime, accident, lawsuit), the analysis of which stands to associate an individual with the event, establish an element of a crime or tort, corroborate or disprove an alibi, and/or determine the manner in which an event occurred.

The job duties of a Firearm and Toolmark Examiner have been grouped into job duty areas. Descriptions of the activities associated with each job duty area are described below.

Collection of Evidence

A Firearm and Toolmark Examiner may examine crime scenes and articles found there related to a crime to identify the evidentiary value or potential of an item or object as it is encountered in an organized search routine. The Examiner must determine and use the appropriate manipulative skills and tools necessary to select, remove, package, and protect the physical evidence in a manner which best maintains the integrity and evidentiary value of the items.

Preservation of Evidence

A Firearm and Toolmark Examiner performs activities to best preserve physical evidence, including: latent evidence, trace and microscopic evidence, and the crime scene in general. Examiners must mark evidence properly and ensure the chain of custody of all evidence collected is consistent with legal and scientific standards.

Examination of Evidence

The examination of evidence is the process of inspecting and/or testing physical evidence by selecting and performing the appropriate techniques to obtain forensically useful information. This necessitates a knowledge of the historical development of firearm and toolmark identification. Examiners must also prioritize procedures and preserve appropriate samples for any subsequent forensic analysis. Examiners must be knowledgeable about appropriate sample sizes, standards, control mechanisms, and testing conditions for performing various types of evidentiary examination procedures

Laboratory Techniques

Firearm and Toolmark Examiners must be proficient in the use of laboratory instrumentation and how they are used in applying valid scientific procedures to the examination of evidence. Examiners use optical, electronic, measurement, and analytical instruments to process and analyze evidence. Such instruments are often used by Examiners to document, sample, examine, analyze, and/or compare various types of physical evidence. Examiners must possess a thorough understanding of the use and limitations of common types of analytical instruments used to examine firearms, toolmarks, and gunshot residues.

Evaluation and Interpretation of Analytical Results

Firearm and Toolmark Examiners must be able to evaluate and interpret the results of physical evidence evaluations. The Examiner must be knowledgeable about the limitations of any methods and procedures used, and of any limitations imposed by federal or state legislation and/or mandates regarding the condition and submission of evidence. This requires Examiners to possess a knowledge of basic probability, statistics, test significance, completeness, the assessment of accuracy, and scientific methodology. Examiners must be able to explain the supportive (or non-supportive) aspects of findings to prove or disprove proposed hypotheses.

Documentation of Physical Evidence and Analytical Results

Firearm and Toolmark Examiners must thoroughly document the nature of the physical evidence as it was discovered, preserved, and analyzed. Also, Examiners must be proficient at properly documenting their interpretations of test results. Documentation requires the use of written notes, sketches, report writing, and still and video photography. Examiners must possess a reasonable mastery of the English language, including the basic rules of punctuation, spelling, grammar, and composition. Examiners must be able to write about technical scientific materials in a clear and succinct fashion that can be understood by readers who do not possess technical expertise. Examiners may sometimes write papers for publication in professional journals and other publications.

Oral Dissemination of Evidence and Analytical Results

Firearm and Toolmark Examiners must orally communicate, both formally and informally, with laypersons as well as with other scientists. Informal oral communication typically takes the form of conveying examination results and their interpretations to investigators, attorneys, and other forensic practitioners. Examiners also may orally report the results of casework and research findings in formal forums with other scientists.

Safe Work Practices

Firearm and Toolmark Examiners must follow all precautionary procedures and observe safe work practices to ensure the safety of the Examiner and all others. Examiners must be aware of all potential hazards to health and welfare that may exist in both the laboratory and in the field.

Maintaining Knowledge of Scientific Developments and Related Literature

A Firearm and Toolmark Examiner must maintain a knowledge of the current developments and practices in: general criminalistics; their appropriate specialty areas; those areas of science that have a direct bearing on relevant physical evidence concerns; and legal decisions that affect the collection, preservation, and presentation of evidence. Activities associated with this job duty area include: reading professional journals and publications; attending professional conferences; obtaining relevant training; and conversing with other professionals in the field. Examiners should also maintain proficiency through participation (either formally or informally) in quality control or quality assurance programs. Examiners may also conduct ad hoc research as casework needs dictate, as well as engage in general research directed to the development of new scientific knowledge.

Testifying in Legal Proceedings

Firearm and Toolmark Examiners must give oral evidence, under oath, through the process of direct and cross-examination during legal proceedings. This involves the summation or elaboration of the Examiner's written reports and examination notes. Such testimony generally includes an explanation of: the testing procedures used to analyze the evidence being presented in the trial; the equipment and/or reagents used; the examination results; the Examiner's interpretations of the examination results; potential sources for variance or error in the test results, and safeguards taken to present such errors. Examiners must possess a knowledge of general courtroom and legal procedures, especially in the areas of expert testimony and the introduction of evidence. As an expert witness, the Firearm and Toolmark Examiner must demonstrate a professional demeanor. The Examiner must speak in a clear, precise, and understandable manner and be able to describe technical procedures in a manner easily understood by lay persons.

Training

Firearm and Toolmark Examiners assist with the training of criminal justice practitioners (such as investigators and attorneys) in the identification, handling, and interpretation of physical evidence. Journey-level Examiners may also assist in the training of entry-level forensic scientists. Activities associated with training include making oral presentations, developing informal and formal training curriculum, interpreting written scientific materials, and evaluating trainees' work on proficiency tests and casework notes/reports.

Maintaining Professional, Ethical Standards of Conduct

Firearm and Toolmark Examiners must subscribe to a code of ethics. Examiners must conduct an unbiased examination and evaluation of the physical evidence, and render interpretations (both orally and in writing) in a fair and unbiased manner. Examiners must be aware of the potential consequences associated with unethical and/or biased behavior.

APPENDIX B

AFTE Job Analysis Questionnaire

ASSOCIATION OF FIREARM AND TOOLMARK EXAMINERS

JOB ANALYSIS QUESTIONNAIRE

1998

**Cooperative Personnel Services
191 Lathrop Way, Suite A
Sacramento, CA 95815
(916) 263-3600**

FIREARM AND TOOLMARK EXAMINER JOB ANALYSIS QUESTIONNAIRE

As a Subject Matter Expert, you have been requested by the *Association of Firearm and Toolmark Examiners* to provide job analysis information on the tasks, knowledges, skills, and abilities associated with the Firearms and Toolmark Examiner job classification. The information you provide in this Job Analysis Questionnaire will greatly assist the *Association of Firearm and Toolmark Examiners* to develop an accurate characterization of the Firearm and Toolmark Examiner position. This information will be used in developing certification examinations in the firearms, toolmark, and gunshot residue content areas.

The knowledge, skills, abilities, and task statements contained in this questionnaire were compiled from other job analyses of this position as well as job analyses of the more general Criminalist position. These job statements were then reviewed by AFTE subject matter experts. The job statements were edited, some were combined, others were deleted, and many more were added to complete this AFTE Firearm and Toolmark Examiner Job Analysis Questionnaire. The results of this questionnaire will be analyzed to determine the most important and frequently performed job tasks, as well as the most important and critical knowledges, skills, and abilities (KSAs). These KSAs will form the basis of the AFTE Firearm and Toolmark Examiner certification examinations.

This questionnaire contains 61 Task Statements, 153 Knowledge Statements, 53 Skills Statements, and 106 Ability Statements. Task Statements are summaries of the individual duties performed by Firearm and Toolmark Examiners. Knowledge Statements are summaries of the individual knowledge areas used by Firearm and Toolmark Examiners. The Skills Statements describe the physical competence (i.e., psychomotor functioning) necessary to perform the individual duties performed by Firearm and Toolmark Examiners. The Ability Statements describe the competencies needed to perform those job duties that require mental functioning (such as performing analysis, or decision-making).

You will be asked to rate each Task Statement on two scales: (1) frequency (i.e., how often you perform the task), and (2) on its importance to successful completion of the job. You will also be asked to rate each of the Knowledge, Skills, and Ability Statements on two scales: (1) on its importance to successful completion of the job, and (2) what level of competency you believe is needed at the time of certification.

A response sheet has been provided to you on which to record your responses to the questionnaire. When you complete this questionnaire, the response sheet should be mailed back to Cooperative Personnel Services (CPS) in the envelope provided (no postage is necessary). It is essential that this information be mailed back to CPS no later than February 28, 1998.

It is important that all AFTE members take the time to complete this questionnaire. Firearm and Toolmark Examiner positions may differ by jurisdiction and/or by geographic area. Therefore, it is imperative that we obtain a representative sample of AFTE members.

Your participation and input into this project are greatly appreciated.

INSTRUCTIONS FOR COMPLETING THE QUESTIONNAIRE RESPONSE SHEET

Please mark all of your responses on the response sheet provided. When completing the questionnaire, take extreme care not to bend the edges of the response sheet or mutilate it in any way. When filling out the response sheet you should:

- Use only a soft-lead pencil (No. 2) to mark your response sheet. Do not use a ball-point pen or other ink pen.
- Completely darken in the appropriate response bubble (do not use an “X” or checkmark to mark the response bubble).
- Make no stray marks on the response sheet, and make sure that all erasures are complete and clean.
- Verify that you have recorded your responses on the correct location of the response sheet for each question.

Demographic Information: The first step in completing the AFTE Job Analysis Questionnaire is to fill in the demographic information located throughout the response sheet. The information you provide in this section will be used to ensure that a representative sample of response sheets is received from the AFTE membership. At no time will this information be used to examine the responses of any particular AFTE member. Please locate and fill in the appropriate response bubbles for the following questions:

Race/Ethnicity: Please indicate your ethnicity from among the options given. If your ethnicity is not listed as one of the choices, then choose “OTHER.” Choose only one option. If you are multi-ethnic, choose the ethnic group with which you identify with the most.

Gender: Please indicate whether you are male or female.

Years of Experience: Indicate the number of years of experience you have in the Firearms and Toolmark Examiner job classification (or related classifications). If you have less than ten years of experience, be sure to darken in the zero in the tens column (e.g., a member with eight years of experience should darken in 08).

AFTE Member Number: Please indicate your AFTE Member Number. The space to record this information is located on page two (the back) of the response sheet.

Job Component Areas: This job analysis questionnaire is comprised of four separate job component areas: (1) Task Statements; (2) Knowledge Statements; (3) Skills Statements; and (4) Ability Statements. Each job component area has a corresponding section on the response sheet in which to record your responses. Please complete all of the ratings for each job component area before beginning the next job component area. Each job component area has its own rating scales. Please read these rating scales thoroughly before you begin your ratings. The rating scales are printed at the top of each page for your reference.

Rate each of the statements as it pertains to your job with your agency. Your ratings should reflect how you actually perform your job, (and not how it theoretically should be performed). Different jurisdictions will

perform the Firearm and Toolmark Examiner duties differently. The purpose of this questionnaire is not to judge any member or jurisdiction on how they perform their job, but to better understand, and take into account, variations in performing the Firearm and Toolmark Examiner job duties.

TASK STATEMENT RATINGS

The next step in completing this questionnaire is to rate the Firearm and Toolmark Examiner Task Statements for frequency and importance. Task Statements are summaries of the individual duties performed by Firearm and Toolmark Examiners. The scales used to rate the Task Statements are described below:

FREQUENCY: Rate each Task Statement on the average frequency the task was performed during the last 12 months.

- A This task was **NOT PERFORMED** during the last 12 months.
- B This task was performed **LESS THAN ONCE EACH MONTH** during the last 12 months.
- C This task was performed **AT LEAST ONCE EACH MONTH** during the last 12 months.
- D This task was performed **AT LEAST ONCE EACH WEEK** during the last 12 months.
- E This task was performed **AT LEAST ONCE EACH DAY** during the last 12 months.

IMPORTANCE: Rate each task for how important or critical it is to the overall performance of the job. Do not consider how often you perform this task. Rate the importance of each task even if you have not performed the task during the past 12 months.

- 1 This task has **NO IMPACT** on overall job performance.
- 2 This task has a **MODERATE IMPACT** on overall job performance.
- 3 This task has a **HIGH IMPACT** on and is **ESSENTIAL** to overall job performance.
- 4 This task has an **EXTREME IMPACT** on and is **CRITICAL** to overall job performance.

RECORDING YOUR RESPONSES: All of your ratings of the Task Statements must be recorded on the response sheet provided. Each Task Statement has a unique number assigned to it. Find the corresponding number on the response sheet. For your convenience, the first Task Statement is marked T1. Notice that next to the number are two sets of response bubbles, the first set has five response bubbles (marked A - E), the second set has four response bubbles (marked 1 - 4). Record your Task Statement Frequency rating in the first set of bubbles by completely darkening the response bubble which corresponds to your rating. Use the same method to record your Task Statement Importance rating in the second set of bubbles. Continue working until you have completed rating all of the Task Statements.

TASK STATEMENTS: Summaries of Individual Duties Performed

FREQUENCY	IMPORTANCE
A NOT PERFORMED B LESS THAN ONCE EACH MONTH C AT LEAST ONCE EACH MONTH D AT LEAST ONCE EACH WEEK E AT LEAST ONCE EACH DAY	1 NO IMPACT 2 MODERATE IMPACT 3 HIGH IMPACT 4 EXTREME IMPACT

COLLECTION OF EVIDENCE

- T1. Marks physical evidence at crime scenes.
2. Makes notes, and sketches, to document the crime scene.
3. Takes measurements to document crime scene using various measuring devices.
4. Uses photographic equipment (still cameras and video equipment) to document crime scene.
5. Conducts search of crime scenes to detect firearm and toolmark evidence.
6. Conducts search of crime scenes to detect non-firearm/toolmark evidence.
7. Collects evidence at the crime scene using proper evidence handling techniques.
8. Performs shooting scene reconstruction activities.
9. Operates metal detectors to discover items of evidence.

PRESERVATION OF EVIDENCE

10. Preserves firearm and toolmark evidence using proper evidence handling techniques.
11. Preserves non-firearm/toolmark evidence using proper evidence handling techniques.
12. Receives and releases evidence following proper chain of custody procedures.

EXAMINATION OF EVIDENCE

13. Performs those examinations appropriate for the identification and/or individualization of the evidence items.
14. Performs initial screening examinations on physical evidence for the presence/absence of trace or serological evidence, preserving the integrity of this evidence (or any other category of evidence which may be present) for subsequent examiners.
15. Examines firearm and toolmark evidence to determine which tests would be most pertinent, relative to the elements of a case or investigation.

TASK STATEMENTS: Summaries of Individual Duties Performed

FREQUENCY	IMPORTANCE
A NOT PERFORMED B LESS THAN ONCE EACH MONTH C AT LEAST ONCE EACH MONTH D AT LEAST ONCE EACH WEEK E AT LEAST ONCE EACH DAY	1 NO IMPACT 2 MODERATE IMPACT 3 HIGH IMPACT 4 EXTREME IMPACT

FIREARMS

16. Examines firearms for general condition, functioning, and safety.
17. Test fires various types of firearms for functioning and comparison purposes.
18. Restores obliterated serial numbers on firearms, tools, etc., using various restoration techniques.
19. Uses sound meters to evaluate silencers as to their structure, design and effectiveness.
20. Functionally examines firearms for alterations by testfiring and disassembling when necessary.
21. Prepares known testfired targets and determines the muzzle to target distance of evidence items.
22. Determines ejection patterns for firearms for purpose of positioning shooters.
23. Maintains and retrieves firearm information from electronic databases.

AMMUNITION

24. Microscopically examines ammunition and components for signs of reloading.
25. Microscopically examines bullets and cartridge cases for marks produced by firearms as well as marks produced by the manufacturer or manufacturing process.
26. Uses measurement and microscopy equipment to examine bullets and cartridge cases to determine the caliber and manufacturer.
27. Visually and microscopically examines bullets and cartridge cases to determine the type and manufacturer of the firearm from which they were fired.
28. Prepares test marks for comparison using appropriate test materials in the production of testfired cartridge components and toolmarks.
29. Uses microscopy equipment to compare questioned bullets and cartridge cases to test fired bullets and cartridge cases to determine if they were fired from the same firearm.
30. Uses microscopy equipment to intercompare bullets and other cartridge components to determine if they originated from the same firearm or are of the same manufacturing source.
31. Examines holes or wounds by physical and chemical means to determine if they were caused by bullets.

TASK STATEMENTS: Summaries of Individual Duties Performed

FREQUENCY	IMPORTANCE
A NOT PERFORMED B LESS THAN ONCE EACH MONTH C AT LEAST ONCE EACH MONTH D AT LEAST ONCE EACH WEEK E AT LEAST ONCE EACH DAY	1 NO IMPACT 2 MODERATE IMPACT 3 HIGH IMPACT 4 EXTREME IMPACT

TOOLMARKS

31. Visually and microscopically examines toolmarks to determine their characteristics and the type, size, and configuration of the tool used.
33. Makes casts of toolmarks using various casting mediums.
34. Visually and microscopically compares questioned toolmarks with test toolmarks to determine if they were produced by the same tool.
35. Visually and microscopically examines tools to determine what area of the tool produced the toolmark and whether this area is capable of producing individual (unique) toolmarks due to the lack of influence from sub-class characteristics.
36. Visually and microscopically examines toolmarks to determine what actions of the tool produced the toolmarks.
37. Visually and microscopically intercompares toolmarks to determine if they were made by the same tool.

GUNSHOT RESIDUE

38. Visually and microscopically examines evidence items for various types of gunshot residue and shot patterns (from shotgun and shot cartridge discharges) when performing distance determinations.
39. Examines samples for the presence of firearms discharge residues by scanning electron microscopy/energy dispersive x-ray.
40. Examines samples by FTIR analysis for the identification of gunpowder.
41. Examines samples by IR luminescence and reflectance for the presence of gunshot residues.

LABORATORY TECHNIQUES

42. Calibrates laboratory equipment to ensure accurate results.
43. Uses common laboratory equipment (pumps, mixers, ultrasonic baths) to prepare evidence for examination.
44. Processes film and film negatives for the purpose of documenting evidence.

TASK STATEMENTS: Summaries of Individual Duties Performed

FREQUENCY	IMPORTANCE
A NOT PERFORMED B LESS THAN ONCE EACH MONTH C AT LEAST ONCE EACH MONTH D AT LEAST ONCE EACH WEEK E AT LEAST ONCE EACH DAY	1 NO IMPACT 2 MODERATE IMPACT 3 HIGH IMPACT 4 EXTREME IMPACT

EVALUATION AND INTERPRETATION OF ANALYTICAL RESULTS

- 45. Evaluates firearm and toolmark evidence to develop an opinion regarding class, sub-class, and individual characteristics.
- 46. Evaluates test results to develop an opinion regarding whether or not a questioned item originated from the suspected source.
- 47. Evaluates examination requests for appropriateness.

DOCUMENTATION OF PHYSICAL EVIDENCE AND ANALYTICAL RESULTS

- 48. Writes technical reports concerning examination findings and the significance of such findings.
- 49. Documents observations and examination results using proper English and scientific notations.
- 50. Documents firearm and toolmark evidence as appropriate through proper notes, sketches and photographs.

ORAL DESCRIPTION OF EVIDENCE, THE ANALYTICAL PROCESS, AND ANALYTICAL RESULTS

- 51. Orally communicates with others (such as attorneys, peers, investigators, etc.) regarding case-related information.

SAFE WORK PRACTICES

- 52. Uses safe work practices to eliminate or minimize the potential of injury to him- or herself, coworkers, or others.

MAINTAINING KNOWLEDGE OF SCIENTIFIC DEVELOPMENTS AND RELATED LITERATURE

- 53. Participates in research and training in areas of firearms and toolmarks.
- 54. Participates in quality control programs to ensure high standards of test results.
- 55. Reads pertinent professional publications to sustain currency of job-related knowledge, skills, and abilities.
- 56. Attends professional meetings to sustain currency of job-related knowledge, skills, and abilities.

TESTIFYING IN LEGAL PROCEEDINGS

- 57. Testifies in legal proceedings regarding examination results and opinions.

TASK STATEMENTS: Summaries of Individual Duties Performed

FREQUENCY	IMPORTANCE
A NOT PERFORMED B LESS THAN ONCE EACH MONTH C AT LEAST ONCE EACH MONTH D AT LEAST ONCE EACH WEEK E AT LEAST ONCE EACH DAY	1 NO IMPACT 2 MODERATE IMPACT 3 HIGH IMPACT 4 EXTREME IMPACT

58. Participates in pre-trial conferences regarding pending testimony.

TRAINING

59. Trains less experienced individuals in: firearm determinations from class characteristics, the examination and comparison of firearms and toolmarks, distance determinations, the examination of firearm discharge residues, etc.

MAINTAINING PROFESSIONAL ETHICAL STANDARDS OF CONDUCT

60. Follows proper professional ethics standards.

61. Encourages others to follow proper professional ethics standards.

This concludes the Task Statement Ratings.

JOB KNOWLEDGE RATINGS

The third step in completing this questionnaire is to rate the Firearm and Toolmark Examiner Knowledge Statements for: (1) importance to job performance, and (2) the level of competency in this knowledge that you believe is essential at the time of certification. Job Knowledge Statements are summaries of the individual knowledge areas used by Firearm and Toolmark Examiners. The scales used to rate the Knowledge Statements are described below:

IMPORTANCE: Rate each Knowledge Statement in relation to its importance for successfully performing the job duties of a Firearm and Toolmark Examiner.

- A** This knowledge is **NOT NEEDED** to successfully perform the job.
- B** This knowledge is **SLIGHTLY IMPORTANT** for successfully performing the job.
- C** This knowledge is **IMPORTANT** for successfully performing the job.
- D** This knowledge is **VERY IMPORTANT** for successfully performing the job.
- E** This knowledge is **CRITICALLY IMPORTANT** for successfully performing the job.

(Note: This Importance scale is slightly different than the one used to rate the Task Statements).

EXPECTED AT CERTIFICATION: Rate each Knowledge Statement as to what level of competency you believe is needed at the time of initial certification to perform the Firearm and Toolmark Examiner job duties.

- 1** Competency in this knowledge is **NOT ESSENTIAL** at the time of certification.
- 2** **SOME COMPETENCY** in this knowledge is **ESSENTIAL** at the time of certification.
- 3** **A HIGH DEGREE OF COMPETENCY** in this knowledge is **ESSENTIAL** at the time of certification.
- 4** **FULL COMPETENCE** in this knowledge is **ESSENTIAL** at the time of certification.

RECORDING YOUR RESPONSES: All of your ratings of the knowledge statements must be recorded on the response sheet provided. Each knowledge statement has a unique number assigned to it. Find the corresponding number on the response sheet. For your convenience, the first Knowledge Statement is marked K1. Notice that next to the number are two sets of response bubbles, the first set has five response bubbles (marked A - E), the second set has four response bubbles (marked 1 - 4). Record your Knowledge Statement Importance rating in the first set of bubbles by completely darkening the response bubble which corresponds to your rating. Use the same method to record your Knowledge Statement "Expected at Certification" rating in the second set of bubbles. Continue working until you have completed rating all of the Knowledge Statements.

JOB KNOWLEDGE STATEMENTS: Summaries of Individual Job Knowledge Areas

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This knowledge is NOT NEEDED to perform the job.</p> <p>B This knowledge is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This knowledge is IMPORTANT for performing the job.</p> <p>D This knowledge is VERY IMPORTANT for performing the job.</p> <p>E This knowledge is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this knowledge is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this knowledge is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this knowledge is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this knowledge is ESSENTIAL.</p>

COLLECTION OF EVIDENCE

- K1. Knowledge of legal search requirements and restrictions governing access to the crime scene and materials that can be legally seized.
2. Knowledge of various search patterns techniques (grid, spiral, line, quadrant, random) and how to select the technique most appropriate for a particular situation.
3. Knowledge of which tools or instruments are most appropriate for the recovery of evidence.
4. Knowledge of shooting-scene reconstruction techniques.
5. Knowledge of non-firearms/toolmark types of forensic evidence: such as trace evidence (hairs, fibers, paint, etc.), serological evidence, etc.

PRESERVATION OF EVIDENCE

6. Knowledge of legal requirements for the preservation of evidence.
7. Knowledge of scientific methodologies for the preservation of evidence.
8. Knowledge of activities to perform to ensure the preservation of a crime scene.
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.
11. Knowledge of the effects of biological agents (bacteria, molds, insects, animals, etc.) on various types of evidence and ways to prevent its effects.
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.

DOCUMENTATION OF PHYSICAL EVIDENCE AND ANALYTICAL RESULTS

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).

JOB KNOWLEDGE STATEMENTS: Summaries of Individual Job Knowledge Areas

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This knowledge is NOT NEEDED to perform the job.</p> <p>B This knowledge is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This knowledge is IMPORTANT for performing the job.</p> <p>D This knowledge is VERY IMPORTANT for performing the job.</p> <p>E This knowledge is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this knowledge is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this knowledge is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this knowledge is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this knowledge is ESSENTIAL.</p>

- 17. Knowledge of the proper methodologies for the written documentation of scientific results.
- 18. Knowledge of how to prepare reports for peer review.
- 19. Knowledge of how to prepare articles for peer review/publication.
- 20. Knowledge of various photographic techniques and their application for documenting evidence and analytical results, and for preparing courtroom exhibits.

EXAMINATION OF EVIDENCE

- 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.
- 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.

EQUIPMENT/TOOLS

- 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.
- 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.

JOB KNOWLEDGE STATEMENTS: Summaries of Individual Job Knowledge Areas

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This knowledge is NOT NEEDED to perform the job.</p> <p>B This knowledge is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This knowledge is IMPORTANT for performing the job.</p> <p>D This knowledge is VERY IMPORTANT for performing the job.</p> <p>E This knowledge is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this knowledge is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this knowledge is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this knowledge is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this knowledge is ESSENTIAL.</p>

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.).
34. Knowledge of how and when to use metal detectors.
35. Knowledge of how and when to use surgical equipment (such as scalpels, needles, scissors, etc.).
36. Knowledge of how and when to use video microscopes.
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.
39. Knowledge of how and when to use gunsmithing tools.
40. Knowledge of how and when to use ultrasonic baths and cleaners.
41. Knowledge of how and when to use various cleaning solutions.
42. Knowledge of how and when to use pulled-bullet/cartridge exemplar files.
43. Knowledge of how and when to use borescopes.
44. Knowledge of how and when to use bore lights.
45. Knowledge of how and when to use IR light and UV light equipment.
46. Knowledge of how and when to use different probes (such as wood, fiberglass, metal, etc.) for bullet holes.
47. Knowledge of how and when to use lasers.
48. Knowledge of how and when to use sieves for screening materials to locate evidence.
49. Knowledge of how and when to use sound meters.
50. Knowledge of how and when to use microfinish exemplar templates.
51. Knowledge of how and when to use magnifying glasses of various powers.
52. Knowledge of how and when to use chemical reagents.
53. Knowledge of how and when to use exposure meters.
54. Knowledge of how and when to use stirring equipment (such as magnetic stirring machines) to mix chemicals.

JOB KNOWLEDGE STATEMENTS: Summaries of Individual Job Knowledge Areas

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This knowledge is NOT NEEDED to perform the job.</p> <p>B This knowledge is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This knowledge is IMPORTANT for performing the job.</p> <p>D This knowledge is VERY IMPORTANT for performing the job.</p> <p>E This knowledge is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this knowledge is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this knowledge is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this knowledge is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this knowledge is ESSENTIAL.</p>

- 55. Knowledge of how and when to use x-ray equipment.
- 56. Knowledge of how and when to use vacuum pumps.
- 57. Knowledge of how and when to use various small handtools (such as screwdrivers, hammers, pliers, etc.).
- 58. Knowledge of how and when to use metal and woodworking machinery (such as drill presses, grinders, dremels, lathes, mills, etc.).
- 59. Knowledge of how and when to use fume hoods.
- 60. Knowledge of how and when to use audio/video equipment (such as tape recorders, TVs, VCRs, monitors, slide projectors, overhead projectors, ELMO demo units in court, etc.).
- 61. Knowledge of how and when to use household equipment (such as refrigerators, dishwashers, vacuum cleaners, and irons).
- 62. Knowledge of how and when to use hot and cold air blowers.
- 63. Knowledge of how and when to use survey equipment.
- 64. Knowledge of how and when to use drafting equipment.
- 65. Knowledge of how and when to use chronograph equipment.
- 66. Knowledge of how and when to use computer systems and work-related computer programs.
- 67. Knowledge of how and when to use examination tables.
- 68. Knowledge of how and when to use bullet and cartridge recovery systems (water, snail, cotton waste, etc.).
- 69. Knowledge of how and when to use bullet pullers.
- 70. Knowledge of how and when to use spring trigger pull scales.
- 71. Knowledge of how and when to use trigger pull weights.
- 72. Knowledge of how and when to use FTIR.

FIREARMS

- 73. Knowledge of the historical development of firearms design.

JOB KNOWLEDGE STATEMENTS: Summaries of Individual Job Knowledge Areas

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This knowledge is NOT NEEDED to perform the job.</p> <p>B This knowledge is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This knowledge is IMPORTANT for performing the job.</p> <p>D This knowledge is VERY IMPORTANT for performing the job.</p> <p>E This knowledge is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this knowledge is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this knowledge is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this knowledge is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this knowledge is ESSENTIAL.</p>

- 74. Knowledge of machining and finishing processes of tools, guns, barrels, breechfaces, extractors, ejectors, firing pins, and silencers (with emphasis on working surfaces and edges) and their effect on individuality.
- 75. Knowledge of muzzleloading firearms designs, including ignition systems and loading techniques.
- 76. Knowledge of breechloading firearms designs, including falling breechlocks, bolt actions, lever actions, pump actions, break open, semiautomatics (blowback, gas-operated, recoil operated, etc.), revolvers--double and single action.
- 77. Knowledge of firearms ignition systems: flintlock, percussion, rimfire, centerfire, caseless ammunition.
- 78. Knowledge of methods of imprinting serial numbers on firearms.
- 79. Knowledge of theory of restorative techniques of serial numbers in firearms.
- 80. Knowledge of sources of information regarding identification markings and serial numbering systems in firearms (including locations of serial numbers, part/assembly numbers, proof marks on firearms and the locations of hidden numbers).
- 81. Knowledge of the proper operation of the different types of firearms encountered in casework.
- 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.

AMMUNITION

- 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.).
- 87. Knowledge of cartridge cases: design (i.e., rimfire, centerfire, Boxer/Berdan priming systems); compositions (copper, brass, steel, aluminum).
- 88. Knowledge of manufacturer information: headstamps, color coding.
- 89. Knowledge of the history/development of ammunition components: cartridge naming system; alternate names; interchangeability.

JOB KNOWLEDGE STATEMENTS: Summaries of Individual Job Knowledge Areas

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This knowledge is NOT NEEDED to perform the job.</p> <p>B This knowledge is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This knowledge is IMPORTANT for performing the job.</p> <p>D This knowledge is VERY IMPORTANT for performing the job.</p> <p>E This knowledge is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this knowledge is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this knowledge is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this knowledge is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this knowledge is ESSENTIAL.</p>

- 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.
- 91. Knowledge of primers: design, color, staking.
- 92. Knowledge of ammunition components.
- 93. Knowledge of ammunition manufacturing methods.
- 94. Knowledge of the types of legal vs. illegal ammunition.
- 95. Knowledge of the principles of ammunition reloading.
- 96. Knowledge of the tools, sources, and types of components used in ammunition reloading, and when to use them.
- 97. Knowledge of proper ammunition selection.

BALLISTICS

- 98. Knowledge of internal ballistics: ignition, pressure, function of chamber design, chamber and cartridge dimensions, headspace considerations.
- 99. Knowledge of exterior ballistics: line of sight vs. bullet path; departure path and angle; trajectories (long and short); angle of fall; ballistic tables (flight time, drop, velocity loss with distance, wind drift, etc.); ballistic programs; bullet stability, rotational velocity, yaw, twist rates necessary to stabilize various bullet types.
- 100. Knowledge of terminal ballistics: penetration, bullet deformation and expansion and its relation to impact velocity and orientation.
- 101. Knowledge of ballistic wounds: penetration, bullet deformation and expansion; penetration mechanics in tissue and tissue simulants; temporary and permanent cavitation.
- 102. Knowledge of bullet holes/bullet impact sites and ricochet marks.
- 103. Knowledge of cartridge case ejection patterns: (physics and mechanics affecting; surface effects on pattern; and the effect of intermediate objects).
- 104. Knowledge of ballistic tables, how to use them and their limitations.
- 105. Knowledge of bullet recovery methods, and the advantages and disadvantages of each.
- 106. Knowledge of chemical tests used in the examination of bullet holes, bullet impact site, and ricochet marks.

JOB KNOWLEDGE STATEMENTS: Summaries of Individual Job Knowledge Areas

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This knowledge is NOT NEEDED to perform the job.</p> <p>B This knowledge is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This knowledge is IMPORTANT for performing the job.</p> <p>D This knowledge is VERY IMPORTANT for performing the job.</p> <p>E This knowledge is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this knowledge is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this knowledge is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this knowledge is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this knowledge is ESSENTIAL.</p>

DISTANCE DETERMINATION

- 106. Knowledge of how and when to perform microscopic examinations for the purpose of distance determination.
- 108. Knowledge of how and when to perform IR reflectance and/or luminescence tests 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.
- 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.
- 113. Knowledge of bullet hole characterization for caliber size determination (within limitations) when performing distance determination.

TOOLMARK IDENTIFICATION

- 114. Knowledge of proper use of tools and materials for testmarks.
- 115. Knowledge of the toolmarks created during the reloading of ammunition.
- 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.

GUNSHOT RESIDUE (Non Distance Determination Examinations)

- 120. Knowledge of firearms-generated discharge products: how deposited; primer constituents, propellant residues, bullet metal and bullet lubricants.
- 121. Knowledge of methods for the collection and analysis of gunshot residue samples, including: atomic absorption; scanning electron microscopy/energy dispersive x-ray.

JOB KNOWLEDGE STATEMENTS: Summaries of Individual Job Knowledge Areas

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This knowledge is NOT NEEDED to perform the job.</p> <p>B This knowledge is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This knowledge is IMPORTANT for performing the job.</p> <p>D This knowledge is VERY IMPORTANT for performing the job.</p> <p>E This knowledge is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this knowledge is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this knowledge is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this knowledge is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this knowledge is ESSENTIAL.</p>

122. Knowledge of different interpretations for any given gunshot residue analytical results.

PHYSICAL SCIENCES

- 123. Knowledge of mathematical operations, and interrelationships (including arithmetic, geometry, calculus, statistics, and their applications).
- 124. Knowledge of physics: the prediction of physical principles, laws, and applications (including material dynamics, light, heat, and electric theory).
- 125. Knowledge of chemistry: the composition, structure, and properties of substances and of the chemical processes and transformations they undergo.
- 126. Knowledge of biology: i.e., plant and living tissue, cells, organisms, etc. (including their functions, interdependencies, and interactions with each other and the environment).
- 127. Knowledge of anatomy and dentistry; i.e., the various organs and components of the body (including their appearances and functions).
- 128. Knowledge of metallurgy: i.e., the science of metalworking, and properties of metals and alloys.

ORAL DESCRIPTION OF EVIDENCE, THE ANALYTICAL PROCESS, AND ANALYTICAL RESULTS

129. Knowledge of correct word usage and pronunciation.

SAFE WORK PRACTICES

- 130. Knowledge of the potential hazardous properties of biological hazards (such as hepatitis, AIDS, etc.).
- 131. Knowledge of the potential hazardous properties of parasites.
- 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.
- 135. Knowledge of how to safely handle potentially dangerous items, such as defective firearms, ammunition, and explosives for laboratory examination.
- 136. Knowledge of radiation hazards and how to safely use radiation equipment (such as x-ray equipment, lasers, etc.).

JOB KNOWLEDGE STATEMENTS: Summaries of Individual Job Knowledge Areas

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This knowledge is NOT NEEDED to perform the job.</p> <p>B This knowledge is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This knowledge is IMPORTANT for performing the job.</p> <p>D This knowledge is VERY IMPORTANT for performing the job.</p> <p>E This knowledge is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this knowledge is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this knowledge is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this knowledge is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this knowledge is ESSENTIAL.</p>

- 137. Knowledge of thermal hazards (cryogenics and excessive heat) and safety methods associated with each.
- 138. Knowledge of the proper use of safety equipment and materials (such as protective clothing, eye and ear protective devices, and disinfectants).
- 139. Knowledge of safety procedures and the potential hazardous properties regarding test firing various firearms.
- 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.

MAINTAINING KNOWLEDGE OF SCIENTIFIC DEVELOPMENTS AND RELATED LITERATURE

- 142. Knowledge of which journals, newsletters and professional publications report information applicable to Firearm and Toolmark Examiners.
- 143. Knowledge of which professional organizations address Firearm and Toolmark Examiners concerns.
- 144. Knowledge of where to find and how to use various reference collections, tables, and databases (including ballistic tables, Drugfire and IBIS, Firearm Reference Collections, Ammunition Reference Collections, General Rifling Characteristics File for make and model determinations, etc.), and the limitations of such databases and tables.

TESTIFYING IN LEGAL PROCEEDINGS

- 145. Knowledge of legal requirements (e.g., *Daubert* and *Frye* cases) and the protocols for the presentation of scientific evidence.
- 146. Knowledge of appropriate legislation and statutory definitions as applied to the expert witness.
- 147. Knowledge of courtroom procedures regarding the testimony of expert witnesses.
- 148. Knowledge of the proper demeanor for testifying in legal proceedings.
- 149. Knowledge of the preparation and use of demonstrative evidence (such as displays, etc.).

TRAINING

- 150. Knowledge of training methods used to teach scientific disciplines.

JOB KNOWLEDGE STATEMENTS: Summaries of Individual Job Knowledge Areas

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This knowledge is NOT NEEDED to perform the job.</p> <p>B This knowledge is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This knowledge is IMPORTANT for performing the job.</p> <p>D This knowledge is VERY IMPORTANT for performing the job.</p> <p>E This knowledge is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this knowledge is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this knowledge is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this knowledge is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this knowledge is ESSENTIAL.</p>

MAINTAINING PROFESSIONAL ETHICAL STANDARDS OF CONDUCT

- 151. Knowledge of the ethical standards maintained by the legal and law enforcement professions.
- 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).

This concludes the Knowledge Statement Ratings.

JOB SKILLS RATINGS

The fourth step in completing this questionnaire is to rate the Firearm and Toolmark Examiner job skills for: (1) importance to job performance, and (2) the level of competency in this skill that you believe is essential at the time of certification. Job skills pertain to the physical competence (i.e., psychomotor functioning) to perform the individual duties performed by Firearm and Toolmark Examiners. The scales used to rate the Skills Statements are described below:

IMPORTANCE: Rate each Skills Statement in relation to its importance for successfully performing the job duties of a Firearm and Toolmark Examiner.

- A This skill is **NOT NEEDED** to successfully perform the job.
- B This skill is **SLIGHTLY IMPORTANT** for successfully performing the job.
- C This skill is **IMPORTANT** for successfully performing the job.
- D This skill is **VERY IMPORTANT** for successfully performing the job.
- E This skill is **CRITICALLY IMPORTANT** for successfully performing the job.

EXPECTED AT CERTIFICATION: Rate each Skills Statement as to what level of competency you believe is needed at the time of initial certification to perform the Firearm and Toolmark Examiner job duties.

- 1 Competency in this skill is **NOT ESSENTIAL** at the time of certification.
- 2 **SOME COMPETENCY** in this skill is **ESSENTIAL** at the time of certification.
- 3 **A HIGH DEGREE OF COMPETENCY** in this skill is **ESSENTIAL** at the time of certification.
- 4 **FULL COMPETENCE** in this skill is **ESSENTIAL** at the time of certification.

RECORDING YOUR RESPONSES: All of your ratings of the Skills Statements must be recorded on the response sheet provided. Each Skills Statement has a unique number assigned to it. Find the corresponding number on the response sheet. For your convenience, the first Skills Statement is marked S1. Notice that next to the number are two sets of response bubbles, the first set has five response bubbles (marked A - E), the second set has four response bubbles (marked 1 - 4). Record your Skills Statement Importance rating in the first set of bubbles by completely darkening the response bubble which corresponds to your rating. Use the same method to record your Skills Statement "Expected at Certification" rating in the second set of bubbles. Continue working until you have completed rating all of the Skills Statements.

JOB SKILLS STATEMENTS: Physical Competence to Perform Individual Job Duties

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This skill is NOT NEEDED to perform the job.</p> <p>B This skill is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This skill is IMPORTANT for performing the job.</p> <p>D This skill is VERY IMPORTANT for performing the job.</p> <p>E This skill is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this skill is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this skill is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this skill is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this skill is ESSENTIAL.</p>

COLLECTION OF EVIDENCE

- S1. Skill in recovering and removing evidence from the crime scene and related objects.
2. Skill in carefully and properly handling physical evidence without loss, contamination, or changes to the evidence that could result in loss of information.
3. Skill in scene diagraming.
4. Skill in taking notes to document a crime scene.
5. Skill in using photographic and video equipment to document a crime scene.
6. Skill in using measurement equipment for the analysis and documentation of the crime scene.
7. Skill in the measurement of cartridge case locations relative to a logical reference point, documentation of the substrate and immediate environment considerations to establish ejection characteristics.
8. Skill in the collection and safeguarding of non-firearms/toolmark evidence (such as trace materials).
9. Skill in making representative casts of marks of forensic interest.
10. Skill in properly preparing (mix or melt) the casting medium.

PRESERVATION OF EVIDENCE

11. Skill in properly packaging and storing evidence.

EXAMINATION OF EVIDENCE

12. Skill in preparing and calibrating ordnance gelatin for use as a tissue simulant.
13. Skill in correctly measuring test and evidence patterns.
14. Skill in disassembling locks, safes, etc. to examine internal components.

LABORATORY TECHNIQUES

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.

JOB SKILLS STATEMENTS: Physical Competence to Perform Individual Job Duties

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This skill is NOT NEEDED to perform the job.</p> <p>B This skill is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This skill is IMPORTANT for performing the job.</p> <p>D This skill is VERY IMPORTANT for performing the job.</p> <p>E This skill is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this skill is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this skill is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this skill is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this skill is ESSENTIAL.</p>

17. Skill in operating the controls/setting of various types of photographic and video equipment.
18. Skill in processing film/negatives as required (includes Polaroid positive/negative film).
19. Skill in properly setting up light sources for suitable illumination when operating photographic or video equipment.
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.).
23. Skill in the proper and safe use of bullet pullers.
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.).
29. Skill in preparing suitable test marks.

SAFE WORK PRACTICES

30. Skill in safely handling, loading and firing firearms.
31. Skill in safely operating recovery equipment for testfired bullets and cartridge cases.

FIREARMS

32. Skill in preparing a proper cast to recover the necessary dimensions in the case of chamber or bore castings or to replicate the class and individual characteristics of various firearm surfaces (e.g., bore, breechface, etc.) necessary to complete a comparison.
33. Skill in locating the site of an obliterated firearm serial number.

JOB SKILLS STATEMENTS: Physical Competence to Perform Individual Job Duties

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This skill is NOT NEEDED to perform the job.</p> <p>B This skill is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This skill is IMPORTANT for performing the job.</p> <p>D This skill is VERY IMPORTANT for performing the job.</p> <p>E This skill is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this skill is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this skill is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this skill is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this skill is ESSENTIAL.</p>

34. Skill in preparing firearms for serial number restorative technique(s).
35. Skill in raising and recording obliterated serial numbers.
36. Skill in preparing test fired specimens suitable for comparison and identification purposes.
37. Skill in measuring firearm trigger pulls.
38. Skill in measuring gun barrel lengths and overall lengths of firearms.
39. Skill in field testing firearms for full automatic firing.
40. Skill in chambering cartridges in firearms for discharge.
41. Skill in safely using appropriate chemicals to restore obliterated serial numbers.
42. Skill in locating any hidden numbers, areas of obliterated serial numbers, assessing the most probable removal method used for the obliteration, and the suitability for restoration.
43. Skill in repairing broken or rusted firearms.
44. Skill in disassembling and reassembling firearm mechanisms.
45. Skill in adequately downloading rifle cartridges as necessary to avoid damage to the recovery device, yet yielding satisfactory test fired bullets.
46. Skill in using remote firing devices (such as Zero-One and Ransom Rest).

AMMUNITION

47. Skill in locating marks on various ammunition components that can be associated with the specific reloading tool that came in contact with the component (cartridge case, primer, bullet).
48. Skill in preparing the appropriate bullet recovery medium, for the type of ammunition represented by the evidence bullet (e.g., wet rolled cotton, water).
49. Skill in modifying expanding bullets in such a way that they will not disintegrate when fired into the recovery device.
50. Skill in the preparation and use of ballistic gelatin.
51. Skill in identifying various marks on ammunition components as having been produced by a particular part of a firearm.

JOB SKILLS STATEMENTS: Physical Competence to Perform Individual Job Duties

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This skill is NOT NEEDED to perform the job.</p> <p>B This skill is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This skill is IMPORTANT for performing the job.</p> <p>D This skill is VERY IMPORTANT for performing the job.</p> <p>E This skill is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this skill is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this skill is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this skill is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this skill is ESSENTIAL.</p>

GUNSHOT RESIDUE

- 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.

This concludes the Skills Statement Ratings.

JOB ABILITY RATINGS

The final step in completing this questionnaire is to rate the Firearm and Toolmark Examiner Ability Statements for: (1) importance to job performance, and (2) the level of competency in this ability that you believe is essential at the time of certification. Job abilities pertain to the competence to perform those job duties that require mental functioning (such as performing analysis, or decision-making). The scales used to rate the Ability Statements are described below:

IMPORTANCE: Rate each Ability Statement in relation to its importance for successfully performing the job duties of a Firearm and Toolmark Examiner.

- A This ability is **NOT NEEDED** to successfully perform the job.
- B This ability is **SLIGHTLY IMPORTANT** for successfully performing the job.
- C This ability is **IMPORTANT** for successfully performing the job.
- D This ability is **VERY IMPORTANT** for successfully performing the job.
- E This ability is **CRITICALLY IMPORTANT** for successfully performing the job.

EXPECTED AT CERTIFICATION: Rate each Ability Statement as to what level of competency you believe is needed at the time of initial certification to perform the Firearm and Toolmark Examiner job duties.

- 1 Competency in this ability is **NOT ESSENTIAL** at the time of certification.
- 2 **SOME COMPETENCY** in this ability is **ESSENTIAL** at the time of certification.
- 3 **A HIGH DEGREE OF COMPETENCY** in this ability is **ESSENTIAL** at the time of certification.
- 4 **FULL COMPETENCE** in this ability is **ESSENTIAL** at the time of certification.

RECORDING YOUR RESPONSES: All of your ratings of the Ability Statements must be recorded on the response sheet provided. Each Ability Statement has a unique number assigned to it. Find the corresponding number on the response sheet. For your convenience, the first Ability Statement is marked A1. Notice that next to the number are two sets of response bubbles, the first set has five response bubbles (marked A - E), the second set has four response bubbles (marked 1 - 4). Record your Ability Statement Importance rating in the first set of bubbles by completely darkening the response bubble which corresponds to your rating. Use the same method to record your Ability Statement "Expected at Certification" rating in the second set of bubbles. Continue working until you have completed rating all of the Ability Statements.

JOB ABILITY STATEMENTS: Competence to Perform Duties Requiring Mental Functioning

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This ability is NOT NEEDED to perform the job.</p> <p>B This ability is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This ability is IMPORTANT for performing the job.</p> <p>D This ability is VERY IMPORTANT for performing the job.</p> <p>E This ability is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this ability is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this ability is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this ability is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this ability is ESSENTIAL.</p>

COLLECTION OF EVIDENCE

- A1. 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.
4. Ability to select the appropriate casting materials.
5. Ability to properly record conditions at a shooting scene or crime scene in general.
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.

PRESERVATION OF EVIDENCE

7. Ability to establish and maintain a proper chain of custody.
8. Ability to maintain a complete inventory of evidence from a particular case.

EXAMINATION OF EVIDENCE

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.

LABORATORY TECHNIQUES

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.
16. Ability to operate job-related computer systems and programs.

JOB ABILITY STATEMENTS: Competence to Perform Duties Requiring Mental Functioning

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This ability is NOT NEEDED to perform the job.</p> <p>B This ability is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This ability is IMPORTANT for performing the job.</p> <p>D This ability is VERY IMPORTANT for performing the job.</p> <p>E This ability is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this ability is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this ability is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this ability is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this ability is ESSENTIAL.</p>

17. Ability to select proper casting material and technique.

18. Ability to operate basic laboratory equipment.

EVALUATION AND INTERPRETATION OF ANALYTICAL RESULTS

19. Ability to understand and interpret technical data output from laboratory instruments.

20. Ability to make detailed calculations accurately.

21. Ability to recognize discrepancies or inconsistencies in analytical findings and determine their cause and significance.

22. Ability to recognize utility and limitations of reference collection/database programs.

23. Ability to recognize the limitations of tests and interpretations.

FIREARMS

24. Ability to determine the design of the lockwork (firing system) in firearms.

25. Ability to locate and identify the type (or types) of safety system(s) incorporated in a particular firearm.

26. Ability to determine the design type, method of operation and ignition of a submitted firearm.

27. Ability to recognize when a firearm has been altered from its original design.

28. Ability to determine the metal type in which the identification numbers were located.

29. Ability to select the best restorative method(s)/solutions for raising obliterated serial numbers based on the substrate.

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.

32. Ability to examine, either directly or through the use of casts, the interior surface of a gun barrel to determine the method of rifling.

33. Ability to recognize and discriminate common rifling profiles.

34. Ability to distinguish "action" markings from those caused during firing.

JOB ABILITY STATEMENTS: Competence to Perform Duties Requiring Mental Functioning

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This ability is NOT NEEDED to perform the job.</p> <p>B This ability is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This ability is IMPORTANT for performing the job.</p> <p>D This ability is VERY IMPORTANT for performing the job.</p> <p>E This ability is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this ability is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this ability is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this ability is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this ability is ESSENTIAL.</p>

- 35. Ability to evaluate the operability of each safety system, chambering method, and lockwork, recognize and explain any defects or failures in each of these systems and the consequences of any such defect or failure.
- 36. Ability to compare firearm mechanisms with standards.
- 37. Ability to recognize which parts of a firearm leave tool marks of forensic interest.

AMMUNITION

- 38. Ability to recognize when fired bullets and casings have been fired in a firearm not designed for them.
- 39. Ability to recognize, compare and identify various ammunition types and components.
- 40. Ability to recognize manufacturer-induced/placed toolmarks (sub-class characteristics) on ammunition as well as their usefulness and limitations.
- 41. Ability to identify reloaded ammunition as having been assembled by the same equipment by determining that specific reloading tool(s) came in contact with cartridge components.
- 42. Ability to recognize and interpret the effects of ammunition/firearms combination on various aspects involved in reconstructing what happened at a shooting scene.
- 43. Ability to recognize reloaded or handloaded ammunition.
- 44. Ability to compare ammunition components on the basis of design characteristics or features.
- 45. Ability to compare unfired propellant samples from disassembled cartridges.
- 46. Ability to recognize: (1) those attributes or characteristics of a particular firearm design which are reflected in the fired projectiles and fired cartridge cases; and (2) non-firearm caused toolmarks on ammunition components.
- 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.
- 50. Ability to make comparisons between evidence and reference cartridges and recovered cartridge components.
- 51. Ability to identify a specific reloading tool as having resized a cartridge case or as having seated a bullet and/or primer.
- 52. Ability to identify a cast bullet as having come from a particular bullet mold.

JOB ABILITY STATEMENTS: Competence to Perform Duties Requiring Mental Functioning

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This ability is NOT NEEDED to perform the job.</p> <p>B This ability is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This ability is IMPORTANT for performing the job.</p> <p>D This ability is VERY IMPORTANT for performing the job.</p> <p>E This ability is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this ability is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this ability is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this ability is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this ability is ESSENTIAL.</p>

- 53. Ability to distinguish between the quality and quantity of matching striae in a true identity and that observed in known non-matches.
- 54. Ability to recognize commercially reloaded or handload ammunition components from their markings and characteristics.
- 55. Ability to identify reloaded ammunition as having been assembled by the same manufacturer and/or containing the same brand of components.
- 56. Ability to recognize the evidentiary value of reloaded ammunition.
- 57. Ability to recognize any manufacturer-induced characteristics.

BALLISTICS

- 58. Ability to identify potential ballistic issues or considerations on specific cases (e.g., questionable ammunition performance, the shooter's sight picture at the moment of the shot, bullet flight time vs. changes in the position of the victim).
- 59. Ability to carry out basic external ballistic calculations.
- 60. Ability to design relevant experiments to evaluate ballistic questions.
- 61. Ability to make velocity measurements with ballistic chronography.
- 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).
- 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.
- 64. Ability to recognize situations where gunshots might be sequenced.
- 65. Ability to integrate shooting scene data with the test firing data and establish the probable position(s) of the shooter and exclude other sites.
- 66. Ability to properly limit the scope of reconstruction to the hypotheses being tested.
- 67. Ability to recognize bullet impact sites at shooting scenes.
- 68. Ability to recognize the limitations of a particular shooting scene reconstruction.
- 69. Ability to compare and interpret test and evidence gunshot discharge patterns.

JOB ABILITY STATEMENTS: Competence to Perform Duties Requiring Mental Functioning

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This ability is NOT NEEDED to perform the job.</p> <p>B This ability is SLIGHTLY IMPORTANT for performing the job.</p> <p>C This ability is IMPORTANT for performing the job.</p> <p>D This ability is VERY IMPORTANT for performing the job.</p> <p>E This ability is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this ability is NOT ESSENTIAL.</p> <p>2 SOME COMPETENCY in this ability is ESSENTIAL.</p> <p>3 A HIGH DEGREE OF COMPETENCY in this ability is ESSENTIAL.</p> <p>4 FULL COMPETENCE in this ability is ESSENTIAL.</p>

70. Ability to accurately record the appearance of bullet holes.

TOOLMARKS

- 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.

GUNSHOT RESIDUES

- 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.

JOB ABILITY STATEMENTS: Competence to Perform Duties Requiring Mental Functioning

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This ability is NOT NEEDED to perform the job. B This ability is SLIGHTLY IMPORTANT for performing the job. C This ability is IMPORTANT for performing the job. D This ability is VERY IMPORTANT for performing the job. E This ability is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this ability is NOT ESSENTIAL. 2 SOME COMPETENCY in this ability is ESSENTIAL. 3 A HIGH DEGREE OF COMPETENCY in this ability is ESSENTIAL. 4 FULL COMPETENCE in this ability is ESSENTIAL.</p>

DOCUMENTATION OF PHYSICAL EVIDENCE AND ANALYTICAL RESULTS

- 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.

ORAL DISSEMINATION OF EVIDENCE AND ANALYTICAL RESULTS

- 90. Ability to explain theory, operations, and applications of various laboratory instruments.
- 91. Ability to speak clearly and succinctly in front of groups.
- 92. Ability to listen to and understand information and ideas presented through spoken words and sentences.
- 93. Ability to answer questions clearly and to the point.

SAFE WORK PRACTICES

- 94. Ability to recognize unsafe conditions.
- 95. Ability to employ safe work practices.
- 96. Ability to render conditions safe.

MAINTAINING KNOWLEDGE OF SCIENTIFIC DEVELOPMENTS AND RELATED LITERATURE

- 97. Ability to recognize the need for additional expertise in certain situations and what can be expected to be gained by their participation.
- 98. Ability to remain current about, and take advantage of, new technologies.

JOB ABILITY STATEMENTS: Competence to Perform Duties Requiring Mental Functioning

IMPORTANCE	EXPECTED AT CERTIFICATION
<p>A This ability is NOT NEEDED to perform the job. B This ability is SLIGHTLY IMPORTANT for performing the job. C This ability is IMPORTANT for performing the job. D This ability is VERY IMPORTANT for performing the job. E This ability is CRITICALLY IMPORTANT for performing the job.</p>	<p>1 Competency in this ability is NOT ESSENTIAL. 2 SOME COMPETENCY in this ability is ESSENTIAL. 3 A HIGH DEGREE OF COMPETENCY in this ability is ESSENTIAL. 4 FULL COMPETENCE in this ability is ESSENTIAL.</p>

TESTIFYING IN LEGAL PROCEEDINGS

- 99. Ability to interpret and present technical results and their significance in lay terms.
- 100. Ability to look professional and maintain a professional demeanor while testifying in legal proceedings.
- 101. Ability to listen to and comprehend statements and questions made during legal proceedings.
- 102. Ability to present effective testimony that is thorough and objective using good communication skills.
- 103. Ability to prepare and use visual displays in legal proceedings.

TRAINING

- 104. Ability to teach others in specific knowledge areas how to perform a specific function (vocational training).

MAINTAINING PROFESSIONAL ETHICAL STANDARDS OF CONDUCT

- 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.

This concludes the AFTE Firearm and Toolmark Examiner Job Analysis Questionnaire.

**Please mail your completed response sheet to CPS no later than February 28,
in the envelope provided.**

Thank you for your assistance in this project.

APPENDIX C

Results of the AFTE Job Analysis Questionnaire

Task Item #	Frequency Rating			Importance Rating		
	N	Mean	s.d.	N	Mean	s.d.
1	199	1.76884422	0.90834191	196	2.464285714	1.19989316
2	199	1.86432161	0.88573625	196	2.602040816	1.18745404
3	199	1.81909548	0.89184701	196	2.505102041	1.20893023
4	199	1.61306533	0.82635267	196	2.352040816	1.22518274
5	199	1.86432161	0.82675184	197	2.725888325	1.15881266
6	199	1.5678392	0.78763862	194	2.149484536	1.17985015
7	199	1.81909548	0.89749212	197	2.827411168	1.23745126
8	199	1.88442211	0.68291454	197	2.725888325	1.02816949
9	199	1.4120603	0.560533	195	1.964102564	0.991585
10	199	4.11557789	1.23979004	198	3.611111111	0.73717652
11	199	3.05527638	1.38241474	199	3.105527638	1.09356224
12	199	4.19095477	1.1693556	199	3.537688442	0.8148475
13	199	4.51256281	0.86374389	199	3.814070352	0.48263064
14	198	3.27777778	1.43509709	197	3.065989848	0.99524926
15	199	4.30150754	0.97418588	198	3.52020202	0.70321666
16	199	4.3919598	0.80222901	197	3.659898477	0.55426545
17	198	4.34343434	0.84495056	198	3.666666667	0.59609559
18	199	2.77386935	0.92338891	198	2.742424242	0.85455969
19	199	1.28140704	0.53296013	197	1.629441624	0.83283766
20	199	3.35175879	1.16640015	199	3.115577889	0.82370716
21	199	2.55276382	0.81400612	198	3.202020202	0.79311502
22	199	2.08542714	0.83347798	197	2.299492386	0.88447479
23	198	3.20707071	1.39707835	196	2.612244898	0.96749906
24	199	3.1959799	1.18781011	199	2.537688442	0.88039057
25	199	4.32160804	0.89729415	198	3.722222222	0.56873813
26	199	4.1758794	0.88433111	199	3.487437186	0.65024701
27	199	4.04522613	0.94439592	198	3.429292929	0.70714304
28	199	3.91457286	1.07672281	198	3.474747475	0.80409402
29	199	4.37688442	0.81876252	199	3.91959799	0.29053736
30	199	4.20100503	0.8931835	199	3.804020101	0.47861745
31	199	2.46231156	0.8917901	199	2.798994975	0.92648952
32	199	2.45728643	0.96762475	199	2.894472362	0.98160845
33	199	2.2361809	0.75176391	199	2.798994975	0.94270136
34	199	2.39698492	0.89791619	199	3.296482412	0.98859031
35	198	2.35858586	0.88856356	197	3.020304569	1.02995636
36	198	2.36363636	0.87206559	199	2.874371859	1.00468422
37	199	2.26130653	0.86576894	199	3.055276382	1.06456222
38	198	2.47474747	0.81662217	196	3.147959184	0.87327613
39	199	1.17085427	0.60382181	194	1.654639175	0.95997848
40	199	1.12562814	0.36138969	194	1.608247423	0.87636438
41	199	1.17085427	0.47242633	193	1.590673575	0.81222179
42	199	2.84422111	1.30300905	198	3.085858586	0.96523426
43	199	2.76884422	1.32071077	198	2.348484848	0.93155224
44	199	1.5678392	1.1165291	193	1.849740933	1.07684553
45	199	4.25125628	0.96252295	197	3.715736041	0.58064539
46	198	4.12121212	1.04490766	196	3.709183673	0.62603133
47	199	4.20100503	1.03952155	196	3.102040816	0.85921605
48	199	4.43718593	0.80077243	199	3.743718593	0.52189267
49	198	4.57575758	0.72084143	198	3.651515152	0.62500577

50	199	4.46733668	0.80884532	198	3.691919192	0.56193588
51	199	4.33165829	0.7853152	197	3.538071066	0.62663853
52	199	4.74371859	0.65106614	199	3.698492462	0.60264379
53	199	2.9798995	1.04909677	199	3.005025126	0.81338231
54	199	3.05527638	1.33407547	198	3.267676768	0.86327535
55	199	3.65829146	0.82500021	198	3.232323232	0.71713308
56	199	2.08040201	0.36731051	199	2.974874372	0.8130078
57	199	2.81407035	0.68209645	199	3.728643216	0.49922533
58	198	2.59090909	0.67539662	197	3.14213198	0.81447462
59	198	2.54040404	1.31600219	195	2.882051282	1.04113137
60	197	4.83248731	0.56906691	198	3.828282828	0.44012929
61	197	4.13705584	1.23159821	195	3.502564103	0.85779842

Knowledge Item #	Expected @ Certification			Importance ratings		
	N	Mean	s.d.	N	Mean	s.d.
1	199	2.17085427	1.20644514	199	1.76884422	0.86271487
2	199	2.28140704	1.04987062	199	1.85427136	0.7679629
3	198	2.83838384	1.22335206	198	2.24747475	0.88091363
4	199	3.18090452	1.17526579	199	2.50753769	0.93132547
5	198	2.76262626	1.12616197	199	2.16080402	0.84940345
6	198	3.34848485	1.31170936	199	2.64321608	1.01421299
7	198	3.61616162	1.09643697	198	2.80808081	0.86882577
8	199	2.92964824	1.33146664	199	2.35175879	0.99842524
9	199	3.35678392	1.16269528	199	2.66331658	0.86585688
10	199	3.50251256	1.08187254	199	2.72864322	0.86849089
11	199	3.11055276	1.29405759	199	2.4321608	0.97139432
12	199	4.1959799	0.94643612	199	3.38190955	0.78165479
13	199	3.34170854	1.12088488	199	2.60301508	0.89227377
14	199	4.37688442	0.79370525	198	3.43434343	0.67833203
15	199	4.2160804	0.83396504	199	3.29648241	0.71600582
16	199	3.84924623	0.91419056	199	2.96984925	0.80346188
17	199	3.82914573	0.94865922	199	2.94974874	0.8087198
18	199	3.72864322	1.0233307	198	2.88383838	0.84998741
19	199	2.84422111	1.11048914	199	2.18592965	0.84721947
20	199	2.79396985	1.18609955	198	2.16666667	0.87113905
21	199	4.42713568	0.79357733	199	3.42713568	0.65402201
22	199	3.32663317	1.11864105	198	2.57575758	0.87944271
23	199	4.09547739	0.96186354	199	3.1758794	0.77474082
24	199	4.10050251	0.89326874	197	3.12690355	0.80757704
25	199	4.46231156	0.7767692	199	3.51256281	0.66559988
26	199	4.47236181	0.80903356	199	3.60301508	0.62618853
27	199	4.44221106	0.7689867	198	3.50505051	0.65877501
28	199	2.63819095	1.16330631	199	2.03015075	0.84033151
29	199	3.94974874	0.95742048	198	3.1010101	0.81850364
30	199	3.03015075	1.091332	199	2.32160804	0.85698875
31	198	3.63636364	1.02213617	198	2.80808081	0.83910476
32	199	2.59798995	1.16740063	199	2.06030151	0.87408359
33	198	4.09090909	0.8619528	199	3.24120603	0.71216738
34	199	1.91457286	1.06255776	198	1.6010101	0.79170765
35	197	2.16751269	1.04849766	198	1.81313131	0.80001859
36	199	1.99497487	1.03229414	198	1.65151515	0.79642139
37	199	2.53768844	1.18804512	199	2.04020101	0.88670993
38	199	2.71859296	0.98021129	199	2.18090452	0.76372108
39	199	3.18090452	1.00876822	199	2.56281407	0.78162232
40	199	2.65326633	1.05187513	199	2.11055276	0.8151589
41	199	3.03015075	0.98426791	198	2.37373737	0.73472062
42	199	3.49748744	0.92591408	199	2.7638191	0.72439281
43	199	2.70854271	1.1306016	199	2.12562814	0.86415515
44	199	3.26633166	1.01723636	198	2.52020202	0.82295491
45	199	2.16080402	0.97663169	198	1.76767677	0.76507898
46	199	2.84924623	1.15355705	198	2.27777778	0.90042918
47	199	2.40703518	1.10561046	198	1.97979798	0.83671824
48	199	2.15577889	1.07348873	199	1.74371859	0.7975013
49	199	1.80904523	0.94479894	198	1.55050505	0.77063804

50	197	1.55329949	0.94946375	195	1.35897436	0.70663933
51	198	2.75252525	1.10576188	198	2.24242424	0.88519589
52	199	3.59296482	1.01012588	198	2.8989899	0.77387481
53	199	1.91457286	1.03364545	199	1.62311558	0.77438039
54	199	2.01005025	0.95340935	198	1.65656566	0.73576668
55	199	1.68844221	0.90085094	198	1.45454545	0.73729823
56	199	1.42713568	0.79357733	199	1.27638191	0.58516593
57	199	3.31155779	1.01175769	199	2.60301508	0.85173083
58	199	2.7638191	1.1098719	198	2.15656566	0.8730205
59	199	3.53768844	1.03832455	199	2.70351759	0.86895833
60	199	2.38190955	1.03224497	199	1.86432161	0.78924809
61	199	2.07537688	1.00470948	199	1.69849246	0.77820548
62	199	1.64321608	0.84587037	197	1.43147208	0.64017246
63	199	1.43718593	0.78162232	198	1.29292929	0.6170591
64	198	1.58585859	0.85508454	197	1.36040609	0.66781385
65	199	2.64321608	1.08634393	197	2.24365482	0.89870817
66	199	3.25125628	1.07176147	199	2.50251256	0.86383203
67	199	2.72864322	1.23776177	199	2.14070352	0.94297054
68	199	4.20100503	0.84075423	199	3.33668342	0.71929473
69	199	3.69346734	0.97520137	199	2.96482412	0.81263311
70	199	3.64321608	1.17565443	199	2.95979899	0.94729384
71	199	3.91457286	0.99378813	199	3.15075377	0.80865703
72	197	1.70558376	1.02748916	198	1.43939394	0.72927447
73	199	3.19095477	0.95012949	198	2.44949495	0.7573496
74	199	4.24120603	0.81780104	199	3.24623116	0.75523317
75	199	3.35678392	1.04366376	199	2.53266332	0.86321483
76	199	4.05527638	0.91118737	199	3.18592965	0.73209469
77	199	3.81407035	0.98504115	199	2.97487437	0.78133004
78	199	3.55276382	0.89667168	199	2.72361809	0.75142624
79	199	3.78894472	0.85023965	199	2.92462312	0.72428769
80	199	3.71859296	0.91076948	199	2.81407035	0.75250626
81	199	4.44221106	0.76239067	199	3.47738693	0.64215641
82	199	3.73869347	0.94391207	199	2.89447236	0.76799595
83	199	3.63819095	0.93189757	199	2.77889447	0.80488206
84	198	2.89393939	1.27205962	198	2.25757576	0.91757691
85	199	3.64824121	0.97280414	199	2.77386935	0.8003286
86	199	4.05025126	0.80245044	199	3.06532663	0.71120453
87	199	4.06532663	0.82923463	199	3.10552764	0.73437914
88	199	3.7839196	0.82176376	199	2.85929648	0.7387551
89	199	3.54271357	0.8915624	199	2.71859296	0.75291087
90	199	3.96984925	0.75149378	199	3.03015075	0.6809793
91	199	3.49246231	0.97374289	199	2.61306533	0.8202181
92	199	4.21105528	0.7886047	199	3.25628141	0.6739363
93	199	3.59296482	0.9046182	199	2.76884422	0.72949005
94	199	3.07537688	1.09606585	199	2.33165829	0.8822336
95	199	3.27638191	0.99949228	199	2.49246231	0.81568801
96	199	3.17085427	1.05454992	199	2.42713568	0.81863852
97	199	4.09547739	0.94062608	199	3.1959799	0.7893124
98	199	3.1959799	1.16201841	199	2.46231156	0.863009
99	199	2.98492462	1.18695514	199	2.28643216	0.87811025
100	199	3.01507538	1.17412072	199	2.31155779	0.90643997

101	199	2.7839196	1.11850492	198	2.11616162	0.83795825
102	199	3.27638191	1.08198983	199	2.57286432	0.84295496
103	199	3.16080402	1.12558463	198	2.46969697	0.85293813
104	199	2.71859296	1.03533825	199	2.11557789	0.75324788
105	199	3.62311558	1.06062129	198	2.78787879	0.86409164
106	199	3.51758794	1.15401898	199	2.73869347	0.84211152
107	198	3.86868687	1.12783396	198	2.99494949	0.90400954
108	198	2.16666667	1.18685696	198	1.67676768	0.84695073
109	198	3.91414141	1.12998002	198	3.05555556	0.89666299
110	198	4.08585859	0.9166824	198	3.15656566	0.78094848
111	198	4.12121212	0.91543701	198	3.24242424	0.7347904
112	198	4.16161616	0.93664344	198	3.24747475	0.78330854
113	198	3.19191919	1.22724377	197	2.47208122	0.94517153
114	198	4.06060606	0.96977868	197	3.11167513	0.77440941
115	198	3.68181818	0.96369252	197	2.86294416	0.78017362
116	198	4.08080808	0.96829714	197	3.19796954	0.79948704
117	197	4.17258883	0.90950755	198	3.24747475	0.77680112
118	197	3.79695431	1.3012517	196	3.02040816	0.98688416
119	197	4.23857868	0.88001276	198	3.2979798	0.71039844
120	198	3.40909091	1.21718581	198	2.67171717	0.94428986
121	198	2.55555556	1.18125995	198	1.98989899	0.87253583
122	197	3.15228426	1.27261476	197	2.43654822	0.97010638
123	198	2.39393939	1.0257416	198	1.86868687	0.71455449
124	198	2.26767677	1.0344648	198	1.77777778	0.72034334
125	196	2.25510204	0.99548957	194	1.78865979	0.69912992
126	198	1.7020202	0.80423748	196	1.45918367	0.60201997
127	198	1.78282828	0.82370223	198	1.47474747	0.56718083
128	198	2.31313131	0.9574338	196	1.80102041	0.72054038
129	195	3.78461538	0.89946676	195	3	0.7251022
130	196	4.24489796	0.90651459	198	3.18181818	0.85927175
131	197	3.02538071	1.36065916	196	2.29591837	1.03981442
132	198	3.71717172	1.06194347	196	2.82653061	0.88318201
133	198	3.64646465	1.04530015	198	2.73737374	0.8793844
134	196	3.76530612	1.05539902	196	2.86734694	0.91301423
135	197	4.44162437	0.79724871	197	3.45685279	0.71028612
136	197	2.62436548	1.37061554	197	2.07106599	1.0424781
137	198	2.34848485	1.30783377	197	1.87309645	0.95785531
138	197	4.13705584	0.96176786	197	3.21319797	0.84830469
139	197	4.5177665	0.73257937	198	3.56060606	0.61608197
140	197	4.12690355	0.84463315	198	3.16666667	0.79177241
141	197	3.71573604	1.05482666	196	2.80102041	0.92608854
142	197	3.80203046	0.89579285	198	2.84343434	0.81279884
143	197	3.76142132	0.93073046	196	2.77040816	0.81859281
144	198	4.31313131	3.72710327	197	3.10659898	0.72408077
145	197	3.53807107	0.98188819	198	2.75252525	0.81506668
146	198	3.28787879	1.06773376	196	2.54081633	0.79959435
147	198	3.96464646	0.85719566	198	3.07070707	0.73702
148	198	4.21717172	0.77937114	198	3.28787879	0.70022081
149	198	3.5959596	0.94433058	198	2.75757576	0.8134767
150	196	3.25510204	1.08897717	197	2.42639594	0.89266495
151	196	3.91836735	0.97321534	198	3.03030303	0.83641179

152
153

198 3.97474747 0.89803434
198 4.07575758 0.93944448

198 3.08080808 0.77625638
198 3.15151515 0.80434905

Skill Item #	Expected @ Certification			Importance Rating		
	N	Mean	s.d.	N	Mean	s.d.
1	197	2.78172589	1.34318805	196	2.24489796	1.00828592
2	196	3.98979592	1.15020531	196	3.10204082	0.91696037
3	195	2.31794872	1.16717824	196	1.86734694	0.8669162
4	196	2.6377551	1.35359088	194	2.10824742	0.99409345
5	196	2.23979592	1.24803351	194	1.80927835	0.92725932
6	196	2.48469388	1.27491394	195	1.98461538	0.94420055
7	196	2.67346939	1.23848965	196	2.14285714	0.9170745
8	195	2.76923077	1.28555693	195	2.23076923	0.92673739
9	195	3.10769231	1.19003262	195	2.42051282	0.90108168
10	197	2.89847716	1.20367113	195	2.2974359	0.89312586
11	195	3.98461538	0.98167185	195	3.14358974	0.81853366
12	197	1.86294416	1.07214141	195	1.58974359	0.84089878
13	197	3.80203046	1.03332036	196	2.94897959	0.83968796
14	195	2.28717949	1.10742096	197	1.84771574	0.84946403
15	196	2.91326531	1.23106273	195	2.24615385	0.908677
16	195	3.94871795	1.06849731	195	3.07692308	0.82439029
17	197	2.44670051	1.10815704	196	1.96938776	0.80325085
18	195	1.97435897	1.04751004	195	1.64615385	0.76179595
19	194	2.50515464	1.17507545	195	1.97435897	0.88186715
20	193	3.97409326	0.93226445	191	3.07853403	0.76716151
21	190	2.51578947	1.0476798	191	2.06806283	0.84640162
22	188	3.64893617	0.94453052	190	2.84210526	0.81410566
23	188	3.7393617	0.91402829	187	2.89839572	0.86468814
24	187	3.94117647	1.03786625	191	2.9895288	0.89436557
25	192	3.48958333	0.99732408	191	2.79581152	0.85543664
26	190	3.17368421	1.05727117	194	2.51546392	0.87110676
27	192	2.70833333	1.14787914	192	2.171875	0.85408818
28	191	2.7591623	1.12137478	193	2.21243523	0.82376851
29	179	4.15083799	0.94490762	188	3.07446809	0.9392153
30	172	4.83139535	0.41962435	190	3.44736842	1.03630827
31	178	4.52808989	0.69850345	191	3.32460733	0.94555566
32	188	3.46808511	1.10130819	190	2.66315789	0.96071541
33	186	3.78494624	0.89864116	189	2.85185185	0.80507649
34	188	3.93085106	0.90778294	191	2.9947644	0.83664356
35	189	4.00529101	0.84738242	193	3.05699482	0.78519191
36	183	4.45901639	0.71653402	193	3.27979275	0.89817869
37	188	4.14893617	0.83323282	191	3.19371728	0.80731022
38	191	3.98429319	0.87945222	192	3.08333333	0.84589142
39	189	4.19047619	0.78936703	189	3.19047619	0.78259952
40	183	4.39344262	0.72503176	193	3.30569948	0.8568466
41	191	4.07853403	0.87003324	194	3.1443299	0.78838315
42	190	3.86842105	0.91348083	193	2.97409326	0.79996897
43	195	3.66666667	0.96145651	195	2.84615385	0.8039356
44	194	3.88659794	0.91477553	194	2.9742268	0.80436353
45	191	3.7539267	1.04487359	191	2.94764398	0.84441334
46	194	3.46907216	1.03391813	193	2.70466321	0.90186671
47	194	3.74226804	1.0208028	194	2.89690722	0.86957242
48	193	3.8238342	0.97363784	192	2.91666667	0.86426032
49	194	3.78865979	0.93944932	192	2.89583333	0.83733767

50	195	2.12307692	1.11004354	195	1.75384615	0.86210189
51	181	4.43646409	0.76201246	189	3.23809524	0.95172216
52	189	3.64550265	1.12809545	193	2.79792746	0.96587388
53	194	3.80412371	1.07384521	193	2.9119171	0.89414353

Ability Item #	Expected @ Cetification			N	Importance Rating		
	N	Mean	s.d.		Mean	s.d.	
1	187	4.09090909	1.06117845	193	3.08290155	0.91479043	
2	190	3.75263158	1.10643544	192	2.8125	0.90735794	
3	190	3.44736842	1.30723199	189	2.63492063	0.98879231	
4	192	3.31770833	1.13861262	191	2.5078534	0.91115375	
5	192	3.03125	1.3877031	191	2.36125654	1.00544124	
6	193	3.36787565	1.42682783	191	2.59685864	1.09052888	
7	182	4.51648352	0.79865408	192	3.32291667	0.98144878	
8	183	4.43715847	0.94061975	193	3.29533679	1.01079023	
9	192	3.9375	1.02136855	192	2.94791667	0.890553	
10	192	4.05729167	0.88728597	194	3.02061856	0.81411615	
11	190	4.25789474	0.88599676	194	3.20618557	0.86901939	
12	187	4.18181818	0.82897197	195	3.14358974	0.84334718	
13	191	4.08900524	0.97734041	193	3.06735751	0.90750445	
14	192	3.39583333	1.03831485	193	2.58031088	0.85087327	
15	192	3.65104167	1.01718169	193	2.79792746	0.85731889	
16	192	3.57291667	1.01036297	190	2.72105263	0.86744711	
17	189	3.42857143	1.00075959	192	2.64583333	0.86803825	
18	186	3.79569892	0.90713853	192	2.9375	0.83525085	
19	188	3.34574468	1.30512481	187	2.60962567	0.94043765	
20	189	3.56613757	1.22131617	188	2.82446809	0.945599	
21	185	3.99459459	1.05034827	189	3.06349206	0.86675629	
22	189	3.83068783	0.87087023	190	2.95263158	0.77859487	
23	189	4.14814815	0.96163605	192	3.171875	0.79041418	
24	190	3.70526316	0.99068342	192	2.86458333	0.8137534	
25	191	4.09947644	0.83700578	189	3.20634921	0.68008284	
26	189	4.11640212	0.84248604	192	3.1875	0.72085609	
27	190	4.15263158	0.78536105	189	3.17460317	0.70423527	
28	191	3.42931937	0.92564575	193	2.60621762	0.77079686	
29	190	3.69473684	0.93235418	192	2.85416667	0.74467276	
30	192	4.359375	0.72430911	192	3.34375	0.65247214	
31	192	4.125	0.82816899	193	3.1761658	0.73601674	
32	192	3.265625	1.16998484	192	2.53125	0.92609776	
33	194	3.65463918	1.0073842	193	2.88601036	0.77557851	
34	193	4.11917098	0.77814907	194	3.22164948	0.66546595	
35	194	4.03608247	0.90120076	193	3.11917098	0.73689618	
36	196	3.79081633	0.95655222	194	2.93298969	0.78234689	
37	195	4.46666667	0.72699542	194	3.50515464	0.62127583	
38	195	4.08717949	0.7581786	192	3.15625	0.63622126	
39	194	4.31958763	0.71325557	192	3.35416667	0.60502549	
40	192	4.21354167	0.76659576	192	3.22395833	0.66855236	
41	194	3.75257732	1.01318692	192	2.89583333	0.81194185	
42	193	3.46632124	1.14571459	193	2.69430052	0.87489205	
43	192	3.81770833	0.82061078	193	2.90673575	0.70828888	
44	192	3.93229167	0.81259648	193	3	0.69221866	
45	192	3.31770833	1.1658756	192	2.57291667	0.90657623	
46	193	4.1761658	0.80367114	194	3.22680412	0.67532613	
47	191	4.41361257	0.72665277	192	3.484375	0.59646921	
48	192	4.796875	0.47491044	195	3.76923077	0.50059441	
49	194	4.60309278	0.58671892	193	3.61658031	0.58464262	
50	194	4.49484536	0.72159454	195	3.55897436	0.60099486	

51	194	3.51546392	1.14370004	193	2.8134715	0.91652927
52	193	3.38860104	1.16783035	193	2.75129534	0.92438655
53	194	4.54639175	0.90503048	192	3.60416667	0.70122058
54	192	3.515625	0.92649518	190	2.69473684	0.75695973
55	194	3.34020619	1.05679737	190	2.66315789	0.8114332
56	195	3.65128205	1.04113137	193	2.83937824	0.80370472
57	194	3.95876289	0.90384929	194	3.08762887	0.75326684
58	196	2.78061224	1.3427227	193	2.22279793	1.01913896
59	193	2.50777202	1.19512539	191	2.02617801	0.90282921
60	194	2.72680412	1.23111773	192	2.11458333	0.90801886
61	195	2.71282051	1.21400324	191	2.20942408	0.91082102
62	192	3.59895833	1.10713959	192	2.796875	0.84716381
63	193	3.11398964	1.3218757	192	2.44791667	0.94752134
64	194	3.05154639	1.16397687	193	2.38860104	0.90096858
65	194	3.08247423	1.21023359	192	2.39583333	0.93762725
66	194	3.1185567	1.29621449	192	2.43229167	0.98979027
67	189	3.25925926	1.22972125	190	2.55789474	0.91681285
68	192	3.41145833	1.33124905	190	2.67368421	0.99141399
69	190	3.92631579	1.13381974	191	3.11518325	0.84438071
70	185	3.25945946	1.08734306	183	2.57377049	0.85405979
71	189	4.63492063	0.71388033	191	3.67015707	0.5813772
72	193	4.05181347	0.97222325	192	3.15625	0.79036243
73	191	4.12565445	0.90897366	191	3.23560209	0.76226085
74	192	4.33333333	0.86426032	189	3.37566138	0.72320226
75	191	4.20418848	1.06384766	190	3.32105263	0.80808019
76	194	3.92268041	1.18680179	191	3.11518325	0.8809862
77	195	3.76923077	1.10438532	192	2.94791667	0.86671785
78	194	3.1185567	1.20506959	191	2.47643979	0.94491431
79	192	3.36979167	1.1861875	191	2.63874346	0.90050658
80	194	2.51546392	1.22252946	192	2.02604167	0.90046466
81	194	3.29896907	1.23979731	193	2.52849741	0.93567396
82	191	3.12041885	1.17480204	192	2.42708333	0.88908202
83	193	3.77720207	1.26536327	192	2.94791667	0.95850879
84	193	4.32124352	0.85416535	192	3.40104167	0.70197847
85	194	4.28865979	0.77471389	192	3.36979167	0.65819359
86	193	4.33678756	0.77429003	193	3.40414508	0.64741748
87	193	4.39378238	0.7432773	194	3.44845361	0.61071832
88	194	4.24226804	0.8131478	193	3.34715026	0.65248297
89	192	4.50520833	0.69400873	194	3.56185567	0.60975546
90	195	3.84102564	0.98982398	194	3.03092784	0.80095291
91	194	4.03608247	0.91828693	194	3.18556701	0.75261061
92	194	4.12371134	0.81128992	194	3.25257732	0.70755989
93	195	4.25641026	0.79683487	193	3.35751295	0.70093541
94	192	4.578125	0.65852495	194	3.55670103	0.64332479
95	192	4.546875	0.69243528	194	3.58247423	0.63237529
96	195	4.48717949	0.73469942	191	3.53926702	0.67064579
97	195	4.25128205	0.83322495	191	3.26701571	0.73047281
98	191	4.15183246	0.77662176	193	3.13471503	0.7089363
99	194	4.40206186	0.71490126	192	3.4375	0.62767751
100	195	4.33846154	0.73098415	194	3.39690722	0.66144035
101	193	4.44559585	0.68343021	193	3.4507772	0.65264838
102	193	4.51813472	0.66217181	193	3.52331606	0.61298908
103	193	3.4611399	1.11793744	192	2.72395833	0.8511458

104	194	3.55154639	1.07728438	193	2.67875648	0.92444494
105	192	4.68229167	0.65370387	191	3.72774869	0.57966838
106	193	4.78238342	0.58121686	193	3.79792746	0.51599

APPENDIX D

KSA Factor Analysis Groupings

AFTE Knowledge Factors

Factor 1: Laboratory Equipment

- 20. Knowledge of various photographic techniques and their application for documenting evidence and analytical results, and for preparing courtroom exhibits.
- 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.).
- 40. Knowledge of how and when to use ultrasonic baths and cleaners.
- 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.
- 65. Knowledge of how and when to use chronograph equipment.
- 136. Knowledge of radiation hazards and how to safely use radiation equipment (such as x-ray equipment, lasers, etc.)

Factor 2: Firearms/Ammunition

- 42. Knowledge of how and when to use pulled-bullet/cartridge exemplar files.
- 78. Knowledge of methods of imprinting serial numbers on firearms.
- 79. Knowledge of theory of restorative techniques of serial numbers in firearms.
- 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.).
- 87. Knowledge of cartridge cases: design (i.e., rimfire, centerfire, Boxer/Berdan priming systems); compositions (copper, brass, steel, aluminum).
- 88. Knowledge of manufacturer information: headstamps, color coding.
- 89. Knowledge of the history/development of ammunition components: cartridge naming system; alternate names; interchangeability.
- 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.
- 91. Knowledge of primers: design, color, staking.
- 92. Knowledge of ammunition components.
- 93. Knowledge of ammunition manufacturing methods.
- 94. Knowledge of the types of legal vs. illegal ammunition.

95. Knowledge of the principles of ammunition reloading.
96. Knowledge of the tools, sources, and types of components used in ammunition reloading, and when to use them.

Factor 3: Collection/Preservation of Evidence

3. Knowledge of which tools or instruments are most appropriate for the recovery of evidence.
4. Knowledge of shooting-scene reconstruction techniques.
5. Knowledge of non-firearms/toolmark types of forensic evidence: such as trace evidence (hairs, fibers, paint, etc.), serological evidence, etc.
6. Knowledge of legal requirements for the preservation of evidence.
7. Knowledge of scientific methodologies for the preservation of evidence.
8. Knowledge of activities to perform to ensure the preservation of a crime scene.
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.
11. Knowledge of the effects of biological agents (bacteria, molds, insects, animals, etc.) on various types of evidence and ways to prevent its effects.
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.
31. Knowledge of how to prepare casts and use of casting materials.
83. Knowledge of the types of trace materials that may be present on firearms.

Factor 4: Ballistics

84. Knowledge of methods for determining if and how often a firearm has been fired since it was last cleaned.
98. Knowledge of internal ballistics: ignition, pressure, function of chamber design, chamber and cartridge dimensions, headspace considerations.
99. Knowledge of exterior ballistics: line of sight vs. bullet path; departure path and angle; trajectories (long and short); angle of fall; ballistic tables (flight time, drop, velocity loss with distance, wind drift, etc.); ballistic programs; bullet stability, rotational velocity, yaw, twist rates necessary to stabilize various bullet types.
100. Knowledge of terminal ballistics: penetration, bullet deformation and expansion and its relation to impact velocity and orientation.
101. Knowledge of ballistic wounds: penetration, bullet deformation and expansion; penetration mechanics in tissue and tissue simulants; temporary and permanent cavitation.
102. Knowledge of bullet holes/bullet impact sites and ricochet marks.
103. Knowledge of bullet ejection patterns: (physics and mechanics affecting; surface effects on pattern; and the effect of intermediate objects).
104. Knowledge of ballistic tables, how to use them and their limitations.
105. Knowledge of bullet recovery methods, and the advantages and disadvantages of each.

Factor 5: Safe Work Practices

- 97. Knowledge of proper ammunition selection.
- 130. Knowledge of the potential hazardous properties of biological hazards (such as hepatitis, AIDS, etc.).
- 131. Knowledge of the potential hazardous properties of parasites.
- 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.
- 135. Knowledge of how to safely handle potentially dangerous items, such as defective firearms, ammunition, and explosives for laboratory examination.
- 138. Knowledge of the proper use of safety equipment and materials (such as protective clothing, eye and ear protective devices, and disinfectants).
- 139. Knowledge of safety procedures and the potential hazardous properties regarding test firing various firearms.
- 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.

Factor 6: Distance Determination

- 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.
- 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.
- 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.

Factor 7: Firearms Design and Identification

- 73. Knowledge of the historical development of firearms design.
- 74. Knowledge of machining and finishing processes of tools, guns, barrels, breechfaces, extractors, ejectors, firing pins, and silencers (with emphasis on working surfaces and edges) and their effect on individuality.
- 75. Knowledge of muzzleloading firearms designs, including ignition systems and loading techniques.
- 76. Knowledge of breechloading firearms designs, including falling breechlocks, bolt actions, lever actions, pump actions, break open, semiautomatics (blowback, gas-operated, recoil operated, etc.), revolvers--double and single action.
- 77. Knowledge of firearms ignition systems: flintlock, percussion, rimfire, centerfire, caseless ammunition.
- 80. Knowledge of sources of information regarding identification markings and serial numbering systems in firearms (including locations of serial numbers, part/assembly numbers, proof marks on firearms and the locations of hidden numbers).

81. Knowledge of the proper operation of the different types of firearms encountered in casework.
82. Knowledge of the different materials that may be present in the bore of a firearm.

Factor 8: Documentation of Physical Evidence and Analytical Results

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.
18. Knowledge of how to prepare reports for peer review.
19. Knowledge of how to prepare articles for peer review/publication.
129. Knowledge of correct word usage and pronunciation.

Factor 9: Professional Development

142. Knowledge of which journals, newsletters and professional publications report information applicable to Firearm and Toolmark Examiners.
143. Knowledge of which professional organizations address Firearm and Toolmark Examiners concerns.
144. Knowledge of where to find and how to use various reference collections, tables, and databases (including ballistic tables, Drugfire and IBIS, Firearm Reference Collections, Ammunition Reference Collections, General Rifling Characteristics File for make and model determinations, etc.), and the limitations of such databases and tables.
145. Knowledge of legal requirements (e.g., *Daubert* and *Frye* cases) and the protocols for the presentation of scientific evidence.
146. Knowledge of appropriate legislation and statutory definitions as applied to the expert witness.
147. Knowledge of courtroom procedures regarding the testimony of expert witnesses.
149. Knowledge of the preparation and use of demonstrative evidence (such as displays, etc.).
150. Knowledge of training methods used to teach scientific disciplines.

Factor 10: Toolmark Identification

114. Knowledge of proper use of tools and materials for testmarks.
115. Knowledge of the toolmarks created during the reloading of ammunition.
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.

Factor 11: Firearms-Related Tools

- 39. Knowledge of how and when to use gunsmithing tools.
- 43. Knowledge of how and when to use borescopes.
- 44. Knowledge of how and when to use bore lights.
- 67. Knowledge of how and when to use examination tables.
- 68. Knowledge of how and when to use bullet and cartridge recovery systems (water, snail, cotton waste, etc.).
- 69. Knowledge of how and when to use bullet pullers.
- 70. Knowledge of how and when to use spring trigger pull scales.
- 71. Knowledge of how and when to use trigger pull weights.

Factor 12: Examination of Evidence

- 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.
- 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.

Factor 13: Maintaining Professional Ethical Standards of Conduct

- 148. Knowledge of the proper demeanor for testifying in legal proceedings.
- 151. Knowledge of the ethical standards maintained by the legal and law enforcement professions.
- 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).

Factor 14: Tools/Equipment

- 38. Knowledge of how and when to use various vises, clamps, and restraining devices.
- 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.).
- 58. Knowledge of how and when to use metal and woodworking machinery (such as drill presses, grinders, dremels, lathes, mills, etc.).
- 59. Knowledge of how and when to use fume hoods.
- 66. Knowledge of how and when to use computer systems and work-related computer programs.

AFTE Skills Factors

Factor 1: Collection of Evidence

1. Skill in recovering and removing evidence from the crime scene and related objects.
2. Skill in carefully and properly handling physical evidence without loss, contamination, or changes to the evidence that could result in loss of information.
4. Skill in taking notes to document a crime scene.
7. Skill in the measurement of cartridge case locations relative to a logical reference point, documentation of the substrate and immediate environment considerations to establish ejection characteristics.
8. Skill in the collection and safeguarding of non-firearms/toolmark evidence (such as trace materials).
9. Skill in making representative casts of marks of forensic interest.
10. Skill in properly preparing (mix or melt) the casting medium.
11. Skill in properly packaging and storing evidence.

Factor 2: Serial Number Restoration Techniques

33. Skill in locating the site of an obliterated firearm serial number.
34. Skill in preparing firearms for serial number restorative technique(s).
35. Skill in raising and recording obliterated serial numbers.
41. Skill in safely using appropriate chemicals to restore obliterated serial numbers.
42. Skill in locating any hidden numbers, areas of obliterated serial numbers, assessing the most probable removal method used for the obliteration, and the suitability for restoration.

Factor 3: Firearms

32. Skill in preparing a proper cast to recover the necessary dimensions in the case of chamber or bore castings or to replicate the class and individual characteristics of various firearm surfaces (e.g., bore, breechface, etc.) necessary to complete a comparison.
39. Skill in field testing firearms for full automatic firing.
40. Skill in chambering cartridges in firearms for discharge.
43. Skill in repairing broken or rusted firearms.
44. Skill in disassembling and reassembling firearm mechanisms.
45. Skill in adequately downloading rifle cartridges as necessary to avoid damage to the recovery device, yet yielding satisfactory test fired bullets.
46. Skill in using remote firing devices (such as Zero-One and Ransom Rest).
47. Skill in locating marks on various ammunition components that can be associated with the specific reloading tool that came in contact with the component (cartridge case, primer, bullet).
48. Skill in preparing the appropriate bullet recovery medium, for the type of ammunition represented by the evidence bullet (e.g., wet rolled cotton, water).
49. Skill in modifying expanding bullets in such a way that they will not disintegrate when fired into the recovery device.
51. Skill in identifying various marks on ammunition components as having been produced by a particular part of a firearm.

Factor 4: Firearms-Related Tools

- 23. Skill in the proper and safe use of bullet pullers.
- 25. Skill in using various handheld tools used for the recovery of evidence (including handtools, surgical tools, vises and clamps, probes, etc.).
- 37. Skill in measuring firearm trigger pulls.
- 38. Skill in measuring gun barrel lengths and overall lengths of firearms.

Factor 5: Gunshot Residues

- 13. Skill in correctly measuring test and evidence patterns.
- 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.

Factor 6: Firearms Safety

- 30. Skill in safely handling, loading and firing firearms.
- 31. Skill in safely operating recovery equipment for testfired bullets and cartridge cases.
- 36. Skill in preparing test fired specimens suitable for comparison and identification purposes.

Factor 7: Laboratory Techniques

- 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).
- 21. Skill in magnesium smoking techniques to reduce surface reflectance when using microscopes.
- 24. Skill in disinfecting evidence and surface areas using appropriate materials.
- 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.).
- 29. Skill in preparing suitable test marks.

Factor 8: Laboratory Equipment

- 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.).

AFTE Abilities Factors

Factor 1: Ballistics

42. Ability to recognize and interpret the effects of ammunition/firearms combination on various aspects involved in reconstructing what happened at a shooting scene.
58. Ability to identify potential ballistic issues or considerations on specific cases (e.g., questionable ammunition performance, the shooter's sight picture at the moment of the shot, bullet flight time vs. changes in the position of the victim).
59. Ability to carry out basic external ballistic calculations.
60. Ability to design relevant experiments to evaluate ballistic questions.
61. Ability to make velocity measurements with ballistic chronography.
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).
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.
64. Ability to recognize situations where gunshots might be sequenced.
65. Ability to integrate shooting scene data with the test firing data and establish the probable position(s) of the shooter and exclude other sites.
66. Ability to properly limit the scope of reconstruction to the hypotheses being tested.
67. Ability to recognize bullet impact sites at shooting scenes.
68. Ability to recognize the limitations of a particular shooting scene reconstruction.

Factor 2: Firearms/Ammunition Analysis

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.
32. Ability to examine, either directly or through the use of casts, the interior surface of a gun barrel to determine the method of rifling.
33. Ability to recognize and discriminate common rifling profiles.
34. Ability to distinguish "action" markings from those caused during firing.
37. Ability to recognize which parts of a firearm leave tool marks of forensic interest.
38. Ability to recognize when fired bullets and casings have been fired in a firearm not designed for them.
39. Ability to recognize, compare and identify various ammunition types and components.
40. Ability to recognize manufacturer-induced/placed toolmarks (sub-class characteristics) on ammunition as well as their usefulness and limitations.
46. Ability to recognize: (1) those attributes or characteristics of a particular firearm design which are reflected in the fired projectiles and fired cartridge cases; and (2) non-firearm caused toolmarks on ammunition components.
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.
50. Ability to make comparisons between evidence and reference cartridges and recovered cartridge components.
53. Ability to distinguish between the quality and quantity of matching striae in a true identity and

- that observed in known non-matches.
57. Ability to recognize any manufacturer-induced characteristics.

Factor 3: Examination/Documentation of Evidence

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.
15. Ability to determine when enhancement techniques are needed when examining evidence.
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.
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.

Factor 4: Gunshot Residues

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.

Factor 5: Ammunition Components

41. Ability to identify reloaded ammunition as having been assembled by the same equipment by determining that specific reloading tool(s) came in contact with cartridge components.
43. Ability to recognize reloaded or handloaded ammunition.
44. Ability to compare ammunition components on the basis of design characteristics or features.
45. Ability to compare unfired propellant samples from disassembled cartridges.

51. Ability to identify a specific reloading tool as having resized a cartridge case or as having seated a bullet and/or primer.
52. Ability to identify a cast bullet as having come from a particular bullet mold.
54. Ability to recognize commercially reloaded or handload ammunition components from their markings and characteristics.
55. Ability to identify reloaded ammunition as having been assembled by the same manufacturer and/or containing the same brand of components.
56. Ability to recognize the evidentiary value of reloaded ammunition.

Factor 6: Firearms Design

24. Ability to determine the design of the lockwork (firing system) in firearms.
25. Ability to locate and identify the type (or types) of safety system(s) incorporated in a particular firearm.
26. Ability to determine the design type, method of operation and ignition of a submitted firearm.
27. Ability to recognize when a firearm has been altered from its original design.
28. Ability to determine the metal type in which the identification numbers were located.
29. Ability to select the best restorative method(s)/solutions for raising obliterated serial numbers based on the substrate.
35. Ability to evaluate the operability of each safety system, chambering method, and lockwork, recognize and explain any defects or failures in each of these systems and the consequences of any such defect or failure.
36. Ability to compare firearm mechanisms with standards.

Factor 7: Collection of Evidence

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.
4. Ability to select the appropriate casting materials.
5. Ability to properly record conditions at a shooting scene or crime scene in general.
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.

Factor 8: Matters and Procedures of Evidence Examination

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).
17. Ability to select proper casting material and technique.
18. Ability to operate basic laboratory equipment.
19. Ability to understand and interpret technical data output from laboratory instruments.
20. Ability to make detailed calculations accurately.
21. Ability to recognize discrepancies or inconsistencies in analytical findings and determine their cause and significance.
22. Ability to recognize utility and limitations of reference collection/database programs.
23. Ability to recognize the limitations of tests and interpretations.

Factor 9: Dissemination of Evidence and Analytical Results

- 90. Ability to explain theory, operations, and applications of various laboratory instruments.
- 91. Ability to speak clearly and succinctly in front of groups.
- 92. Ability to listen to and understand information and ideas presented through spoken words and sentences.
- 93. Ability to answer questions clearly and to the point.

Factor 10: Safe Work Practices

- 94. Ability to recognize unsafe conditions.
- 95. Ability to employ safe work practices.
- 96. Ability to render conditions safe.

Factor 11: Testifying in Legal Proceedings

- 99. Ability to interpret and present technical results and their significance in lay terms.
- 100. Ability to look professional and maintain a professional demeanor while testifying in legal proceedings.
- 101. Ability to listen to and comprehend statements and questions made during legal proceedings.
- 102. Ability to present effective testimony that is thorough and objective using good communication skills.

Factor 12: Professional Development

- 16. Ability to operate job-related computer systems and programs.
- 97. Ability to recognize the need for additional expertise in certain situations and what can be expected to be gained by their participation.
- 98. Ability to remain current about, and take advantage of, new technologies.
- 103. Ability to prepare and use visual displays in legal proceedings.
- 104. Ability to teach others in specific knowledge areas how to perform a specific function (vocational training).

Factor 13: Toolmark Identification

- 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.

Factor 14: Preservation of Evidence

- 7. Ability to establish and maintain a proper chain of custody.
- 8. Ability to maintain a complete inventory of evidence from a particular case.

APPENDIX E

Tasks Statements/KSA Linkages

TASK STATEMENT - KNOWLEDGE LINKAGES

Task Statements	1	2	3	4	5	6	7	8	9	10	11	12	13	14
10. Preserves firearm and toolmark evidence using proper evidence handling techniques.	X		X	X	X	X	X	X	X	X	X	X	X	X
11. Preserves non-firearm/toolmark evidence using proper evidence handling techniques.	X		X		X	X	X	X	X	X	X	X	X	X
12. Receives and releases evidence following proper chain of custody procedures.			X					X	X				X	
13. Performs those examinations appropriate for the identification and/or individualization of the evidence items.	X	X		X	X	X	X	X	X	X	X	X	X	X
14. Performs initial screening examinations on physical evidence for the presence/absence of trace or serological evidence, preserving the integrity of this evidence (or any other category of evidence which may be present) for subsequent examiners.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
15. Examines firearm and toolmark evidence to determine which tests would be most pertinent, relative to the elements of a case or investigation.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
16. Examines firearms for general condition, functioning, and safety.		X	X	X	X		X	X	X		X	X	X	X
17. Test fires various types of firearms for functioning and comparison purposes.		X		X	X		X	X	X		X	X	X	X
18. Restores obliterated serial numbers on firearms, tools, etc., using various restoration techniques.	X	X	X		X		X	X	X	X		X	X	X
20. Functionally examines firearms for alterations by testfiring and disassembling when necessary.	X	X		X	X		X	X	X	X	X	X	X	X
21. Prepares known testfired targets and determines the muzzle to target distance of evidence items.		X			X	X	X	X	X		X	X	X	X
22. Determines ejection patterns for firearms for purpose of positioning shooters.	X	X		X	X		X	X	X			X	X	X
23. Maintains and retrieves firearm information from electronic databases.				X			X	X	X			X	X	X
24. Microscopically examines ammunition and components for signs of reloading.	X	X						X		X	X	X	X	
25. Microscopically examines bullets and cartridge cases for marks produced by firearms as well as marks produced by the manufacturer or manufacturing process.	X	X						X	X	X	X	X	X	

TASK STATEMENT - KNOWLEDGE LINKAGES

Task Statements	1	2	3	4	5	6	7	8	9	10	11	12	13	14
26. Uses measurement and microscopy equipment to examine bullets and cartridge cases to determine the caliber and manufacturer.	X	X						X	X	X		X	X	
27. Visually and microscopically examines bullets and cartridge cases to determine the type and manufacturer of the firearm from which they were fired.	X	X					X	X	X	X		X	X	
28. Prepares test marks for comparison using appropriate test materials in the production of testfired cartridge components and toolmarks.		X			X		X	X	X	X	X	X	X	X
29. Uses microscopy equipment to compare questioned bullets and cartridge cases to test fired bullets and cartridge cases to determine if they were fired from the same firearm.	X	X					X	X	X	X		X	X	
30. Uses microscopy equipment to intercompare bullets and other cartridge components to determine if they originated from the same firearm or are of the same manufacturing source.	X	X					X	X	X	X		X	X	
31. Examines holes or wounds by physical and chemical means to determine if they were caused by bullets.	X	X	X	X	X	X	X	X		X		X	X	X
32. Visually and microscopically examines toolmarks to determine their characteristics and the type, size, and configuration of the tool used.	X		X					X	X	X		X	X	
33. Makes casts of toolmarks using various casting mediums.			X					X		X		X	X	
34. Visually and microscopically compares questioned toolmarks with test toolmarks to determine if they were produced by the same tool.	X							X	X	X		X	X	
35. Visually and microscopically examines tools to determine what area of the tool produced the toolmark and whether this area is capable of producing individual (unique) toolmarks due to the lack of influence from sub-class characteristics.	X							X	X	X		X	X	
36. Visually and microscopically examines toolmarks to determine what actions of the tool produced the toolmarks.	X							X	X	X		X	X	
37. Visually and microscopically intercompares toolmarks to determine if they were made by the same tool.	X							X	X	X		X	X	

TASK STATEMENT - KNOWLEDGE LINKAGES

Task Statements	1	2	3	4	5	6	7	8	9	10	11	12	13	14
38. Visually and microscopically examines evidence items for various types of gunshot residue and shot patterns (from shotgun and shot cartridge discharges) when performing distance determinations.	X	X		X		X	X	X	X			X	X	
42. Calibrates laboratory equipment to ensure accurate results.	X							X	X	X	X	X	X	
43. Uses common laboratory equipment (pumps, mixers, ultrasonic baths) to prepare evidence for examination.	X	X	X		X	X		X		X		X	X	X
44. Evaluates firearm and toolmark evidence to develop an opinion regarding class, sub-class, and individual characteristics.	X	X					X	X	X	X		X	X	
46. Evaluates test results to develop an opinion regarding whether or not a questioned item originated from the suspected source.	X	X		X			X	X	X	X		X	X	
47. Evaluates examination requests for appropriateness.		X	X	X	X	X	X	X		X	X	X	X	
48. Writes technical reports concerning examination findings and the significance of such findings.	X	X	X	X	X	X	X	X	X	X	X	X	X	
49. Documents observations and examination results using proper English and scientific notations.	X	X	X	X	X	X	X	X	X	X	X	X	X	
50. Documents firearm and toolmark evidence as appropriate through proper notes, sketches and photographs.	X	X	X	X	X	X	X	X	X	X	X	X	X	
51. Orally communicates with others (such as attorneys, peers, investigators, etc.) regarding case-related information.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
52. Uses safe work practices to eliminate or minimize the potential of injury to him- or herself, coworkers, or others.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
53. Participates in research and training in areas of firearms and toolmarks.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
54. Participates in quality control programs to ensure high standards of test results.	X	X	X	X	X	X	X	X	X	X	X	X	X	X

TASK STATEMENT - KNOWLEDGE LINKAGES

Task Statements	1	2	3	4	5	6	7	8	9	10	11	12	13	14
55. Reads pertinent professional publications to sustain currency of job-related knowledge, skills, and abilities.	X	X	X	X	X	X	X	X	X	X	X	X	X	
56. Attends professional meetings to sustain currency of job-related knowledge, skills, and abilities.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
57. Testifies in legal proceedings regarding examination results and opinions.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
58. Participates in pre-trial conferences regarding pending testimony.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
59. Trains less experienced individuals in: firearm determinations from class characteristics, the examination and comparison of firearms and toolmarks, distance determinations, the examination of firearm discharge residues, etc.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
60. Follows proper professional ethics standards.								X	X			X	X	
61. Encourages others to follow proper professional ethics standards.								X	X			X	X	

TASK STATEMENT - ABILITIES LINKAGES

Task Statements	1	2	3	4	5	6	7	8	9	10	11	12	13	14
10. Preserves firearm and toolmark evidence using proper evidence handling techniques.	X	X	X	X	X	X	X	X		X		X	X	X
11. Preserves non-firearm/toolmark evidence using proper evidence handling techniques.	X	X	X	X		X	X	X		X		X	X	X
12. Receives and releases evidence following proper chain of custody procedures.			X								X			X
13. Performs those examinations appropriate for the identification and/or individualization of the evidence items.	X	X	X	X	X	X	X	X			X	X	X	
14. Performs initial screening examinations on physical evidence for the presence/absence of trace or serological evidence, preserving the integrity of this evidence (or any other category of evidence which may be present) for subsequent examiners.	X	X	X	X	X	X	X	X		X	X	X	X	
15. Examines firearm and toolmark evidence to determine which tests would be most pertinent, relative to the elements of a case or investigation.	X	X	X	X	X	X	X	X		X	X	X	X	
16. Examines firearms for general condition, functioning, and safety.	X	X	X			X	X	X		X		X		
17. Test fires various types of firearms for functioning and comparison purposes.		X	X			X	X	X		X		X		
18. Restores obliterated serial numbers on firearms, tools, etc., using various restoration techniques.			X			X	X	X		X		X	X	
20. Functionally examines firearms for alterations by testfiring and disassembling when necessary.		X	X			X	X	X		X		X	X	
21. Prepares known testfired targets and determines the muzzle to target distance of evidence items.	X		X	X	X		X	X		X		X		
22. Determines ejection patterns for firearms for purpose of positioning shooters.	X		X		X	X	X	X		X		X		
23. Maintains and retrieves firearm information from electronic databases.	X	X	X		X	X		X				X		
24. Microscopically examines ammunition and components for signs of reloading.		X	X		X		X	X				X	X	
25. Microscopically examines bullets and cartridge cases for marks produced by firearms as well as marks produced by the manufacturer or manufacturing process.		X	X		X	X	X	X				X	X	
26. Uses measurement and microscopy equipment to examine bullets and cartridge cases to determine the caliber and manufacturer.		X	X		X		X	X				X	X	

TASK STATEMENT - ABILITIES LINKAGES

Task Statements	1	2	3	4	5	6	7	8	9	10	11	12	13	14
27. Visually and microscopically examines bullets and cartridge cases to determine the type and manufacturer of the firearm from which they were fired.		X	X			X	X	X				X		
28. Prepares test marks for comparison using appropriate test materials in the production of testfired cartridge components and toolmarks.		X	X		X		X	X		X		X	X	
29. Uses microscopy equipment to compare questioned bullets and cartridge cases to test fired bullets and cartridge cases to determine if they were fired from the same firearm.		X	X			X	X	X				X	X	
30. Uses microscopy equipment to intercompare bullets and other cartridge components to determine if they originated from the same firearm or are of the same manufacturing source.		X	X		X	X	X	X				X	X	
31. Examines holes or wounds by physical and chemical means to determine if they were caused by bullets.	X		X	X			X	X		X		X		
32. Visually and microscopically examines toolmarks to determine their characteristics and the type, size, and configuration of the tool used.		X	X		X		X	X				X	X	
33. Makes casts of toolmarks using various casting mediums.			X				X	X		X		X		
34. Visually and microscopically compares questioned toolmarks with test toolmarks to determine if they were produced by the same tool.		X	X		X		X	X				X	X	
35. Visually and microscopically examines tools to determines what area of the tool produced the toolmark and whether this area is capable of producing individual (unique) toolmarks due to the lack of influence from sub-class characteristics.		X	X		X		X	X				X	X	
36. Visually and microscopically examines toolmarks to determine what actions of the tool produced the toolmarks.		X	X		X		X	X				X	X	
37. Visually and microscopically intercompares toolmarks to determine if they were made by the same tool.		X	X		X		X	X				X	X	
38. Visually and microscopically examines evidence items for various types of gunshot residue and shot patterns (from shotgun and shot cartridge discharges) when performing distance determinations.	X		X	X	X		X	X				X		
42. Calibrates laboratory equipment to ensure accurate results.	X		X	X				X		X		X		

TASK STATEMENT - ABILITIES LINKAGES

Task Statements	1	2	3	4	5	6	7	8	9	10	11	12	13	14
43. Uses common laboratory equipment (pumps, mixers, ultrasonic baths) to prepare evidence for examination.			X					X		X		X		
44. Evaluates firearm and toolmark evidence to develop an opinion regarding class, sub-class, and individual characteristics.		X	X		X	X	X	X		X		X	X	
46. Evaluates test results to develop an opinion regarding whether or not a questioned item originated from the suspected source.	X	X	X	X	X	X	X	X				X	X	
47. Evaluates examination requests for appropriateness.	X	X	X	X	X	X	X	X	X	X		X	X	X
48. Writes technical reports concerning examination findings and the significance of such findings.	X	X	X	X	X	X	X	X	X			X	X	X
49. Documents observations and examination results using proper English and scientific notations.	X	X	X	X	X	X	X	X	X			X	X	X
50. Documents firearm and toolmark evidence as appropriate through proper notes, sketches and photographs.	X	X	X	X	X	X	X	X	X			X	X	X
51. Orally communicates with others (such as attorneys, peers, investigators, etc.) regarding case-related information.	X	X	X	X	X	X	X	X	X		X	X	X	X
52. Uses safe work practices to eliminate or minimize the potential of injury to him- or herself, coworkers, or others.	X	X	X	X	X	X	X	X	X	X		X	X	
53. Participates in research and training in areas of firearms and toolmarks.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
54. Participates in quality control programs to ensure high standards of test results.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
55. Reads pertinent professional publications to sustain currency of job-related knowledge, skills, and abilities.			X						X			X		
56. Attends professional meetings to sustain currency of job-related knowledge, skills, and abilities.			X						X			X		
57. Testifies in legal proceedings regarding examination results and opinions.	X	X	X	X	X	X	X	X	X	X	X	X	X	X

TASK STATEMENT - ABILITIES LINKAGES

Task Statements	1	2	3	4	5	6	7	8	9	10	11	12	13	14
58. Participates in pre-trial conferences regarding pending testimony.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
59. Trains less experienced individuals in: firearm determinations from class characteristics, the examination and comparison of firearms and toolmarks, distance determinations, the examination of firearm discharge residues, etc.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
60. Follows proper professional ethics standards.	X		X					X	X		X	X		
61. Encourages others to follow proper professional ethics standards.	X		X					X	X		X	X		

TASK STATEMENT - SKILLS LINKAGES

Task Statements	1	2	3	4	5	6	7	8
10. Preserves firearm and toolmark evidence using proper evidence handling techniques.	X	X	X	X	X	X	X	X
11. Preserves non-firearm/toolmark evidence using proper evidence handling techniques.	X	X	X	X	X	X	X	X
12. Receives and releases evidence following proper chain of custody procedures.	X							
13. Performs those examinations appropriate for the identification and/or individualization of the evidence items.		X	X	X	X	X	X	X
14. Performs initial screening examinations on physical evidence for the presence/absence of trace or serological evidence, preserving the integrity of this evidence (or any other category of evidence which may be present) for subsequent examiners.	X	X	X	X	X	X	X	X
15. Examines firearm and toolmark evidence to determine which tests would be most pertinent, relative to the elements of a case or investigation.	X	X	X		X	X	X	X
16. Examines firearms for general condition, functioning, and safety.	X		X	X		X	X	
17. Test fires various types of firearms for functioning and comparison purposes.			X	X		X	X	
18. Restores obliterated serial numbers on firearms, tools, etc., using various restoration techniques.		X	X			X	X	X
20. Functionally examines firearms for alterations by testfiring and disassembling when necessary.			X	X		X	X	X
21. Prepares known testfired targets and determines the muzzle to target distance of evidence items.			X		X	X		X
22. Determines ejection patterns for firearms for purpose of positioning shooters.	X		X			X		X
23. Maintains and retrieves firearm information from electronic databases.		X						
24. Microscopically examines ammunition and components for signs of reloading.			X	X			X	X
25. Microscopically examines bullets and cartridge cases for marks produced by firearms as well as marks produced by the manufacturer or manufacturing process.			X	X				X

TASK STATEMENT - SKILLS LINKAGES

Task Statements	1	2	3	4	5	6	7	8
26. Uses measurement and microscopy equipment to examine bullets and cartridge cases to determine the caliber and manufacturer.			X	X			X	X
27. Visually and microscopically examines bullets and cartridge cases to determine the type and manufacturer of the firearm from which they were fired.			X					X
28. Prepares test marks for comparison using appropriate test materials in the production of testfired cartridge components and toolmarks.	X		X			X	X	
29. Uses microscopy equipment to compare questioned bullets and cartridge cases to test fired bullets and cartridge cases to determine if they were fired from the same firearm.			X				X	X
30. Uses microscopy equipment to intercompare bullets and other cartridge components to determine if they originated from the same firearm or are of the same manufacturing source.			X	X				X
31. Examines holes or wounds by physical and chemical means to determine if they were caused by bullets.	X				X		X	X
32. Visually and microscopically examines toolmarks to determine their characteristics and the type, size, and configuration of the tool used.		X	X					X
33. Makes casts of toolmarks using various casting mediums.	X	X	X				X	
34. Visually and microscopically compares questioned toolmarks with test toolmarks to determine if they were produced by the same tool.			X				X	X
35. Visually and microscopically examines tools to determine what area of the tool produced the toolmark and whether this area is capable of producing individual (unique) toolmarks due to the lack of influence from sub-class characteristics.	X		X					X
36. Visually and microscopically examines toolmarks to determine what actions of the tool produced the toolmarks.			X				X	X
37. Visually and microscopically intercompares toolmarks to determine if they were made by the same tool.			X				X	X
38. Visually and microscopically examines evidence items for various types of gunshot residue and shot patterns (from shotgun and shot cartridge discharges) when performing distance determinations.					X			X

TASK STATEMENT - SKILLS LINKAGES

Task Statements	1	2	3	4	5	6	7	8
42. Calibrates laboratory equipment to ensure accurate results.							X	X
43. Uses common laboratory equipment (pumps, mixers, ultrasonic baths) to prepare evidence for examination.	X	X	X				X	
44. Evaluates firearm and toolmark evidence to develop an opinion regarding class, sub-class, and individual characteristics.			X			X		X
46. Evaluates test results to develop an opinion regarding whether or not a questioned item originated from the suspected source.			X				X	X
47. Evaluates examination requests for appropriateness.	X	X	X		X			
48. Writes technical reports concerning examination findings and the significance of such findings.	X	X	X	X	X	X	X	X
49. Documents observations and examination results using proper English and scientific notations.	X	X	X	X	X	X	X	X
50. Documents firearm and toolmark evidence as appropriate through proper notes, sketches and photographs.	X	X	X	X	X	X	X	X
51. Orally communicates with others (such as attorneys, peers, investigators, etc.) regarding case-related information.	X	X	X	X	X	X	X	X
52. Uses safe work practices to eliminate or minimize the potential of injury to him- or herself, coworkers, or others.	X	X	X	X	X	X	X	X
53. Participates in research and training in areas of firearms and toolmarks.	X	X	X	X	X	X	X	X
54. Participates in quality control programs to ensure high standards of test results.	X	X	X	X	X	X	X	X
55. Reads pertinent professional publications to sustain currency of job-related knowledge, skills, and abilities.								
56. Attends professional meetings to sustain currency of job-related knowledge, skills, and abilities.								
57. Testifies in legal proceedings regarding examination results and opinions.	X	X	X	X	X	X	X	X

TASK STATEMENT - SKILLS LINKAGES

Task Statements	1	2	3	4	5	6	7	8
58. Participates in pre-trial conferences regarding pending testimony.	X	X	X	X	X	X	X	X
59. Trains less experienced individuals in: firearm determinations from class characteristics, the examination and comparison of firearms and toolmarks, distance determinations, the examination of firearm discharge residues, etc.	X	X	X	X	X	X	X	X
60. Follows proper professional ethics standards.								
61. Encourages others to follow proper professional ethics standards.								

APENDIX F

KSAs Linked to the AFTE Written Examination

KSAs Linked to the Firearms Written Examination by the AFTE Certification Committee

Knowledge Factor 1:

20. Knowledge of various photographic techniques and their application for documenting evidence and analytical results, and for preparing courtroom exhibits.
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.).
40. Knowledge of how and when to use ultrasonic baths and cleaners.
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.
65. Knowledge of how and when to use chronograph equipment.
136. Knowledge of radiation hazards and how to safely use radiation equipment (such as x-ray equipment, lasers, etc.)

Knowledge Factor 2:

73. Knowledge of the historical development of firearms design.
78. Knowledge of methods of imprinting serial numbers on firearms.
79. Knowledge of theory of restorative techniques of serial numbers in firearms.
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.).
87. Knowledge of cartridge cases: design (i.e., rimfire, centerfire, Boxer/Berdan priming systems); compositions (copper, brass, steel, aluminum).
88. Knowledge of manufacturer information: headstamps, color coding.
89. Knowledge of the history/development of ammunition components: cartridge naming system; alternate names; interchangeability.
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.
91. Knowledge of primers: design, color, staking.
92. Knowledge of ammunition components.
93. Knowledge of ammunition manufacturing methods.
94. Knowledge of the types of legal vs. illegal ammunition.

KSAs Linked to the Firearms Written Examination (Cont.)

- 95. Knowledge of the principles of ammunition reloading.
- 96. Knowledge of the tools, sources, and types of components used in ammunition reloading, and when to use them.

Knowledge Factor 3:

- 3. Knowledge of which tools or instruments are most appropriate for the recovery of evidence.
- 4. Knowledge of shooting-scene reconstruction techniques.
- 5. Knowledge of non-firearms/toolmark types of forensic evidence: such as trace evidence (hairs, fibers, paint, etc.), serological evidence, etc.
- 6. Knowledge of legal requirements for the preservation of evidence.
- 7. Knowledge of scientific methodologies for the preservation of evidence.
- 8. Knowledge of activities to perform to ensure the preservation of a crime scene.
- 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.
- 11. Knowledge of the effects of biological agents (bacteria, molds, insects, animals, etc.) on various types of evidence and ways to prevent its effects.
- 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.
- 31. Knowledge of how to prepare casts and use of casting materials.
- 83. Knowledge of the types of trace materials that may be present on firearms.

Knowledge Factor 4:

- 84. Knowledge of methods for determining if and how often a firearm has been fired since it was last cleaned.
- 98. Knowledge of internal ballistics: ignition, pressure, function of chamber design, chamber and cartridge dimensions, headspace considerations.
- 99. Knowledge of exterior ballistics: line of sight vs. bullet path; departure path and angle; trajectories (long and short); angle of fall; ballistic tables (flight time, drop, velocity loss with distance, wind drift, etc.); ballistic programs; bullet stability, rotational velocity, yaw, twist rates necessary to stabilize various bullet types.
- 100. Knowledge of terminal ballistics: penetration, bullet deformation and expansion and its relation to impact velocity and orientation.
- 101. Knowledge of ballistic wounds: penetration, bullet deformation and expansion; penetration mechanics in tissue and tissue simulants; temporary and permanent cavitation.
- 102. Knowledge of bullet holes/bullet impact sites and ricochet marks.
- 103. Knowledge of cartridge ejection patterns: (physics and mechanics affecting; surface effects on pattern; and the effect of intermediate objects).
- 104. Knowledge of ballistic tables, how to use them and their limitations.
- 105. Knowledge of bullet recovery methods, and the advantages and disadvantages of each.
- 120. Knowledge of firearms-generated discharge products: how deposited; primer constituents, propellant residues, bullet metal and bullet lubricants.

Knowledge Factor 5:

- 97. Knowledge of proper ammunition selection.
- 130. Knowledge of the potential hazardous properties of biological hazards (such as hepatitis, AIDS, etc.).
- 131. Knowledge of the potential hazardous properties of parasites.

KSAs Linked to the Firearms Written Examination (Cont.)

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.
135. Knowledge of how to safely handle potentially dangerous items, such as defective firearms, ammunition, and explosives for laboratory examination.
138. Knowledge of the proper use of safety equipment and materials (such as protective clothing, eye and ear protective devices, and disinfectants).
139. Knowledge of safety procedures and the potential hazardous properties regarding test firing various firearms.
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.

Knowledge Factor 6:

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.
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.
113. Knowledge of bullet hole characterization for caliber size determination (within limitations) when performing distance determination.

Knowledge Factor 7:

42. Knowledge of how and when to use pulled-bullet/cartridge exemplar files.
44. Knowledge of how and when to use bore lights.
74. Knowledge of machining and finishing processes of tools, guns, barrels, breechfaces, extractors, ejectors, firing pins, and silencers (with emphasis on working surfaces and edges) and their effect on individuality.
75. Knowledge of muzzleloading firearms designs, including ignition systems and loading techniques.
76. Knowledge of breechloading firearms designs, including falling breechlocks, bolt actions, lever actions, pump actions, break open, semiautomatics (blowback, gas-operated, recoil operated, etc.), revolvers--double and single action.
77. Knowledge of firearms ignition systems: flintlock, percussion, rimfire, centerfire, caseless ammunition.
80. Knowledge of sources of information regarding identification markings and serial numbering systems in firearms (including locations of serial numbers, part/assembly numbers, proof marks on firearms and the locations of hidden numbers).
81. Knowledge of the proper operation of the different types of firearms encountered in casework.
82. Knowledge of the different materials that may be present in the bore of a firearm.

KSAs Linked to the Firearms Written Examination (Cont.)

Knowledge Factor 8:

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.
18. Knowledge of how to prepare reports for peer review.
19. Knowledge of how to prepare articles for peer review/publication.
129. Knowledge of correct word usage and pronunciation.

Knowledge Factor 9:

142. Knowledge of which journals, newsletters and professional publications report information applicable to Firearm and Toolmark Examiners.
143. Knowledge of which professional organizations address Firearm and Toolmark Examiners concerns.
144. Knowledge of where to find and how to use various reference collections, tables, and databases (including ballistic tables, Drugfire and IBIS, Firearm Reference Collections, Ammunition Reference Collections, General Rifling Characteristics File for make and model determinations, etc.), and the limitations of such databases and tables.
145. Knowledge of legal requirements (e.g., *Daubert* and *Frye* cases) and the protocols for the presentation of scientific evidence.
146. Knowledge of appropriate legislation and statutory definitions as applied to the expert witness.
147. Knowledge of courtroom procedures regarding the testimony of expert witnesses.
149. Knowledge of the preparation and use of demonstrative evidence (such as displays, etc.).
150. Knowledge of training methods used to teach scientific disciplines.

Knowledge Factor 10:

114. Knowledge of proper use of tools and materials for testmarks.
115. Knowledge of the toolmarks created during the reloading of ammunition.
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.

Knowledge Factor 11:

43. Knowledge of how and when to use borescopes.
67. Knowledge of how and when to use examination tables.
68. Knowledge of how and when to use bullet and cartridge recovery systems (water, snail, cotton waste, etc.).
69. Knowledge of how and when to use bullet pullers.
70. Knowledge of how and when to use spring trigger pull scales.
71. Knowledge of how and when to use trigger pull weights.

KSAs Linked to the Firearms Written Examination (Cont.)

Knowledge Factor 12:

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.
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.

Knowledge Factor 13:

148. Knowledge of the proper demeanor for testifying in legal proceedings.
151. Knowledge of the ethical standards maintained by the legal and law enforcement professions.
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).

Knowledge Factor 14:

38. Knowledge of how and when to use various vises, clamps, and restraining devices.
39. Knowledge of how and when to use gunsmithing tools.
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.).
58. Knowledge of how and when to use metal and woodworking machinery (such as drill presses, grinders, dremels, lathes, mills, etc.).
59. Knowledge of how and when to use fume hoods.
66. Knowledge of how and when to use computer systems and work-related computer programs.

Ability Factor 1:

42. Ability to recognize and interpret the effects of ammunition/firearms combination on various aspects involved in reconstructing what happened at a shooting scene.
58. Ability to identify potential ballistic issues or considerations on specific cases (e.g., questionable ammunition performance, the shooter's sight picture at the moment of the shot, bullet flight time vs. changes in the position of the victim).
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).
64. Ability to recognize situations where gunshots might be sequenced.
66. Ability to properly limit the scope of reconstruction to the hypotheses being tested.
68. Ability to recognize the limitations of a particular shooting scene reconstruction.

KSAs Linked to the Firearms Written Examination (Cont.)

Ability Factor 2:

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.
37. Ability to recognize which parts of a firearm leave tool marks of forensic interest.
38. Ability to recognize when fired bullets and casings have been fired in a firearm not designed for them.
39. Ability to recognize, compare and identify various ammunition types and components.
40. Ability to recognize manufacturer-induced/placed toolmarks (sub-class characteristics) on ammunition as well as their usefulness and limitations.
46. Ability to recognize: (1) those attributes or characteristics of a particular firearm design which are reflected in the fired projectiles and fired cartridge cases; and (2) non-firearm caused toolmarks on ammunition components.
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.
50. Ability to make comparisons between evidence and reference cartridges and recovered cartridge components.
53. Ability to distinguish between the quality and quantity of matching striae in a true identity and that observed in known non-matches.
57. Ability to recognize any manufacturer-induced characteristics.

Ability Factor 3:

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.
15. Ability to determine when enhancement techniques are needed when examining evidence.
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.
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.

KSAs Linked to the Firearms Written Examination (Cont.)

Ability Factor 4:

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.
82. Ability to recognize the various physical and chemical forms of propellants, their purpose in various cartridges and their value as physical evidence.

Ability Factor 5:

41. Ability to identify reloaded ammunition as having been assembled by the same equipment by determining that specific reloading tool(s) came in contact with cartridge components.
43. Ability to recognize reloaded or handloaded ammunition.
44. Ability to compare ammunition components on the basis of design characteristics or features.
54. Ability to recognize commercially reloaded or handload ammunition components from their markings and characteristics.
55. Ability to identify reloaded ammunition as having been assembled by the same manufacturer and/or containing the same brand of components.
56. Ability to recognize the evidentiary value of reloaded ammunition.

Ability Factor 6:

24. Ability to determine the design of the lockwork (firing system) in firearms.
25. Ability to locate and identify the type (or types) of safety system(s) incorporated in a particular firearm.
26. Ability to determine the design type, method of operation and ignition of a submitted firearm.
27. Ability to recognize when a firearm has been altered from its original design.
28. Ability to determine the metal type in which the identification numbers were located.
29. Ability to select the best restorative method(s)/solutions for raising obliterated serial numbers based on the substrate.
35. Ability to evaluate the operability of each safety system, chambering method, and lockwork, recognize and explain any defects or failures in each of these systems and the consequences of any such defect or failure.
36. Ability to compare firearm mechanisms with standards.

Ability Factor 7:

1. Ability to recognize the evidence potential of an item.
2. Ability to recognize and safeguard non-firearms evidence, such as trace materials.
4. Ability to select the appropriate casting materials.
5. Ability to properly record conditions at a shooting scene or crime scene in general.
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.

KSAs Linked to the Firearms Written Examination (Cont.)

Ability Factor 8:

- 13. Ability to use scientific methodology, statistics, and logic in solving forensic problems.
- 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.
- 22. Ability to recognize utility and limitations of reference collection/database programs.
- 23. Ability to recognize the limitations of tests and interpretations.

Ability Factor 10:

- 94. Ability to recognize unsafe conditions.
- 95. Ability to employ safe work practices.
- 99. Ability to interpret and present technical results and their significance in lay terms.

Ability Factor 12:

- 97. Ability to recognize the need for additional expertise in certain situations and what can be expected to be gained by their participation.
- 98. Ability to remain current about, and take advantage of, new technologies.

Ability Factor 13:

- 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.

Ability Factor 14:

- 7. Ability to establish and maintain a proper chain of custody.
- 8. Ability to maintain a complete inventory of evidence from a particular case.

KSAs Linked to the Gunshot Residue Written Examination by the AFTE Certification Committee

Knowledge Factor 1:

- 20. Knowledge of various photographic techniques and their application for documenting evidence and analytical results, and for preparing courtroom exhibits.
- 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.
- 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.).
- 40. Knowledge of how and when to use ultrasonic baths and cleaners.
- 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.
- 65. Knowledge of how and when to use chronograph equipment.
- 136. Knowledge of radiation hazards and how to safely use radiation equipment (such as x-ray equipment, lasers, etc.)

Knowledge Factor 2:

- 73. Knowledge of the historical development of firearms design.
- 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.).
- 87. Knowledge of cartridge cases: design (i.e., rimfire, centerfire, Boxer/Berdan priming systems); compositions (copper, brass, steel, aluminum).
- 88. Knowledge of manufacturer information: headstamps, color coding.
- 89. Knowledge of the history/development of ammunition components: cartridge naming system; alternate names; interchangeability.
- 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.
- 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.

KSAs Linked to the Gunshot Residue Written Examination (Cont.)

Knowledge Factor 3:

3. Knowledge of which tools or instruments are most appropriate for the recovery of evidence.
4. Knowledge of shooting-scene reconstruction techniques.
5. Knowledge of non-firearms/toolmark types of forensic evidence: such as trace evidence (hairs, fibers, paint, etc.), serological evidence, etc.
6. Knowledge of legal requirements for the preservation of evidence.
7. Knowledge of scientific methodologies for the preservation of evidence.
8. Knowledge of activities to perform to ensure the preservation of a crime scene.
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.
11. Knowledge of the effects of biological agents (bacteria, molds, insects, animals, etc.) on various types of evidence and ways to prevent its effects.
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.
83. Knowledge of the types of trace materials that may be present on firearms.

Knowledge Factor 4:

84. Knowledge of methods for determining if and how often a firearm has been fired since it was last cleaned.
102. Knowledge of bullet holes/bullet impact sites and ricochet marks.
105. Knowledge of bullet recovery methods, and the advantages and disadvantages of each.
120. Knowledge of firearms-generated discharge products: how deposited; primer constituents, propellant residues, bullet metal and bullet lubricants.

Knowledge Factor 5:

97. Knowledge of proper ammunition selection.
130. Knowledge of the potential hazardous properties of biological hazards (such as hepatitis, AIDS, etc.).
131. Knowledge of the potential hazardous properties of parasites.
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.
135. Knowledge of how to safely handle potentially dangerous items, such as defective firearms, ammunition, and explosives for laboratory examination.
138. Knowledge of the proper use of safety equipment and materials (such as protective clothing, eye and ear protective devices, and disinfectants).
139. Knowledge of safety procedures and the potential hazardous properties regarding test firing various firearms.
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.

KSAs Linked to the Gunshot Residue Written Examination (Cont.)

Knowledge Factor 6:

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.
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.
113. Knowledge of bullet hole characterization for caliber size determination (within limitations) when performing distance determination.

Knowledge Factor 7:

42. Knowledge of how and when to use pulled-bullet/cartridge exemplar files.
44. Knowledge of how and when to use bore lights.
75. Knowledge of muzzleloading firearms designs, including ignition systems and loading techniques.
76. Knowledge of breechloading firearms designs, including falling breechlocks, bolt actions, lever actions, pump actions, break open, semiautomatics (blowback, gas-operated, recoil operated, etc.), revolvers--double and single action.
77. Knowledge of firearms ignition systems: flintlock, percussion, rimfire, centerfire, caseless ammunition.
81. Knowledge of the proper operation of the different types of firearms encountered in casework.
82. Knowledge of the different materials that may be present in the bore of a firearm.

Knowledge Factor 8:

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.
18. Knowledge of how to prepare reports for peer review.
19. Knowledge of how to prepare articles for peer review/publication.
129. Knowledge of correct word usage and pronunciation.

Knowledge Factor 9:

142. Knowledge of which journals, newsletters and professional publications report information applicable to Firearm and Toolmark Examiners.
143. Knowledge of which professional organizations address Firearm and Toolmark Examiners concerns.
144. Knowledge of where to find and how to use various reference collections, tables, and databases (including ballistic tables, Drugfire and IBIS, Firearm Reference Collections, Ammunition Reference Collections, General Rifling Characteristics File for make and model determinations, etc.), and the limitations of such databases and tables.

KSAs Linked to the Gunshot Residue Written Examination (Cont.)

- 145. Knowledge of legal requirements (e.g., *Daubert* and *Frye* cases) and the protocols for the presentation of scientific evidence.
- 146. Knowledge of appropriate legislation and statutory definitions as applied to the expert witness.
- 147. Knowledge of courtroom procedures regarding the testimony of expert witnesses.
- 149. Knowledge of the preparation and use of demonstrative evidence (such as displays, etc.).
- 150. Knowledge of training methods used to teach scientific disciplines.

Knowledge Factor 11:

- 43. Knowledge of how and when to use borescopes.
- 67. Knowledge of how and when to use examination tables.
- 68. Knowledge of how and when to use bullet and cartridge recovery systems (water, snail, cotton waste, etc.).
- 69. Knowledge of how and when to use bullet pullers.

Knowledge Factor 12:

- 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.
- 25. Knowledge of sequential priorities for conducting scientific tests so as not to destroy evidence or contaminate test results.

Knowledge Factor 13:

- 148. Knowledge of the proper demeanor for testifying in legal proceedings.
- 151. Knowledge of the ethical standards maintained by the legal and law enforcement professions.
- 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).

Knowledge Factor 14:

- 38. Knowledge of how and when to use various vises, clamps, and restraining devices.
- 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.
- 66. Knowledge of how and when to use computer systems and work-related computer programs.
- 42. Ability to recognize and interpret the effects of ammunition/firearms combination on various aspects involved in reconstructing what happened at a shooting scene.

KSAs Linked to the Gunshot Residue Written Examination (Cont.)

Ability Factor 1:

58. Ability to identify potential ballistic issues or considerations on specific cases (e.g., questionable ammunition performance, the shooter's sight picture at the moment of the shot, bullet flight time vs. changes in the position of the victim).
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).
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.
64. Ability to recognize situations where gunshots might be sequenced.
66. Ability to properly limit the scope of reconstruction to the hypotheses being tested.
67. Ability to recognize bullet impact sites at shooting scenes.
68. Ability to recognize the limitations of a particular shooting scene reconstruction.

Ability Factor 2:

39. Ability to recognize, compare and identify various ammunition types and components.

Ability Factor 3:

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.
15. Ability to determine when enhancement techniques are needed when examining evidence.
86. Ability to maintain clear and comprehensive case notes.
87. Ability to read and understand information and ideas presented in writing.
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.

Ability Factor 4:

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.

KSAs Linked to the Gunshot Residue Written Examination (Cont.)

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.

Ability Factor 5:

43. Ability to recognize reloaded or handloaded ammunition.
45. Ability to compare unfired propellant samples from disassembled cartridges.

Ability Factor 7:

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.
5. Ability to properly record conditions at a shooting scene or crime scene in general.
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.

Ability Factor 8:

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).
18. Ability to operate basic laboratory equipment.
19. Ability to understand and interpret technical data output from laboratory instruments
20. Ability to make detailed calculations accurately.
21. Ability to recognize discrepancies or inconsistencies in analytical findings and determine their cause and significance.
22. Ability to recognize utility and limitations of reference collection/database programs.
- I.** Ability to recognize the limitations of tests and interpretations.

Ability Factor 10:

94. Ability to recognize unsafe conditions.
95. Ability to employ safe work practices.

Ability Factor 12:

97. Ability to recognize the need for additional expertise in certain situations and what can be expected to be gained by their participation.
98. Ability to remain current about, and take advantage of, new technologies.

Ability Factor 14:

7. Ability to establish and maintain a proper chain of custody.
8. Ability to maintain a complete inventory of evidence from a particular case.

KSAs Linked to the Toolmark Written Examination by the AFTE Certification Committee

Knowledge Factor 1:

20. Knowledge of various photographic techniques and their application for documenting evidence and analytical results, and for preparing courtroom exhibits.
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.).
40. Knowledge of how and when to use ultrasonic baths and cleaners.
41. Knowledge of how and when to use various cleaning solutions.
51. Knowledge of how and when to use magnifying glasses of various powers.

Knowledge Factor 2:

78. Knowledge of methods of imprinting serial numbers on firearms.
79. Knowledge of theory of restorative techniques of serial numbers in firearms.
96. Knowledge of the tools, sources, and types of components used in ammunition reloading, and when to use them.

Knowledge Factor 3:

3. Knowledge of which tools or instruments are most appropriate for the recovery of evidence.
5. Knowledge of non-firearms/toolmark types of forensic evidence: such as trace evidence (hairs, fibers, paint, etc.), serological evidence, etc.
6. Knowledge of legal requirements for the preservation of evidence.
7. Knowledge of scientific methodologies for the preservation of evidence.
8. Knowledge of activities to perform to ensure the preservation of a crime scene.
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.
11. Knowledge of the effects of biological agents (bacteria, molds, insects, animals, etc.) on various types of evidence and ways to prevent its effects.
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.
31. Knowledge of how to prepare casts and use of casting materials.

Knowledge Factor 4:

102. Knowledge of bullet holes/bullet impact sites and ricochet marks.

KSAs Linked to the Toolmark Written Examination (Cont.)

Knowledge Factor 5:

130. Knowledge of the potential hazardous properties of biological hazards (such as hepatitis, AIDS, etc.).
131. Knowledge of the potential hazardous properties of parasites.
132. Knowledge of the potential hazardous properties of toxic and reactive chemicals.
134. Knowledge of the proper methods for the handling and disposing of hazardous materials.
135. Knowledge of how to safely handle potentially dangerous items, such as defective firearms, ammunition, and explosives for laboratory examination.
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.

Knowledge Factor 7:

74. Knowledge of machining and finishing processes of tools, guns, barrels, breechfaces, extractors, ejectors, firing pins, and silencers (with emphasis on working surfaces and edges) and their effect on individuality.
80. Knowledge of sources of information regarding identification markings and serial numbering systems in firearms (including locations of serial numbers, part/assembly numbers, proof marks on firearms and the locations of hidden numbers).

Knowledge Factor 8:

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.
18. Knowledge of how to prepare reports for peer review.
19. Knowledge of how to prepare articles for peer review/publication.
129. Knowledge of correct word usage and pronunciation.

Knowledge Factor 9:

142. Knowledge of which journals, newsletters and professional publications report information applicable to Firearm and Toolmark Examiners.
143. Knowledge of which professional organizations address Firearm and Toolmark Examiners concerns.
144. Knowledge of where to find and how to use various reference collections, tables, and databases (including ballistic tables, Drugfire and IBIS, Firearm Reference Collections, Ammunition Reference Collections, General Rifling Characteristics File for make and model determinations, etc.), and the limitations of such databases and tables.
145. Knowledge of legal requirements (e.g., *Daubert* and *Frye* cases) and the protocols for the presentation of scientific evidence.
146. Knowledge of appropriate legislation and statutory definitions as applied to the expert witness.
147. Knowledge of courtroom procedures regarding the testimony of expert witnesses.
149. Knowledge of the preparation and use of demonstrative evidence (such as displays, etc.).
150. Knowledge of training methods used to teach scientific disciplines.

KSAs Linked to the Toolmark Written Examination (Cont.)

Knowledge Factor 10:

114. Knowledge of proper use of tools and materials for testmarks.
115. Knowledge of the toolmarks created during the reloading of ammunition.
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.

Knowledge Factor 11:

67. Knowledge of how and when to use examination tables.
69. Knowledge of how and when to use bullet pullers.

Knowledge Factor 12:

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.
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.

Knowledge Factor 13:

148. Knowledge of the proper demeanor for testifying in legal proceedings.
151. Knowledge of the ethical standards maintained by the legal and law enforcement professions.
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).

Knowledge Factor 14:

38. Knowledge of how and when to use various vises, clamps, and restraining devices.
39. Knowledge of how and when to use gunsmithing tools.
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.).
58. Knowledge of how and when to use metal and woodworking machinery (such as drill presses, grinders, dremels, lathes, mills, etc.).
59. Knowledge of how and when to use fume hoods.
66. Knowledge of how and when to use computer systems and work-related computer programs.

KSAs Linked to the Toolmark Written Examination (Cont.)

Ability Factor 2:

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.
37. Ability to recognize which parts of a firearm leave tool marks of forensic interest.
40. Ability to recognize manufacturer-induced/placed toolmarks (sub-class characteristics) on ammunition as well as their usefulness and limitations.
46. Ability to recognize: (1) those attributes or characteristics of a particular firearm design which are reflected in the fired projectiles and fired cartridge cases; and (2) non-firearm caused toolmarks on ammunition components.
57. Ability to recognize any manufacturer-induced characteristics.

Ability Factor 3:

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.
15. Ability to determine when enhancement techniques are needed when examining evidence.
88. Ability to read and understand information and ideas presented in writing.
89. Ability to properly document evidence items, examinations, and comparisons.
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.

Ability Factor 6:

27. Ability to recognize when a firearm has been altered from its original design.
28. Ability to determine the metal type in which the identification numbers were located.

Ability Factor 7:

1. Ability to recognize the evidence potential of an item.
2. Ability to recognize and safeguard non-firearms evidence, such as trace materials.
4. Ability to select the appropriate casting materials.
5. Ability to properly record conditions at a shooting scene or crime scene in general.
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.

KSAs Linked to the Toolmark Written Examination (Cont.)

Ability Factor 8:

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).
17. Ability to select proper casting material and technique.
18. Ability to operate basic laboratory equipment.
19. Ability to understand and interpret technical data output from laboratory instruments.
21. Ability to recognize discrepancies or inconsistencies in analytical findings and determine their cause and significance.
22. Ability to recognize utility and limitations of reference collection/database programs.
23. Ability to recognize the limitations of tests and interpretations.

Ability Factor 10:

94. Ability to recognize unsafe conditions.
95. Ability to employ safe work practices.

Ability Factor 12:

97. Ability to recognize the need for additional expertise in certain situations and what can be expected to be gained by their participation.

Ability Factor 13:

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.

Ability Factor 14:

7. Ability to establish and maintain a proper chain of custody.
8. Ability to maintain a complete inventory of evidence from a particular case.

APPENDIX G

Angoff Rating Instructions

**Criterion-Referenced
Cutoff Score
Determination
Subject Matter Expert
Training Outline**



Criterion-Referenced Cutoff Score Determination Subject Matter Expert Training Outline

Introduction

- *The nature of passpoints. The discussion covers what a passpoint is and what it means.*
 - *Arbitrary--70%*
 - *Norm-referenced*
 - *Criterion-referenced*

Angoff Method

- *An overview of the modified Angoff method is discussed.*

Minimally Acceptable and Superior Candidates

- *Raters discuss what it means to be a minimally competent candidate versus a superior candidate. Emphasis is placed on understanding that minimum competence does not mean substandard.*

Development of Behavioral Descriptions of each Competency Level

- *Use Task/Occupational Analysis as a basis.*
- *Reach consensus amongst meeting participants on wording, meaning, and so on.*

Discussion on How to Assign Angoff Ratings

- *Additional instruction is provided to raters on how to assign Angoff ratings for each item.*

Calibration Session

- *To ensure raters are using the same thought processes when making their ratings, the raters are asked to evaluate a subset of test items. Next, raters are asked to report their ratings to the group. If there are significant differences between ratings, the raters are asked to explain how they arrived at their ratings. Consensus is then attained on the ratings. This process is repeated for each calibration item.*

Rater Monitoring

- *Throughout the rating session, raters are periodically asked to report their ratings for particular items to ensure consistency. Raters who appear to be group outliers receive additional individualized training.*

Criterion-Referenced Cutoff Score Determination

Background

In licensure and certification testing it is a common practice to use a criterion-referenced approach to set the passpoint (cutoff score) for an examination. This approach provides a defensible rationale for identifying a cutoff score. The cutoff score is estimated using the Angoff method.

The main rationale behind criterion-referenced cutoff scores is that one must be able to distinguish between candidates who can demonstrate sufficient knowledge to be licensed or certified and those who cannot. The cutoff score creates two classifications of candidates: those who are competent to perform the duties in a safe and effective/definitive manner and those who may not perform at this level.

Defining levels of Competency

In order to distinguish between those who are competent to do the job and those who are not, we must first define levels of competency as they relate to observable work behaviors. There are two levels of competency that must be defined.

Minimal Acceptable Candidate (MAC): a concept that describes what the minimally acceptable candidate should be able to do, or should know, on the very first day on the job. The minimally acceptable candidate should be defined according to observable work behaviors through which a person can demonstrate his/her knowledge, skills, or abilities.

Superior Worker: a concept that describes what the superior, or highly qualified person should be able to do, or should know, on the very first day on the job. The superior worker should be defined according to observable work behaviors through which a person can demonstrate his/her knowledge, skills, or abilities.

The Angoff Method

The Angoff method defines the cutoff score as the lowest score the minimally acceptable candidate is likely to achieve. Candidates scoring below this level are believed to lack sufficient knowledge, skills, or abilities to be certified.

For each test item, subject matter experts are asked to estimate the probability that a minimally competent applicant will get the answer correct. These probabilities are then summed and divided by the number of subject matter experts. The result is the passing standard.

In general, the appropriate passing point will correspond to a judgement of the number of items that can be answered correctly by a minimally acceptable candidate. This judgement is made by subject matter experts who evaluate the test material on an item-by-item basis. The evaluation process is commonly called an Angoff Review, and is named for one of the psychologists who originally developed the technique.

A minimally acceptable candidate is one who meets the standard, though barely. A minimally acceptable candidate has enough of the requisite knowledge and skill to do the job, although their technical background may be limited. A minimally acceptable candidate is borderline, but acceptable.

In performing an Angoff Review, each subject matter expert is asked to assign a number to each test item, based on the percentage of minimally acceptable candidates who might reasonably be expected to answer it correctly. Thus, if all or nearly all minimally acceptable candidates would be able to answer the item correctly, it would be assigned a value of 95-100. However, because even strong candidates come from a variety of backgrounds and are not expected to know everything, many perfectly good items will receive lower numbers. With traditional four-choice items, the lowest number assigned would be 25, which represents the percentage of candidates who might be expected to get the item correct by guessing.

Angoff ratings by subject matter experts are pooled and averaged to yield an overall average for the test. This overall average is the expected total score for a minimally acceptable candidate and becomes the tentative passing point, expressed as a percentage of possible total points. After the test is administered, statistical analysis is performed on both the individual items and the test as a whole, and the final pass point determination is made. Usually, because of limitations of the test and other considerations, the results of the statistical analysis may suggest a passing point slightly below that derived from the Angoff Review.

INSTRUCTIONS FOR RATING TASKS

For each item you are asked to provide data on three separate dimensions. First you are asked to assign an Angoff rating for each item. The instructions are as follows:

For each item, enter a number from 25 to 100 in the "Minimum Acceptable" column which represents your estimate of the percentage of minimally acceptable candidates who you believe would answer the item correctly. Your item rating can also be considered the probability that a minimally acceptable candidate would answer the item correctly. Thus, a rating of 50 would mean that a minimally acceptable candidate would have about a 50-50 chance of choosing the correct answer and a rating of 80 would mean an 80% chance, and so on. Brief notes can be made in the appropriate column, though these are not required. You should definitely make a note, however, if you believe the item is incorrectly keyed or is otherwise seriously defective.

First look at the item without consulting the key. Look closely at the wrong answers as well as the right one. If a minimally acceptable candidate could eliminate one or two alternatives then the probability of the minimally acceptable candidate choosing the right answer is increased. For example, the minimally acceptable candidate who can eliminate two wrong answers gets to select from only two alternatives and hence has at least a 50% chance of picking the right

answer. Obviously, if candidates can easily eliminate all the wrong answers, they will all get the item correct. On the other hand, remember that minimally acceptable candidates are borderline candidates whose knowledge and skills, while acceptable, are limited, and that not even strong candidates are expected to earn perfect scores.

For the second set of ratings, you are asked to determine how appropriate an item is as a measure of the three disciplines (i.e., Firearms, Toolmark, and Gunshot Residue). If an item appears appropriate for the discipline circle “Yes.” If not, please circle “No.” Bear in mind that an item may be relevant for more than one discipline.

Finally, in the “Comments” section note any problems or areas of concern with a particular item. For example, an item may be measuring information that is only tangentially related to the discipline.

Please be sure to put your name on each page.

APPENDIX H

KSAs and Angoff Ratings for the AFTE Written Examination Items

AFTE Firearms Written Examination

		Form A				Form B	
Order	Item #	KSA	Angoff	Order	Item #	KSA	Angoff
1	628	146	76.67	1	629	146	76.25
2	390	90	70	2	314	90, 92	59.17
3	325	73	69.58	3	388	73	75.42
4	683	15	86.25	4	593	15	57.5
5	166	83	75.42	5	166	83	75.42
6	424	26	73.33	6	455	26	50.42
7	262	107, 109	77.92	7	261	21, 107, 109	74.17
8	425	43	62.08	8	418	43	72.92
9	587	81	70.42	9	588	81	77.08
10	288	25	76.25	10	288	25	76.25
11	357	A34	83.33	11	333	A35	61.25
12	340	A30	77.5	12	339	A30	70.42
13	419	A54	67.92	13	420	A54	75.42
14	411	100	51.25	14	414	100	55.83
15	729	97	72.92	15	729	97	72.92
16	401	9	78.75	16	171	7, 13	80
17	97	82	66.67	17	163	82	81.25
18	482	153	69.17	18	483	153	72.5
19	155	86	77.5	19	121	86, 89	76.25
20	496	30	55	20	496	30	55
21	565	74	72.58	21	306	74	57.92
22	359	A64	72.92	22	399	A64	76.67
23	737	95	74.58	23	417	95	55.83
24	580	135	73.75	24	753	135	73.75
25	210	111	79.17	25	210	111	79.17
26	702	90	69.92	26	69	90	91.25
27	673	A1	67.08	27	672	A1	71.67
28	465	26	63.75	28	467	27	55.83
29	99	99	84.17	29	312	99	69.17
30	185	80	71.67	30	185	80	71.67
31	441	37	66.25	31	442	37	78.75
32	562	74	72.92	32	541	74	71.67
33	25	52	67.5	33	365	59	72.08
34	642	106	47.5	34	744	21, 106	70
35	691	37	80.42	35	691	37	80.42
36	603	96	67.5	36	310	96	69.58
37	369	26	84.58	37	370	26	77.08
38	303	75, 76	65	38	531	75	60.42
39	684	145	66.25	39	239	145	70
40	364	43	79.17	40	364	43	79.17
41	245	A7	75	41	291	A7	73.33
42	584	110	67.5	42	582	110	72.5
43	679	82	75.83	43	184	82, 77	71.25
44	187	11	72.08	44	77	11	79.58
45	117	89	73.75	45	117	89	73.75

		Form A				Form B	
Order	Item #	KSA	Angoff	Order	Item #	KSA	Angoff
46	363	31	79.17	46	368	31	75
47	735	A46	74.17	47	707	A46	69.17
48	522	144	65.83	48	524	144	68.33
49	380	91, 90, 93	70.83	49	313	91, 92, 93	69.58
50	165	120	67.08	50	165	120	67.08
51	188	21	73.75	51	477	21	74.58
52	177	85	68.33	52	176	85	74.17
53	94	33, 144	84.17	53	435	33	67.08
54	100	98	77.5	54	709	98	78.75
55	613	76	65.83	55	613	76	65.83
56	597	95	72.5	56	578	95, 89	55.83
57	490	30	67.08	57	491	30	77.5
58	591	112	77.08	58	211	112	80.83
59	134	87, 92	63.75	59	133	87, 92	72.08
60	699	A47, A48	70.83	60	699	A47, A48	70.83
61	400	4	72.5	61	230	4	83.75
62	169	120	64.58	62	170	120	67.08
63	48	135	76.25	63	573	130	76.25
64	572	24	77.82	64	458	24	68.75
65	421	81	70	65	421	81	70
66	592	14	72.08	66	595	14	74.58
67	355	37	76.67	67	356	37	75.42
68	123	86, 88, 92	74.17	68	128	88, 89, 92	73.75
69	614	100, 101	71.67	69	650	102, 100, 62	74.17
70	56	73, A24	64.58	70	56	73, A24	64.58
71	472	A45	66.67	71	476	A45	75.83
72	317	85	70	72	434	85	72.08
73	626	27	71.25	73	156	30	75
74	459	25	70.42	74	461	25	75.83
75	440	A48	54.17	75	440	A48	54.17
76	319	86	76.25	76	392	86	71.67
77	404	31	59.58	77	409	31	68.75
78	576	147	60	78	625	147	74.17
79	21	74	73.75	79	22	74	73.33
80	7	22	55.42	80	7	22	55.42
81	688	33	76.25	81	687	34	73.33
82	697	49	75.42	82	698	46	75
83	640	87	70.42	83	138	87	73.33
84	190	A62	84.17	84	686	A62	71.25
85	140	93	75.42	85	140	93	75.42
86	700	28, 29	68.75	86	701	28, 29	67.92
87	24	132	71.25	87	34	132	78.75
88	315	76	79.17	88	311	76, 98	71.67
89	403	12	70	89	408	12	81.67
90	30	133	69.17	90	30	133	69.17

Form A				Form B			
Order	Item #	KSA	Angoff	Order	Item #	KSA	Angoff
91	191	98	78.75	91	258	98	80.42
92	351	117	73.75	92	353	117	80
93	289	24	73.75	93	290	26	78.33
94	287	120, 122	65.83	94	172	5, 120, 122	75.42
95	206	101	63.75	95	206	101	63.75
96	98	69	75.83	96	324	69	67.5
97	641	85	66.67	97	372	85	68.33
98	304	30, 31, 33	76.67	98	16	33	68.33
99	504	A94, A95	78.75	99	503	A94, A95	72.92
100	644	46, 47	47.92	100	644	46, 47	47.92
			7126.19				7129.6

AFTE Gunshot Residue Written Exams

Form A				Form B			
Order	Item #	KSA	Angoff	Order	Item #	KSA	Angoff
1	189		109 77.08	1	201		109 76.25
2	239		145 70	2	241	145, 147	55
3	408		12 81.67	3	403		12 70
4	845		76 74.17	4	622	85, 98, A58	67.5
5	207		107 80	5	207		107 80
6	746		148 62.08	6	917	146, 149	70.42
7	959		110 78.33	7	962		111 57.8
8	593		15 57.5	8	596		A8 72.92
9	350		A62 72.5	9	36		133 79.17
10	180	109, 21	72.92	10	180	109, 21	72.92
11	478		21 72.92	11	477		21 74.58
12	801		120 51.67	12	818		120 67.08
13	635		5 55.42	13	642	5, 106	47.5
14	418		45 72.92	14	434		85 72.08
15	7		22 55.42	15	7		22 55.42
16	205		107 85	16	208		107 76.67
17	517		129 80	17	518		129 80.42
18	839		2, 3 61.25	18	764	111, A69	44.17
19	277	52, 107, A76	63.33	19	279	52, 107, A75	65
20	268		109 74.58	20	268		109 74.58
21	188		21 73.75	21	569		21 73.33
22	171		7, 13 80	22	933		5, 9 74.58
23	655	75, 76, 98	71.67	23	709		12 70.42
24	985		85 68.33	24	372		85 68.33
25	475		81 73.33	25	475		81 73.33
26	263		52, 109 55.83	26	30		133 69.17
27	30		133 69.17	27	35		11 81.67
28	307	62, 67, 101	77.92	28	468		5 74.17
29	745		111 54.17	29	278	52, 107, A75	70.42
30	538		81, 99 74.58	30	538		81, 99 74.58
31	190		A62 84.17	31	195		21 85
32	365		59 72.08	32	301		A95 76.67
33	585		A68 45.42	33	591		112 77.08
34	834		130 77.92	34	937		41 70
35	794		85, 92, 96 64.58	35	794	85, 92, 96	64.58
36	474		81 67.08	36	295		25 79.17
37	800		120 77.92	37	820		120 74.58
38	164		91 77.92	38	654	87, 91, 92	75
39	868		109 68.33	39	869		109 75.42
40	963		107 37.5	40	963		107 37.5
41	582		110 72.5	41	584		110 67.5
42	182		23 77.08	42	186		12, 88 77.92
43	798		89, 91, A80 37.92	43	185		80 71.67
44	854		A62 76.25	44	857		109 77.08
45	25		52 67.5	45	25		52 67.5

Form A				Form B			
Order	Item #	KSA	Angoff	Order	Item #	KSA	Angoff
46	210		111 79.17	46	211		112 80.83
47	482		153 69.17	47	483		153 72.5
48	509	A18,A19	45.83	48	807	107, 110, A78	62.5
49	261	21, 107,109	74.17	49	262	107, 109	77.92
50	172	5, 120, 122	75.72	50	172	5, 120, 122	75.72
51	197		21 84.58	51	198		21 83.33
52	663	110, A75	77.5	52	664	107, A75	74.17
53	805	73, 90, 98	84.17	53	808	73, 90, 99	64.58
54	749		21 67.92	54	952		68 75.42
55	974		111 77.08	55	974		111 77.08
56	28		132 73.33	56	34		132 78.75
57	202		112 77.08	57	165		120 67.08
58	641		85 66.67	58	795	85, 92, 96	65
59	677		106 78.75	59	618	151, 152, 153	74.17
60	287	120, 122	65.83	60	287	120, 122	65.83
61	240		147 82.08	61	242		147 81.25
62	471	A45	71.67	62	476	A45	75.83
63	844		76 73.33	63	846		76 75.83
64	743		110 63.33	64	890	5, A1, A84	74.58
65	545	89, 91, 93	63.75	65	545	89, 91, 93	63.75
66	177		85 68.33	66	178		85 67.92
67	849		21 75	67	804	21, 111	72.08
68	652		99 79.17	68	650	24, 25, 26	74.17
69	181		86 85.42	69	833		113 63.33
70	486		30 81.25	70	486		30 81.25
71	264		109 75.42	71	265		109 48.75
72	904		87 70	72	902		87 62.5
73	187		11 72.08	73	986		69 71.67
74	848		83 71.67	74	959		110 78.33
75	621	112, 120, 122	69.58	75	621	112, 120, 122	69.58
76	592		14 72.08	76	595		14 74.58
77	278	52, 107, A75	70.42	77	783	109, A76	75
78	816	107, 109, A75	64.17	78	911		101 76.25
79	529	21, 25, 76	73.33	79	284	120, 122	66.25
80	882		153 75.83	80	882		153 75.83
81	167		120 79.17	81	168		120 80.83
82	238		146 85.83	82	625		147 74.17
83	184	82, 77	71.25	83	888		85 72.08
84	962		111 57.8	84	631		17 69.17
85	647		90 78.33	85	647		90 78.33
86	33		130 88.33	86	29		130 85.42
87	485		30 60.83	87	472		A45 66.67
88	614	100, 101	71.67	88	813	73, 90, 98	67.5
89	809	109, A79	73.75	89	873		A81 72.92
90	166		83 75.42	90	166		83 75.42
91	196		21 84.17	91	173	109, 132	75.45
92	396		99 73.75	92	280	99, 101, 105	50.83

Form A			
Order	Item #	KSA	Angoff
93	646	19, 117, 118	72.08
94	513	A99, A23	60.83
95	175	92	79.58
96	169	120	64.58
97	918	14,17,18	72.08
98	362	120	77.5
99	814	107, 109, A75	74.17
100	554	90, 92,99	67.92
7/8/99			7125.6

Form B			
Order	Item #	KSA	Angoff
93	828	3, 6	77.92
94	285	109	44.17
95	175	92	79.58
96	170	120	67.08
97	919	14	72.5
98	362	120	77.5
99	815	107, 109, A75	80.83
100	554	90, 92,99	67.92
			7126.05

AFTE Toolmark Written Examination

Form A				Form B			
Order	Item #	KSA	Angoff	Order	Item #	KSA	Angoff
1	235		117 81.25	1	3		117 94.17
2	560		74 73.33	2	562		74 72.92
3	919		14 72.5	3	593		15 57.5
4	761		93 73.33	4	506	A73, A74	70
5	834		130 77.92	5	834		130 77.92
6	636		5 70.83	6	217		5 65
7	294		152 73.75	7	482		153 69.17
8	21		74 73.75	8	22		74 73.33
9	503	A94, A95	72.92	9	504	A94, A95	78.75
10	851		26 70	10	851		26 70
11	351		117 73.75	11	353		117 80
12	829		3 77.08	12	230		4 83.75
13	337	A73	81.67	13	233		116 80
14	992		116 51.11	14	995	119, 31	58.33
15	943		116 67.5	15	943		116 67.5
16	16		33 68.33	16	464		14 77.5
17	219		5 62.92	17	214		5 63.75
18	291	A7	73.33	18	573		130 76.25
19	984	A72	77.92	19	879	A72	74.58
20	239		145 70	20	558	22, A11, A71	66.25
21	561		2 77.5	21	228		5 69.58
22	483		153 72.5	22	618	151, 152, 153	74.17
23	29		130 85.42	23	29		130 85.42
24	770	78, 80, A29	63.75	24	680		80 79.58
25	367		151 71.25	25	954		13 64.17
26	271	116, A71	82.5	26	272	116, A71	82.5
27	276		29 59.58	27	27		28 86.67
28	218		5 56.67	28	695		116 77.5
29	790		116 41.67	29	479		114 64.58
30	810	74, A31	67.5	30	810	74, A31	67.5
31	996	114, 116	88.33	31	999		14 85
32	226	A9	74.58	32	563	22, A9	77.5
33	719		12 70.42	33	9		147 77.08
34	826		78 72.5	34	637		78 60
35	931		114 69.17	35	931		114 69.17
36	788	116, 117, A72	75.42	36	273	5, 116, A71	76.25
37	957		13 62.92	37	955		13 68.33
38	825	111, A28, A29	75.42	38	700	A28, A29	68.75
39	781	118, A73, A74	78.75	39	75		118 89.17
40	867		31 50.42	40	867		31 50.42
41	224	114, 119	80.42	41	231		114 84.58
42	882		153 75.83	42	677		116 78.75
43	958		116 71.67	43	780	119, A71	73.33
44	923		57 52.08	44	452		17 44.17
45	855	73, 74	63.75	45	855	73, 74	63.75

Form A				Form B			
Order	Item #	KSA	Angoff	Order	Item #	KSA	Angoff
46	718		79 75	46	769	78, 80, A29	74.17
47	242		147 81.25	47	240	147	82.08
48	213		5 67.08	48	215	5	66.25
49	802	116, A71	62.08	49	451	119	67.92
50	697		49 75.42	50	697	49	75.42
51	998	119, 22, 38	75.55	51	991	116	75.55
52	11		29 76.67	52	18	29	94.17
53	480		114 80	53	481	114	48.33
54	17	28, 20	79.17	54	685	149	75.83
55	404		31 59.58	55	404	31	59.58
56	778		79 53.33	56	776	79	54.17
57	291		A7 73.33	57	245	7	75
58	74		116 85.83	58	220	5	61.67
59	626		27 71.25	59	709	12	70.42
60	856		A72 60.42	60	856	A72	60.42
61	865	24, A33	70	61	748	74	75.83
62	787	116, 117, A72	78.33	62	2	74	81.25
63	988		117 79.44	63	989	117	80
64	7		22 55.42	64	37	5, 6, 7	85
65	684		145 66.25	65	684	145	66.25
66	430	73, 116	80	66	505	A99	82.08
67	221		13 81.25	67	6	26	74.58
68	238		146 85.83	68	625	147	74.17
69	232		114 81.67	69	791	116	40.83
70	23		71 63.33	70	23	71	63.33
71	212		A73 68.75	71	803	116, A73	75
72	828		3, 6 77.92	72	246	8	65.83
73	821	A28, A29	76.67	73	701	A28, A29	67.92
74	229		117, A47 81.25	74	897	A56	66.25
75	558	22, A11, A71	66.25	75	239	145	70
76	565		74 72.58	76	349	116, A49	75.83
77	403		12 70	77	227	10	72.5
78	917	146, 149	70.42	78	918	14, 17, 18	72.08
79	576		147 60	79	746	148	62.08
80	852		27 72.92	80	852	27	72.92
81	811	116, A11	71.25	81	812	116, A11	73.33
82	444		6 75.42	82	445	6	67.5
83	653		31, 73 73.75	83	866	39	75.42
84	247	A73, A74	75.83	84	768	78, 80, A29	73.75
85	564		71 61.67	85	564	71	61.67
86	236		117 85	86	222	117	84.17
87	24		132 71.25	87	34	132	78.75
88	20		15 88.75	88	410	10	74.58
89	14		28 89.58	89	15	51	86.25
90	973		116 57.5	90	973	116	57.5

Form A			
Order	Item #	KSA	Angoff
91	987	119	61.11
92	225	26	62.08
93	553	K21, K23	80
94	274	116, A71	80
95	954	13	64.17
96	596	A8	72.92
97	592	14	72.08
98	237	117	85.42
99	5	26	88.33
100	786	116, A72	64.58

7198.1

Form B			
Order	Item #	KSA	Angoff
91	990	116	70
92	216	5	60.83
93	337	A73	81.67
94	275	116, 119, A71	75
95	367	151	71.25
96	396	99	73.75
97	595	14	74.58
98	354	117	82.82
99	982	26	71.25
100	786	116, A72	64.58

7198

APPENDIX I

Written Examination Proctor Instructions

COOPERATIVE PERSONNEL SERVICES

INSTRUCTIONS TO EXAMINING PROCTORS*

These proctor instructions provide you with information that is **specific**** to the following tests. This document is accompanied by a proctor's manual that supplies you with standard procedures for administering a test.

Room Set-up: If table clothes are present, provide a backing (thin cardboard backing from notepads) for scan-tron answer sheets. Remove all napkins and other material that could be used for notes. Be sure and collect these backing cards during checkout.

Introduce all Proctors present and describe their duties: (Example - line of sight responsibility for those using the restroom)

“This written test is for: AFTE Gunshot Residue, Firearm, and Toolmark (select appropriate one) Certification.”

“At this time, everything must be removed from the table except for number 2 pencils and erasers. Please place any backpacks, purses, binders, books, etc. on the floor out of your line of sight.”

“Absolutely no talking is permitted from this point on during the examination” (until I ask if there are any questions just before the test begins).

If the agency has instructed candidates to bring special equipment or reference materials, advise the candidates at this time of the additional materials they are allowed to use.

Proctor note: If a candidate is found to have been using unauthorized aids, collect them from the candidate and note it on the proctor's report.

“You have received the applicant’s Security Agreement.” or “The Security Agreement will now be distributed. Please read or complete reading and sign/date this agreement

* CPS – May 1999, edited by J. Murdock 7/11/99 and 7/29/99.

** This document is to be filled out and signed by the chief Proctor on page five. It then becomes an attachment to the Proctor’s Report for the test in which it is used.

and hand it in.” (Have assistant proctor collect these.)

Proctor note: Discuss the 1) “AFTE Retention of Certification Examination Records” and 2) “Procedure for Appealing the Results of an AFTE Certification Examination” and announce that copies of each are available to interested candidates.

“The test books and answer sheets will now be distributed. Do not open test books until told to do so.”

“Please turn off any beepers/pagers, or watches that beep.”

“Refer to the answer sheet. Now you will fill in the information requested on the answer sheet.”

“Enter the title of the test you are authorized to take.” [allow time]

“Enter the form (or version designation) from the test cover and the test booklet number from the top of your test book. For example, if you have Version B – Test # 3 – enter B-3 in the space marked “control #.” [allow time]

“Enter the agency name. For our purposes use AFTE.” [allow time]

“Enter today's date.” [allow time]

“Enter your name. Print your last name, then your first name, and then your middle initial, and blacken the corresponding letters.” [allow time]

“Your responses to the next four items are optional.”

“Enter your social security number and blacken the corresponding numbers.”
[allow time]

“The following information is collected by Cooperative Personnel Services for research purposes only. No test scoring decisions will be based on this information.”

“Please complete the following information.”

“Blacken the boxes which indicate your ethnicity, the highest grade you have completed in school, and your gender.” [allow time]

“Now turn to page ii in your test book and read the “Instructions to Candidates” and

examination hints.” [allow time]

“In answering the questions, remember the following points:”

“Be sure to mark the space on your answer sheet that has the same number as the question in the test book.”

“Completely fill in the answer space.”

“Keep your pencil from making any marks on the answer sheet except for your answer.”

“If you change an answer, be sure to completely erase your first answer. Failure to do so can result in the machine not scoring your answer.”

“It is to your advantage to answer all questions. Work rapidly but carefully. If you are not sure of the answer to a question, skip it and come back to it later.”

“The pass point for this examination is 70.”

“The results will be ready in approximately _____. You will be notified by mail.”

“Read and consider all choices to each question.”

“You may write in the test book.”

“Scratch paper is prohibited.”

“Are there any questions?” [Make reasonable explanations as necessary.]

“If you have a concern about any specific question on the test, you may record your comments on the Comment Form. Turn this form in with your answer sheet. If you have a concern about any other portion of the test, tell the Chief Proctor, who will make a note of it. The proctors will not be able to answer any questions regarding the test content.”

“You may also write any general comments you may have about the test. It is aimed at the five year experience level; that is two years of training and three years as a court qualified examiner.”

“We are now ready to begin the test.”

“You will have 3 hours to complete the test although it is designed to be completed in two hours. If you finish before time is called, you may review your work or hand in your test material, sign out, and leave.”

Checkout procedure: Candidates take all test materials to the check out Proctor, one at a time. The check out Proctor will do the following:

1. Collect test booklet. Leaf through it to be sure all pages are intact. Record the version number and booklet number next to the candidate’s printed name on the roster.
2. Review answer sheet for completeness of entries and responses. Make no changes. Have candidate blacken any partial markings.
3. Have candidate sign the answer sheet. Proctor place a check mark and initials at the top of this sheet. Collect answer sheet and any backing material.
4. Review “comment” form for clarity of responses. Encourage candidates to record their name. Write any interview comments on this form. Collect comment form(s).
5. Have candidate sign out in the proper column on roster.

“It is now _____. Time will be called at _____. Turn to Section 1 and begin.”

When there are 15 minutes remaining, say,

“There are 15 minutes left.”

When time is up, say:

“Stop! Time is up. Close your test book and lay down your pencils. Put your answer sheet on top of your test book. Remain seated until all material is collected. You will then be dismissed individually, after you complete the checkout procedure.”

“You are not permitted to change answers or discuss examination questions when you turn in the examination materials. Please do not talk when you are waiting to check out.”

“Thank you for your cooperation.”

Proctor: Please sign and date on the line below that you have maintained the standardization of the test administration by reading these proctor's instructions to the candidates where indicated. Return this signed sheet with the proctor's report.

Test Title _____ Test Version(s) _____ Test Date/Time _____

Name (Print) _____ Date _____

Name (Signature) _____

APPENDIX J

Written Examination Comment Form

AFTE CERTIFICATION TEST COMMENT FORM*

The Association of Firearm and Toolmark Examiners and Cooperative Personnel Services (CPS) welcome your comments about test questions. Please comment** below on specific examination questions. Your comments will be carefully reviewed by CPS's Test Development staff and AFTE.

Test Title _____ Test Version _____ Test Date _____

Comments by*** _____ Phone Number*** _____

QUESTION # _____ COMMENT*** _____

QUESTION # _____ COMMENT: _____

QUESTION # _____ COMMENT: _____

QUESTION # _____ COMMENT _____

QUESTION # _____ COMMENT: _____

QUESTION # _____ COMMENT: _____

QUESTION # _____ COMMENT: _____

*CPS – July 1999, edited by J. Murdock 7/13/99

**Typical comment examples: (1) No correct answer; (2) More than one correct answer; (3) Question is unclear; (4) Question is not related to this profession; (5) Question is out of date; (6) Terminology or spelling error (please specify); (7) Etc. (Please specify.)

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.

APPENDIX L

Practical Examination Comment Forms

AFTE Firearm Practical Examination Comment Forms

Component 1: Cartridge Comparison

Please use this form to record your observations and comments regarding Component 1: Cartridge Comparison of the AFTE Firearm Practical Examination. You will be afforded an opportunity to discuss your comments during the Angoff Panel meeting. You may use additional sheets of paper as needed.

Time Limits:

1. Is there too much or not enough time for a competent examiner to complete the exercise?
-

Test Instructions:

1. Were the test instructions clear and easy to understand?
-
2. Did the test instructions have all the information you needed to begin the exercise?
-

Examination Materials:

1. Were the examination materials clearly labeled or marked?
-
2. Were the examination materials representative of what is actually performed on the job?
-
3. Were the examination materials appropriately prepared for the exercise?
-
4. How could the examination materials be improved for this exercise?
-

Exercise Difficulty Levels:

1. Is the test exercise either too easy or too difficult? Please explain your response.
-

Scoring Criteria:

1. Was the scoring criteria used for this exercise clear and easy to understand?
-
2. Is the scoring criteria fair to all candidates?
-

Worksheets:

1. Were the exercise response worksheets clear and easy to understand?
-
2. Do the exercise response worksheets allow the candidate to accurately and thoroughly record his/her responses?
-

Packaging:

1. Were the examination materials appropriately packaged for this exercise?
-
2. Were the packaging requirements appropriate for this examination?
-

Proctors:

1. Are proctors needed to administer this examination exercise?
-

Overall:

1. Is this exercise assessing the appropriate job knowledge, skills, and abilities?
-
2. Other comments:
-
-
-
-

AFTE Firearm Practical Examination Comment Forms

Component 2: Bullet Comparison

Please use this form to record your observations and comments regarding Component 2: Bullet Comparison of the AFTE Firearm Practical Examination. You will be afforded an opportunity to discuss your comments during the Angoff Panel meeting. You may use additional sheets of paper as needed.

Time Limits:

1. Is there too much or not enough time for a competent examiner to complete the exercise?
-

Test Instructions:

1. Were the test instructions clear and easy to understand?
-
2. Did the test instructions have all the information you needed to begin the exercise?
-

Examination Materials:

1. Were the examination materials clearly labeled or marked?
-
2. Were the examination materials representative of what is actually performed on the job?
-
3. Were the examination materials appropriately prepared for the exercise?
-
4. How could the examination materials be improved for this exercise?
-

Exercise Difficulty Levels:

1. Is the test exercise either too easy or too difficult? Please explain your response.
-

Scoring Criteria:

1. Was the scoring criteria used for this exercise clear and easy to understand?
-
2. Is the scoring criteria fair to all candidates?
-

Worksheets:

1. Were the exercise response worksheets clear and easy to understand?
-
2. Do the exercise response worksheets allow the candidate to accurately and thoroughly record his/her responses?
-

Packaging:

1. Were the examination materials appropriately packaged for this exercise?
-
2. Were the packaging requirements appropriate for this examination?
-

Proctors:

1. Are proctors needed to administer this examination exercise?
-

Overall:

1. Is this exercise assessing the appropriate job knowledge, skills, and abilities?
-
2. Other comments:
-
-
-
-

AFTE Gunshot Residue Practical Examination Comment Forms Component 1: Distance Determination

Please use this form to record your observations and comments regarding Component 1: Distance Determination of the AFTE Gunshot Residue Practical Examination. You will be afforded an opportunity to discuss your comments during the Angoff Panel meeting. You may use additional sheets of paper as needed.

Time Limits:

1. Is there too much or not enough time for a competent examiner to complete the exercise?
-

Test Instructions:

1. Were the test instructions clear and easy to understand?
-
2. Did the test instructions have all the information you needed to begin the exercise?
-

Examination Materials:

1. Were the examination materials clearly labeled or marked?
-
2. Were the examination materials representative of what is actually performed on the job?
-
3. Were the examination materials appropriately prepared for the exercise?
-
4. How could the examination materials be improved for this exercise?
-

Exercise Difficulty Levels:

1. Is the test exercise either too easy or too difficult? Please explain your response.
-

Scoring Criteria:

1. Was the scoring criteria used for this exercise clear and easy to understand?
-
2. Is the scoring criteria fair to all candidates?
-

Worksheets:

1. Were the exercise response worksheets clear and easy to understand?
-
2. Do the exercise response worksheets allow the candidate to accurately and thoroughly record his/her responses?
-

Packaging:

1. Were the examination materials appropriately packaged for this exercise?
-
2. Were the packaging requirements appropriate for this examination?
-

Proctors:

1. Are proctors needed to administer this examination exercise?
-

Overall:

1. Is this exercise assessing the appropriate job knowledge, skills, and abilities?
-
2. Other comments:
-
-
-
-

AFTE Gunshot Residue Practical Examination Comment Forms

Component 2: Shot Dispersion

Please use this form to record your observations and comments regarding Component 2: Shot Dispersion of the AFTE Gunshot Residue Practical Examination. You will be afforded an opportunity to discuss your comments during the Angoff Panel meeting. You may use additional sheets of paper as needed.

Time Limits:

1. Is there too much or not enough time for a competent examiner to complete the exercise?
-

Test Instructions:

1. Were the test instructions clear and easy to understand?
-

2. Did the test instructions have all the information you needed to begin the exercise?
-

Examination Materials:

1. Were the examination materials clearly labeled or marked?
-

2. Were the examination materials representative of what is actually performed on the job?
-

3. Were the examination materials appropriately prepared for the exercise?
-

4. How could the examination materials be improved for this exercise?
-

Exercise Difficulty Levels:

1. Is the test exercise either too easy or too difficult? Please explain your response.
-

Scoring Criteria:

1. Was the scoring criteria used for this exercise clear and easy to understand?
-

2. Is the scoring criteria fair to all candidates?
-

Worksheets:

1. Were the exercise response worksheets clear and easy to understand?
-

2. Do the exercise response worksheets allow the candidate to accurately and thoroughly record his/her responses?
-

Packaging:

1. Were the examination materials appropriately packaged for this exercise?
-

2. Were the packaging requirements appropriate for this examination?
-

Proctors:

1. Are proctors needed to administer this examination exercise?
-

Overall:

1. Is this exercise assessing the appropriate job knowledge, skills, and abilities?
-

2. Other comments:
-
-
-
-

AFTE Toolmark Practical Examination Comment Forms

Component 1: Identification of Striated Marks

Please use this form to record your observations and comments regarding Component 1: Identification of Striated Marks of the AFTE Toolmark Practical Examination. You will be afforded an opportunity to discuss your comments during the Angoff Panel meeting. You may use additional sheets of paper as needed.

Time Limits:

1. Is there too much or not enough time for a competent examiner to complete the exercise?
-

Test Instructions:

1. Were the test instructions clear and easy to understand?
-
2. Did the test instructions have all the information you needed to begin the exercise?
-

Examination Materials:

1. Were the examination materials clearly labeled or marked?
-
2. Were the examination materials representative of what is actually performed on the job?
-
3. Were the examination materials appropriately prepared for the exercise?
-
4. How could the examination materials be improved for this exercise?
-

Exercise Difficulty Levels:

1. Is the test exercise either too easy or too difficult? Please explain your response.
-

Scoring Criteria:

1. Was the scoring criteria used for this exercise clear and easy to understand?
-
2. Is the scoring criteria fair to all candidates?
-

Worksheets:

1. Were the exercise response worksheets clear and easy to understand?
-
2. Do the exercise response worksheets allow the candidate to accurately and thoroughly record his/her responses?
-

Packaging:

1. Were the examination materials appropriately packaged for this exercise?
-
2. Were the packaging requirements appropriate for this examination?
-

Proctors:

1. Are proctors needed to administer this examination exercise?
-

Overall:

1. Is this exercise assessing the appropriate job knowledge, skills, and abilities?
-

2. Other comments:
-
-
-
-

AFTE Toolmark Practical Examination Comment Forms
Component 2: Identification of Impressed Marks

Please use this form to record your observations and comments regarding Component 2: Identification of Impressed Marks of the AFTE Toolmark Residue Practical Examination. You will be afforded an opportunity to discuss your comments during the Angoff Panel meeting. You may use additional sheets of paper as needed.

Time Limits:

1. Is there too much or not enough time for a competent examiner to complete the exercise?
-

Test Instructions:

1. Were the test instructions clear and easy to understand?
-
2. Did the test instructions have all the information you needed to begin the exercise?
-

Examination Materials:

1. Were the examination materials clearly labeled or marked?
-
2. Were the examination materials representative of what is actually performed on the job?
-
3. Were the examination materials appropriately prepared for the exercise?
-
4. How could the examination materials be improved for this exercise?
-

Exercise Difficulty Levels:

1. Is the test exercise either too easy or too difficult? Please explain your response.
-

Scoring Criteria:

1. Was the scoring criteria used for this exercise clear and easy to understand?
-
2. Is the scoring criteria fair to all candidates?
-

Worksheets:

1. Were the exercise response worksheets clear and easy to understand?
-
2. Do the exercise response worksheets allow the candidate to accurately and thoroughly record his/her responses?
-

Packaging:

1. Were the examination materials appropriately packaged for this exercise?
-
2. Were the packaging requirements appropriate for this examination?
-

Proctors:

1. Are proctors needed to administer this examination exercise?
-

Overall:

1. Is this exercise assessing the appropriate job knowledge, skills, and abilities?
-
2. Other comments:
-
-
-
-

APPENDIX M

AFTE Test Security Agreements

AFTE CERTIFICATION COMMITTEE SECURITY AGREEMENT

As a member of the AFTE Certification Committee, participating in any or all of the elements of the written and practical certification tests, such as design, scoring mechanism, preparation of practical test samples, etc., I, the undersigned, accept responsibility for maintaining the strict confidentiality of all examination-related materials.

I accept responsibility for protecting confidential materials and information.

I will not discuss any aspect of the test development process with which I have been involved with anyone except other AFTE Certification Committee members.

I have not and will not discuss the contents of any examination materials except with other AFTE Certification Committee members.

I will ensure that, should I serve in the capacity of Chief Proctor, Proctor Reports will be properly completed and submitted in a timely fashion.

I am aware that all examination related materials are to be kept in a secured location and that all such materials under my control will be secured when they are not in use or under my observation.

I am aware that violations of these provisions may result in termination of my AFTE membership.

I have read and understand the provisions of this Security Agreement. My signature below signifies that I agree to the terms of this agreement.

Printed Name: _____

Signature: _____ Date: _____

7/12/99 JEM

AFTE ANGOFF PANEL TEST SECURITY AGREEMENT

In order to maintain the integrity of the AFTE certification examination process, it is imperative that strict test security precautions be followed. As a member of the Angoff Panel, you will be required to review most, if not all, of the items that have been developed for the AFTE written examinations. You will also be required to review test materials relating to the AFTE Practical Examinations. As an Angoff Panel Member you must agree to comply with the following conditions:

- 1. TEST MATERIALS MUST BE SECURED AT ALL TIMES.** Store test materials in a secure place at all times. Do not leave examination materials lying around where they can be viewed by other potential candidates. During the administration of the practical tests, do not allow others to examine the test materials or your responses to the examination exercises.

- 2. ALL EXAMINATION-RELATED MATERIALS MUST BE RETURNED.** Return all examination materials, including any notes made during the test administration, to the person or agency designated as responsible for exam material. Instructions on how to return the examinations materials are included in your test materials. Do not retain or copy any examination materials for your own files.

- 3. DISCUSSION OF AFTE TEST MATERIALS IS PROHIBITED.** Do not discuss the administration and/or results of the AFTE practical examinations with any other person, prior to the Angoff Panel meeting. You will be allowed to discuss the AFTE Practical Examinations only during the Angoff Panel meeting. After the Angoff Panel meeting, you will not be allowed to discuss the AFTE written and practical test contents with anyone, except members of the CPS staff. Discussing the test materials with other members of the Angoff Panel after the Angoff meeting has been completed is prohibited. Topics that may not be discussed with others include, but are not limited to: written examination items and responses; the contents or formats of the practical examinations; examination reference lists; test scoring standards; the identities of other Angoff Panel members; examination results; topics discussed during the Angoff Panel meeting; the results of the Angoff Panel meeting; and your evaluation/opinion of the examination.

For three years from the date of the Angoff Panel, involvement in any exam-oriented review program for prospective AFTE certification candidates is prohibited. Do not help colleagues with hints regarding the content of the examination. Prohibited activities include, but are not limited to: developing candidate review materials; coaching prospective examinees; or giving exam-oriented presentations or seminars.

As a participant on the AFTE Angoff Panel, you will have access to confidential examination material. By signing this form, you agree to assume personal responsibility for keeping these materials secure. You also agree to avoid future activities that would compromise the security of the AFTE Certification Examinations. If you are found to have violated this security agreement, you will be expelled from AFTE and will be liable for civil action.

I have read the foregoing and I agree to the conditions listed above.

Signature: _____ Date: _____

Printed Name: _____ Telephone: (____) _____

Address: _____

Agency: _____ Telephone: (____) _____

Agency Address: _____

AFTE PROCTOR SECURITY AGREEMENT

As a Proctor participating in the administration of examination(s) for the Association of Firearm and Toolmark Examiners, hereinafter called AFTE, I, the undersigned, accept responsibility for maintaining the strict confidentiality of all examination-related materials.

I accept responsibility for protecting confidential materials and information.

I will not discuss any aspect of the examination administration process with anyone except other designated Proctors and the AFTE Certification Committee contact person. I will not discuss the contents of any examination materials except with the AFTE Certification Committee contact person. If Cooperative Personnel Services (CPS) is involved with any aspect of this testing, discussions may be held with their contact person as well.

I will not retain, nor will I make any copies of examination-related materials. I will ensure that all examination-related materials are to be kept in a secured location and will return all materials to the AFTE Certification Committee contact person or to CPS, whichever is appropriate. All materials under my control will be secured when they are not in use or under my observation.

I will ensure that Proctor Reports are properly completed and submitted in a timely fashion.

I am aware that violations of these provisions may result in termination of my AFTE membership.

I have read and understand the provisions of this Security Agreement. My signature below signifies that I agree to the terms of this agreement without reservation.

Printed Name: _____

Signature: _____ Date: _____

7/12/99 JEM

AFTE CERTIFICATION TEST APPLICANT SECURITY AGREEMENT

As An applicant taking an AFTE Certification Test, I, the undersigned, accept responsibility for maintaining the strict confidentiality of all examination-related materials.

I will not destroy, alter, or deface any test materials.

I will not take test materials from the examination room/area.

I will not make copies, photographs, or notes of test questions, either during or following the examination period.

I will not transmit test questions in any form to any other person or entity during or after the examination.

I will not use any unauthorized notes or aids during the examination.

During the examination, I will not cheat in any way, including giving or receiving assistance or copying from someone else's test booklet/answer sheet.

I have read and understand the provisions of this Security Agreement. My signature below signifies that I agree to the terms of this agreement without reservation. I understand also that any violation of this agreement may result in termination of my AFTE membership.

Printed Name: _____

Signature: _____ Date: _____

7/12/99 JEM

SUBJECT MATTER EXPERT EXAMINATION SECURITY AGREEMENT

California law authorizes state agencies to maintain the security of their licensing examinations. The most specific of these laws, section 123 of the Business and Professions Code, makes it a misdemeanor for any person to subvert or attempt to subvert any licensing examination or the administration of an examination. A person found guilty of these actions is liable for the actual damages sustained by the agency administering the examination, not to exceed \$10,000, and the costs of litigation. In addition, a board may deny, suspend, revoke, or otherwise restrict the license of an applicant or a licensee who has violated this section. The complete provisions of section 123 follow.

Examination material must be kept secure throughout its preparation, review, administration, and scoring. As a participant in this project, you will have access to confidential examination material. By signing this form, you are agreeing to assume personal responsibility for keeping this material secure. You are also agreeing to avoid future activities that would compromise the security of the exam. The specific examination security standards with which you are asked to comply are to:

1. Keep all exam material secure while it is in your possession.
2. Return all exam material, including any rough drafts, to the person from the licensing agency or testing firm designated as responsible for exam material. Do not retain or copy any exam material for your own files.
3. Discuss this exam only during formal exam development or review meetings. Topics that may not be discussed with others include, but are not limited to, exam items and responses, scoring standards, the identities and performances of examinees, exam results, and your evaluation of the exam.
4. For two years from this date, avoid involvement in any exam-oriented review program for prospective examinees of this licensing agency. Prohibited activities include, but are not limited to, developing review materials, coaching prospective examinees, or giving exam oriented presentations or seminars.

I have read the foregoing and certify as requested.

Signature _____ Today's Date _____

Printed Name _____ Telephone () _____

Address _____

Title of Examination _____

License Number _____

Social Security Number _____

APPENDIX N

Content Analysis of the AFTE Written Examinations

Content Analysis of the AFTE Written Examinations

The percentage of items in each of the content categories (listed in the tables below) should be regarded as only estimates. Many of the written test items are linked to multiple KSAs, thereby enabling them to be included in more than one of the content categories (and thus, making it difficult to establish the exact percentage of items in each category). Additionally, the numbers in the tables below reflect the percentages of items in each of the content areas for the examinations administered during the 1999 AFTE Training Seminar. Future item edits to the AFTE written examinations could result in slight variations in these percentages.

AFTE Firearm Written Examination

Content Area	Proposed %	% in Form A	% in Form B
Collection and Preservation of Firearms Evidence	13	9	9
Examination of Firearms Evidence	60	69	69
Examination of Gunshot Residue Evidence	6	7	7
Examination of Toolmark Evidence	4	1	1
Documentation of Physical Evidence and Analytical Results	4	2	2
Safe Work Practices	7	6	6
Professional Development	4	4	4
Maintaining Professional Ethical Standards of Conduct	2	2	2

AFTE Gunshot Residue Written Examination

Content Area	Proposed %	% in Form A	% in Form B
Collection and Preservation of Firearms Evidence	16	9	10
Examination of Firearms Evidence	10	14	14
Examination of Gunshot Residue Evidence	39	46	47
Examination of Toolmark Evidence	0	0	0
Documentation of Physical Evidence and Analytical Results	5	6	6
Safe Work Practices	9	4	5
Professional Development	6	4	5
Maintaining Professional Ethical Standards of Conduct	3	4	3

AFTE Toolmark Written Examination

Content Area	Proposed %	% in Form A	% in Form B
Collection and Preservation of Firearms Evidence	21	22	21
Examination of Firearms Evidence	14	13	16
Examination of Gunshot Residue Evidence	0	0	0
Examination of Toolmark Evidence	39	46	39
Documentation of Physical Evidence and Analytical Results	6	5	8
Safe Work Practices	8	4	5
Professional Development	9	6	7
Maintaining Professional Ethical Standards of Conduct	3	4	4