



AMERICAN BOARD OF CRIMINALISTICS

"Professional Competency Certification in Criminalistics"

BIOLOGICAL EVIDENCE SCREENING EXAMINATION

Candidate Study Guide

American Board of Criminalistics

Updated May 2021

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Biological Evidence Screening Examination

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Introduction

Congratulations on your decision to pursue certification!

This examination was created through the Developing a Curriculum (DACUM) process. Using a panel of Subject Matter Experts (SME), a job analysis was completed to define the profession of Forensic Biology. As a result of this job analysis, two separate job classifications were generated – Biological Evidence Screener and Forensic DNA Analyst. The Biological Evidence Screener Job Description (08-1002S) was created and lists the duties and associated tasks for that position. The SME was comprised of practitioners from a variety of types of laboratories (e.g., city/county, state, federal, etc.) across the country. The tasks and duties in the job description may include ones that are not performed specifically by your Forensic Science Service Provider but are part of the larger role of a Biological Evidence Screener.

The tasks listed in the job description were aligned to Knowledge-Skill (K-S) categories, and these categories were grouped into larger Domains (e.g., Science and Math, Quality Assurance/Quality Control, etc.) to create the Biological Evidence Screening Examination Blueprint. This blueprint was subsequently used to determine the number of questions in each of the larger domains.

The examination is structured around the knowledge and skills needed to perform tasks and duties of the job. The study guide was developed using the job description and the examination blueprint. All K-S categories are represented in the examination. Refer to the Biological Evidence Screening Examination Blueprint for a detailed breakdown of the Knowledge/Skills and Tasks used to create this examination.

References listed in this Study Guide were used to write examination questions; however, not all questions were written using these references.

For more information on the development of this examination, please refer to additional examination development documents on the ABC website.

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Examination Outline

Domain	Knowledge-Skill	% of Exam
Science and Math		27%
	Biology (e.g., molecular, cellular)	
	Chemistry	
	Math	
Process		23%
	Organizational (e.g., time management, multi-tasking)	
	Critical thinking (e.g., analytical, decision making, problem solving)	
	Scientific method	
Laboratory		13%
	Good laboratory practice (e.g., safety, PPE)	
	Laboratory skills (e.g., pipetting, robotics)	
Computer		10%
	Computer	
	LIMS	
Quality Assurance/Quality Control		9%
	ISO 17025 / ANAB	
	QAS	
	SWGDM	
Communication		8%
	Communication (e.g., oral, written, presentation, listening, interpersonal)	
Forensic Disciplines		6%
	Other forensic disciplines	
Legal		4%
	Legal system	

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Science and Math

The Science and Math domain makes up 27% of the examination. The knowledge and skills needed to succeed in this domain are:

- Scientific concepts in the field of biology – especially molecular and cellular
 - Forensic serology
 - Characteristics of body fluids
 - Body fluid detection and identification
 - Genetics
 - DNA
- Scientific concepts in the field of chemistry
 - Scientific units
 - Scientific nomenclature
 - Basic definitions of scientific concepts (e.g., chemicals, molecules, solutions, etc.)
- Mathematical concepts and their application to the fields of biology and chemistry
 - Dilutions
 - Basic calculations and SI unit conversions
- Statistical definitions and concepts
 - Mean, median, mode, etc.
 - Confidence interval, standard deviation, and variability

Process

The Process domain makes up 23% of the examination. The knowledge and skills needed to succeed in this domain are:

- Organizational
 - Testing plans
 - Technical and administrative reviews
 - Recommendations, guidelines, and best practices from national and international organizations (e.g., ASB, ASTM, NIJ, NIST, OSAC, SWGDAM, etc.)
- Critical Thinking
 - Sample collection for body fluid testing
 - Sample collection for forensic DNA analysis
 - Body fluid testing procedures

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Process (continued)

- Scientific Method
 - Types of evidence and methods of transfer
 - Handling and storage of evidence
 - Analysis of evidence, including order of analysis for evidence with multiple disciplines requested
 - Sample collection from evidence, especially for downstream processing
 - Adequate note taking and documentation
 - Interpretation of results
 - Report writing

Laboratory

The Laboratory domain makes up 13% of the examination. The knowledge and skills needed to succeed in this domain are:

- Basic concepts in good laboratory practice
 - Communication of laboratory safety procedures
 - Proper Personal Protective Equipment (PPE) in the laboratory
- Basic laboratory skills
 - Proper use of laboratory glassware, pipettes, and other measuring devices
 - Contamination prevention procedures
 - Purpose and basic use of equipment commonly used for sample collection and body fluid testing
 - Sample collection from evidence for body fluid testing and subsequent DNA processing

Computer

The Computer domain makes up 10% of the examination. The knowledge and skills needed to succeed in this domain are:

- Use of computer software in forensic science
 - Documentation and analysis of evidence
 - Proficiency testing
 - Draft and final reports
 - Court testimony
- Use of LIMS in biological evidence screening
 - Maintaining chain of custody
 - Inventory, documentation, and analysis of evidence, samples, etc.
 - Security

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Quality Assurance/Quality Control

The Quality Assurance/Quality Control domain makes up 9% of the examination. The knowledge and skills needed to succeed in this domain are:

- Quality assurance and quality control in the crime laboratory
 - Validation and verification
 - Different types of controls, performance checks
 - Training programs
 - Note taking
 - Report writing
 - Technical and administrative reviews
 - Proficiency testing
 - Expert testimony
- ISO Accreditation
 - ISO/IEC 17025 and AR 3125 standards and accreditation requirements
 - Accreditation process
 - Guiding Principles of Professional Responsibility
- Quality Assurance Standards (QAS)
 - FBI Quality Assurance Standards for DNA Databasing Laboratories
 - FBI Quality Assurance Standards for DNA Testing Laboratories
 - The Guidance Document for the FBI Quality Assurance Standards for Forensic DNA Testing and DNA Databasing Laboratories
- Scientific Working Group on DNA Analysis Methods (SWGDM)
 - Recommendations, guidelines, and best practices

Communication

The Communication domain makes up 8% of the examination. The knowledge and skills needed to succeed in this domain are:

- Ways to effectively communicate in forensic science
 - Technical and administrative documentation
 - Adequate note taking
 - Writing and reviewing reports
 - Courtroom testimony
 - Communication between the laboratory and the customer

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Forensic Disciplines

The Forensic Disciplines domain makes up 6% of the examination. The knowledge and skills needed to succeed in this domain are:

- Basic knowledge of different types of forensic evidence
- Basic knowledge of common forensic analyses performed on different types of evidence
- Collection of samples from evidence
- Preservation of evidence for testing in other disciplines
- Coordination of testing with other disciplines

Legal

The Legal domain makes up 4% of the examination. The knowledge and skills needed to succeed in this domain are:

- Case file documentation for legal proceedings (e.g., administrative, technical, supporting, etc.)
- Knowledge of proper expert testimony
- Basic understanding of the Federal Rules of Evidence
- Understanding the difference between Daubert and Frye
- Basic understanding of different types of warrants, subpoenas, etc.
- Court cases important to the field of forensic science

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References

General College Textbooks (or similar)	Edition	Author
<ul style="list-style-type: none">• Molecular Biology of the Cell	6 th	Alberts, Bruce, et al.
<ul style="list-style-type: none">• Campbell Biology	11 th	Campbell, Neil A.
<ul style="list-style-type: none">• Lehninger Principles of Biochemistry	7 th	Nelson, David L. and Cox, Michael M.
<ul style="list-style-type: none">• General Chemistry Principles and Modern Applications	7 th	Petrucci, Ralph H. and Harwood, William S.

Forensic DNA Typing - Butler Series	Edition	Author
<ul style="list-style-type: none">• Forensic DNA Typing	2 nd	Butler, John M.
<ul style="list-style-type: none">• Fundamentals of Forensic DNA Typing	3 rd	Butler, John M.
<ul style="list-style-type: none">• Advanced Topics in Forensic DNA Typing: Methodology	3 rd	Butler, John M.

Other Forensic Science Books	Edition	Author
<ul style="list-style-type: none">• Forensic Chemistry	2 nd	Bell, Suzanne
<ul style="list-style-type: none">• Sourcebook in Forensic Serology, Immunology & Biochemistry	1 st	Gaensslen, R. E.
<ul style="list-style-type: none">• Fundamentals of Forensic Science	2 nd or later	Houck, M. and Siegel, J.
<ul style="list-style-type: none">• Criminalistics: An Introduction to Forensic Science	7 th or later	Saferstein, R.
<ul style="list-style-type: none">• Forensic Science Handbook, Volume I	2 nd	Saferstein, R.
<ul style="list-style-type: none">• Forensic Science Handbook, Volume II	2 nd	Saferstein, R.

Guidance/Standards Documents	Edition	Author
<ul style="list-style-type: none">• Rules of Professional Conduct		ABC
<ul style="list-style-type: none">• ISO/IEC 17025: General Requirements for the Competence of Testing and Calibration Laboratories	2017	ISO/IEC
<ul style="list-style-type: none">• AR 3125 ISO/IEC 17025: Forensic Science Testing and Calibration Laboratories Accreditation Requirements	2019	ANSI National Accreditation Board

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- Quality Assurance Standards for Forensic DNA Testing Laboratories 2011 and later Federal Bureau of Investigation
- Quality Assurance Standards for DNA Databasing Laboratories 2011 and later Federal Bureau of Investigation
- National Best Practices for Sexual Assault Kits: A Multidisciplinary Approach National Institute of Justice
- The Biological Evidence Preservation Handbook: Best Practices for Evidence Handlers NISTIR 7928 Ballou et. al.

SWGDM Publications (or similar, more recent)

- Contamination Prevention and Detection Guidelines for Forensic DNA Laboratories (2017)
- Guidelines for the Collection and Serological Examination of Biological Evidence (2015)
- Interpretation Guidelines for Autosomal STR Typing by Forensic DNA Testing Laboratories (2017) and Addendum (2019)
- Recommendations for the Efficient DNA Processing of Sexual Assault Evidence Kits (2016)
- The Guidance Document for the FBI Quality Assurance Standards for Forensic DNA Testing and DNA Databasing Laboratories (2020)
- Training Guidelines (2020)

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Example Questions

Below are 10 questions that represent the structure of questions on the examination. The primary Knowledge-Skill (K-S) Category and Associated Job Task(s) are also included. Refer to the Introduction for additional information regarding K-S and Job Tasks.

Knowledge-Skill: 1.1 – Biology

Job Task: B5 – Perform tests for blood

1. One function of human hemoglobin is to:
 - A. catalyze adenosine triphosphate reactions
 - B. clear haptoglobin from circulation
 - C. remove carbon dioxide from cells
 - D. generate polymorphic enzymes

Knowledge-Skill: 1.1 – Biology

Job Task: B5 – Perform tests for blood

2. Which of the following contain the molecules that most presumptive tests detect in blood?
 - A. Erythrocytes
 - B. Plasma
 - C. Thrombocytes
 - D. Leukocytes

Knowledge-Skill: 1.6 – Math

Job Task: G3 – Prepare laboratory reagents

3. How much 20% SDS is needed to prepare 500 mL of 10% SDS?
 - A. 50 mL
 - B. 100 mL
 - C. 25 mL
 - D. 250 mL

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Knowledge-Skill: 1.1 – Biology

Job Task: B4 – Document evidence

4. Which of the following provides the **MOST** accurate outlook on evidence examination?
- A. Contamination during evidence exam will not compromise DNA results because current mixture interpretation software can easily identify donors.
 - B. No amount of hard work in the final analytical stages can compensate for mistakes made during evidence examination.
 - C. Presumptive testing prior to DNA testing has no benefit and should be bypassed in order to expedite results.
 - D. Mistakes made during evidence examination are readily overcome thanks to sophisticated downstream DNA typing instrumentation.

Knowledge-Skill: 1.2 – Chemistry

Job Task: B5 – Perform tests for blood

5. During the TMB test:
- A. tetramethylbenzidine is reduced to tetramethylbenzidine diimine
 - B. tetramethylbenzidine diimine is oxidized to tetramethylbenzidine
 - C. tetramethylbenzidine is oxidized to tetramethylbenzidine diimine
 - D. tetramethylbenzidine diimine is reduced to tetramethylbenzidine

Knowledge-Skill: 1.1 – Biology

Job Task: B6 – Perform tests for semen

6. Which of the following **BEST** justifies the use of enzymatic tests over microscopic tests to detect semen?
- A. Semen degradation prevents detection by microscopy in aged samples.
 - B. The semen sample could have originated from an azoospermic donor.
 - C. Microscopy is an older method with limited utility in modern forensic science.
 - D. The stains used to visualize sperm cells microscopically have been proven to be unstable and unreliable.

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Knowledge-Skill: 5.2 – Critical Thinking

Job Task: B5 – Perform tests for blood

7. An example of a catalytic presumptive test for presence of blood is:

- A. Teichmann
- B. *o*-tolidine
- C. Absorption spectroscopy
- D. Takayama

Knowledge-Skill: 5.3 – Scientific Method

Job Task: B9 – Collect samples from evidence

8. Cellular material is optimally collected using:

- A. One dry swab followed by one wet swab
- B. Two wet swabs
- C. One wet swab followed by one dry swab
- D. Two dry swabs

Knowledge-Skill: 6.1 – Good laboratory practice

Job Task: G12 – Perform contamination prevention procedures

9. When examining evidence, all of the following are acceptable as contamination prevention measures **EXCEPT**:

- A. cleaning sampling tools (e.g., tweezers) with bleach followed by water
- B. autoclaving sample tubes prior to use
- C. using disposable sample tools (e.g., tweezers)
- D. submerging sample tubes in bleach and air drying prior to use

Knowledge-Skill: 6.2 – Laboratory skills

Job Task: B5 – Perform test for blood

10. High dose hook effect seen in immunoassay-based blood tests (e.g., SERATEC HemDirect) can be overcome by:

- A. diluting the sample
- B. choosing a buffer that prevents high dose hook effect from happening
- C. concentrating the sample
- D. using more sample substrate

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Example Questions Key

1. C
2. A
3. D
4. B
5. C
6. B
7. B
8. C
9. D
10. A