AMERICAN BOARD OF CRIMINALISTICS
"Professional Competency Certification in Criminalistics"

Study Guide for the Comprehensive Criminalistics Certification Examination

Introduction

Your study guide consists of a Job Description, a list of Knowledge, Skills, and Abilities (KSAs), References, and 20 Sample Question primer for the examination.

- The **Job Description** describes the education, background, training, and specific duties of an analyst in each discipline.
- The **KSAs** have ten major sections. Sections I-IX cover the core knowledge and skills expected of every forensic scientist and comprise 40% of the examination. Section X, consisting of the specific, discipline related, in-depth, upper level knowledge, skills, and abilities will make up 60% of the examination. Please note that the sub-categories listed under the capital letters in the KSAs are examples and are not meant to be all-inclusive, or to indicate that there will necessarily be a question on the examination from every sub-category.
- The **References** are broken into core references and discipline-related references. The core references are identical for all the ABC examinations. The discipline-related references are specific to each discipline.
- There are twenty S**ample Questions** to give you an idea of the range of content and difficulty that will appear on the examination. For further information, please see "Introduction to ABC Certification Examinations."

Study Guide for the Comprehensive Criminalistics Certification Examination

Job Description

A criminalist may specialize in one or more areas, such as: Drug chemistry, Fire Debris Analysis, Trace Evidence Analysis, Biological Materials Analysis, Firearms Examination, Toolmarks Examination, Footwear/Tire track Examination, Document Examination and/or Fingerprint Examination.

A qualified criminalist must be able to:

- Recognize, collect, secure, and preserve physical evidence at a crime scene, from items previously collected at a crime scene, or from items submitted to the laboratory that are associated with a crime scene.
- Perform physical, chemical, and/or biological analyses to locate and identify items having evidential value.
- Interpret and compare analytical data generated from the analyses of physical/chemical evidence and known exemplars.
- Recognize the potential for forensic examinations in areas outside an area of specialization, prioritize the sequence of examinations, and handle evidence accordingly.
- Evaluate the appropriateness and/or the appropriate method of securing samples for later analyses by other examiners.
- Use and maintain assigned laboratory instrumentation.
- Observe safe practices to insure the safety of analyst and co-workers
- Thoroughly and accurately produce documentation that describes analytical procedures and instrumental use, as well as support of all results and conclusions.
- Prepare case notes and reports that state conclusions reached, the process by which those conclusions were reached, the data upon which the conclusions were based, and the limitations and reasonable alternative interpretations of the data.
- Prepare notes and reports in such a manner that they are suitable for peer review and independent evaluation by other knowledgeable scientists.
- Effectively communicate verbally with investigators, other scientists and litigation personnel.
- Explain in terms understandable to judges and juries, during testimony under oath, the analytical processes, results, conclusions, significance, and limitations of conclusions.
- Recognize and employ quality assurance measures to ensure the integrity of the analyses.
- Engage in impartial and ethical work practices.

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Knowledge, Skills, and Abilities

I. History
- A. Evolution of practice
- B. Significant historical figures (e.g., Locard, Gross, Orfila, Kirk)

II. Crime Scene Preservation
- A. Securing
- B. Isolating
- C. Recording
- D. Searching
- E. Recognition of evidentiary value
- F. Safety

III. Crime Laboratory Operations-Overview
- A. Laboratory Disciplines
  1. Forensic biology
  2. Controlled substances
  3. Trace analysis
  4. Toxicology
  5. Latent fingerprints
  6. Questioned documents
  7. Fire debris
  8. Firearms/Toolmarks
  9. Digital evidence
- B. Evidence associated with each discipline

IV. QA/QC
- A. Accreditation, Certification, Standardization
  1. Laboratory accreditation
     a) Audit trails
     b) Accrediting bodies
     c) ISO 17025
     d) DAB standards
     e) ASCLD/LAB
  2. Personnel certification
     a) ABC
     b) IAAI
     c) IAI
     d) ABFT
     e) AFTE

3. Standardization
    a) ASTM
    b) UN
    c) TWG/SWG

B. QA/QC Application
1. Noncompliant data
2. Documentation evaluation
3. Validation and verification
4. Linearity
5. Limits of detection
6. Limits of quantitation
7. Limits of reporting
8. Negative and positive controls
9. Calibrators
10. Estimate of uncertainty
11. Traceability
12. Corrective and preventative actions
13. Proficiency testing
14. Confidence interval/confidence limits

C. Document/Data Management
1. Databases
2. LIMS
3. Case document preservation/integrity

V. Safety
A. Chemical Hygiene
1. Safety labeling (MSDS)
2. Communication plans

B. Universal Precautions
1. Blood-borne pathogens
2. Personal protective equipment

C. Hazardous Waste/Biohazardous Waste Handling
1. Spill control

VI. Legal
A. Decisions/laws
1. Frye
2. Daubert/Kumho
3. Brady

B. Legal terms
1. Chain of custody
2. Discovery
3. Voir dire

4. Duces tecum
5. Subpoena

C. Court Testimony
1. Monitoring
2. Courtroom etiquette

D. Procedural Law
1. Hearings, trials, appeals
2. Advocacy, burden of proof
3. Subpoenas and affidavits
4. Rules of evidence

VII. Ethics

A. ABC Code of Professional Ethics
1. Conflict of interest
2. Professional integrity
3. Objectivity
4. Professional obligations

VIII. Evidence Handling

A. Evidence Recognition and Collection
1. Prioritization based on circumstance
2. Sampling
3. Preservation

B. Evidence Classes (Class/Individual)
1. Exclusionary evidence
2. Identification
3. Direct vs. indirect evidence
4. Tangible vs. latent evidence

C. Evidence Preservation
1. Chain of custody
2. Alteration/degradation
3. Storage(long term/short term)

D. Evidence Packaging
1. Proper sealing
2. Types of packaging

IX. General Science Terms and Principles

A. Definitions and applications
1. Scientific method

B. General Chemistry Concepts
1. Nomenclature (IUPAC)
2. Type of molecules (e.g., aromatics, isoalkanes)
3. Atomic, molecular weights
4. Acids/bases

5. Periodic Table
6. Elemental composition
7. Bonding
    a) Ionic
    b) Covalent
    c) Hydrogen
    d) Van der Waals
    e) Stereoisomer
    f) Enantiomer

C. General Biology Concepts
1. Cell structure
2. Genetics
3. Botany
4. Characteristics of body fluids

D. General Physics Concepts
1. Energy
2. Electromagnetic spectrum
3. Force

E. General Physiology and Anatomy Concepts

F. General Statistics
1. Mean
2. Median
3. Mode
4. Standard deviation
5. Variability
6. Population characteristics

G. Stoichiometry

H. Logic
1. Critical thinking
2. Inductive and deductive reasoning

I. Metric System
1. Metric to metric conversion
2. Metric to English conversion

X. Forensic Science Applications for Criminalists

A. Principles and concepts

1. Measurements, procedures, and tests commonly used in the examination of physical evidence, in forensic biology, trace, firearms and toolmarks, fingerprints, fire debris, questioned documents, controlled substance, and toxicology/blood alcohol determinations, The nature and significance of the information derived from analysis conducted from above listed disciplines

2. Scientific method and general chemical, physical and biological basis for examinations, evaluation, and interpretations a criminalist would generally encountered.

B. Types of evidence composition
   1. Properties of commonly encountered evidence materials that allow their characterization in the areas of forensic biology, trace, firearms and toolmarks, fingerprints, fire debris, questioned documents, controlled substance, and toxicology.

C. Evolution of the discipline
   1. Forensic Biology
   2. Trace
   3. Firearms and Toolmarks
   4. Fingerprints
   5. Fire Debris
   6. Questioned Documents
   7. Controlled Substances
   8. Blood Alcohol Determinations

D. Accepted standards and practices
   1. DAB
   2. SWGMAT
   3. SWGFAST
   4. SWGDRUG
   5. SWGDOC
   6. SWGDAM

E. Results and Conclusions
   1. Process analysis
      a. Interpret the microscopic, chemical, and instrumental data obtained from the analysis of evidence while being cognizant of conditions or circumstances that may affect the results.
      b. Understand the limitations of an analysis in order to formulate a conclusion concerning evidence
      c. Apply the knowledge of class versus individual characteristics to evidence
      d. Evaluate requests for analysis to determine what collections(questions and known), examinations, and comparisons should be conducted to develop the most forensically useful information based on sample origin, type, quantity, condition, specific case scenarios, etc.

e. Collection of appropriate control and reference samples for comparison in evidence
f. Use of appropriate photographic, digital imaging, photomicrography equipment and techniques

2. QA/QC
3. Reporting
   a. Construct a report which may include: chain of custody information, description of evidence, nature of analysis, results of tests, conclusions, summary, and information regarding the disposition of the evidence.
4. Case Management
   a. Maintenance of documents and data for discovery

F. Technique/Practice/Instrument

1. Microscopy
   a. Polarized Light Microscopy
   b. Comparison Microscopy
   c. Stereomicroscopy
   d. Optical Properties
   e. Illumination Techniques
2. Elemental Analysis
   a. XRF
   b. XRD
   c. ICP
   d. SEM
3. Spectrometry
   a. infrared
   b. raman
   c. uv/ visible
   d. fluorescence
   e. mass spectroscopy
4. Chromatography
   a. Detectors and Introduction techniques
   b. Gas chromatography
   c. HPLC
   d. TLC
   e. Ion Chromatography

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5. Forensic Biology
    a. Screening Techniques
    b. Identification
    c. Genetic Tests
        1. PCR
        2. STR
        3. y-STR
        4. mDNA
6. Impression and Fingerprint
    a. Enhancement Techniques
    b. Comparison Criteria
7. Firearms and Toolmarks
    a. Comparison Microscopy
    b. Weapons and Ammunition
    c. Gunshot Residue
    d. Serial number restoration
8. Photography
    a. Lighting
    b. Depth of Field
    c. Digital
    d. Traditional

References

Listed below are the references for the Comprehensive Criminalistics Certification Examination. Small numbers of examination questions may have been drawn from a variety of other sources including general instrumental or chemistry text. Similar information may be obtained by studying earlier or later editions of the listed works, as well as other works covering the same topics.

Techniques of Crime Scene Investigation, 7th Edition, by Fisher, B.J. (Boca Raton: CRC Press, 2004) ISBN 0-8493-1691-X.

Criminalistics, An Introduction to Forensic Science, 7th Edition (or higher), by Saferstein, R. (Upper Saddle River, NJ: Prentice Hall, 1998) ISBN 0-13-592940-7.

Forensic Science Handbook, Volume I, 2nd Edition, edited by Saferstein, R. (Englewood Cliffs, NJ: Prentice Hall, 2002) ISBN 0-13-091058-9.

Forensic Science Handbook, Volume II, 2nd Edition, edited by Saferstein, R. (Englewood Cliffs, NJ: Prentice Hall, 2005) ISBN 0-13-112434-X.

Forensic Science Handbook, Volume III, edited by Saferstein, R. (Englewood Cliffs, NJ: Prentice Hall, 1993) ISBN 0-13-325390-2.

Fundamentals of Forensic Science, by Houck, M., Siegel, J. (Burlington, MA: Elsevier Academic Press, 2006) 0-12-356762-9.

Forensic Chemistry, by Bell, S., (Upper Saddle River, NJ: Pearson Prentice Hall, 2006) ISBN 0-13-147835-4.

"The Rule of Professional Conduct" supplied by the American Board of Criminalistics. www.criminalistics.com

Forensic DNA Typing, by Butler, J. (San Diego, CA: Academic Press, 2001) ISBN 0-12-147951-X

ISO/IEC 17025: General requirements for the competence of testing and calibration laboratories. International Organization of Standards, (ISO copyright office, Switzerland, 2005)

Books

Any collegiate level Instrumental Analysis and General Chemistry Textbooks that cover the instrumentation and topics outlined in the KSAs.

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Sample Questions

1. Which of the following best describes the value of field kits for the chemical testing of controlled substances?

    a. They remove the necessity for laboratory analysis.
    b. They are presumptive tests.
    c. They have questionable reliability.
    d. They allow the officer to make a field identification.

2. The primary reason for proving "chain of custody" on a particular item in court is to:

    a. Authenticate the item.
    b. Show how many people handled the item.
    c. Show how long it was in each person's possession.
    d. Deter or prevent unauthorized individuals from handling the evidence.

3. Which of the following spectral regions has the highest energy?

    a. Ultraviolet.
    b. Infrared.
    c. Radio.
    d. Visible.

4. Human genomic DNA is not found in:

    a. White blood cells.
    b. Red blood cells.
    c. Spermatozoa.
    d. Epithelial cells.

5. You receive an envelope containing a semi-automatic pistol for an operability check. You open the envelope to examine the weapon. You first remove a fully loaded magazine. The weapon is now:

    a. Potentially still loaded and unsafe.
    b. Unloaded and safe.
    c. Potentially still loaded but safe.
    d. Rendered safe because of a magazine disconnect.

6. When handling biological materials which of the following is the most reasonable approach to take?

    a. Precautions are not normally necessary for sample handling since transmission of disease has not been shown to occur from such contact.
    b. Precautions need only be taken when samples are in the liquid state since disease vectors are no longer viable upon drying.
    c. Precautions should be taken regardless of the condition or the origin of the samples being handled.
    d. Precautions need only be taken with unknown stains and liquids since preservatives and chelating agents present in reference samples will kill any communicable disease.

7. Which of the following actions is not forbidden by the ABC Rules of Professional Conduct?

    a. Embellishing one's qualifications when testifying.
    b. Utilizing a secret method.
    c. Refusing to honor a subpoena duces tecum.
    d. Interpreting equivocal results based only on an employer's wishes.

8. Upon reviewing your notes for a court appearance in one week, you realize that there is a clerical error and two results have been reversed. Which of the following is the best course of action?

    a. Issue a corrected report including the date of the correction and testify to the error if asked.
    b. Immediately notify the attorney and issue a report which makes the correction clear.
    c. Immediately make an entry in your notes as to your discovery and correct it in testimony if asked.
    d. Correct the error in testimony if asked, but make no additions or alterations to your notes.

9. A defendant has a combination of genetic marker types common to a particular evidence stain and 0.1 percent of the population. This means:

    a. approximately 1 out of 1000 people would have the same types
    b. the next 999 people that walked into the court room would not have the same combination of types
    c. we are 99.9% certain that the person responsible is being tried
    d. we are 0.1% certain that the person responsible is being tried

10. A drunk driver struck a pedestrian at a dark intersection. Realizing that the headlamps were not on, the driver turns them on before the police arrive. The broken right front low beam flashes and goes out. The police collect the headlamp and submit it to you for examination. You are likely to find which of the following indicators?

    I. A sharp break
    II. Hot deformation
    III. Fused glass
    IV. Large amounts of WO3 deposits

    a. IV only
    b. I only
    c. II and III
    d. II, III, and IV

11. Consider a fiber mounted in a Cargille oil having a refractive index (RI) of 1.520. When the distance between the focused fiber specimen and the microscope's objective lens is increased the observed Becke line moves away from the fiber. Which statement is correct?

    a. $n(iso)<1.52$
    b. $n(iso)>1.52$
    c. $n(parallel)>1.52$
    d. $n(parallel)<1.52$

12. Microscopic examination of paint chips recovered from the clothing of a pedestrian hit-and-run victim discloses the presence of numerous tiny glass spheres in the paint. These glass spheres are diagnostic of which one of the following?

    a. a reflective paint
    b. a automobile body filler
    c. a broken headlamp on the suspect automobile
    d. a custom topcoat formulation on the suspect automobile

13. What purpose does humidity serve when processing latent prints with Cyanoacrylate?

    a. causes polymerization and the formation of white particles on the ridges
    b. cools the fuming chamber
    c. accelerates development time
    d. causes a chemical reaction that will turn the ridges purple

14. How many moles of Na2SO4 are required to make 500 ml of 0.5 M Na2SO4?

    a. 0.25
    b. 2.5
    c. 0.025
    d. 25

15. What are the most important components of a polymerase chain reaction?

    a. oligonucleotides
    b. dinucleotides
    c. ribonucleotides
    d. dideoxynucleotides

16. What will you do if the signal (e.g. peak height) obtained during the analysis is 2/5 times the noise level?

    a. not report anything qualitative or quantitative
    b. report qualitative results but not quantitative
    c. report quantitative results, but not qualitative
    d. report both qualitative and quantitative result

17. Which one of the following statements applies to FT-IR but NOT to dispersive IR?

    a. the technique is considered to be a confirmatory test
    b. the resulting spectrum is a measure of molecular vibration
    c. the infrared radiation is analyzed utilizing interferometer
    d. solid samples are prepared by mixing the sample with KBr and pressing a pellet

18. Which one of the following groups are vegetable fibers used in making rope and cordage?

    a. jute, hemp, manila, sisal
    b. coir, flax, cotton, chrysotile
    c. sisal, kapok, hemp, burlap
    d. cotton, flax, kapok, coir

19. The differences in striation markings along a gun's bore could be the result of:

    a. imperfections of the rifling cutter, distortions caused by a broach cutter, and wear from the firing of bullets over time
    b. imperfections of the rifling cutter
    c. distortions caused by a broach cutter
    d. wear from the firing of bullets over time

20. What is the value of a single piece of class evidence?
    a. aid in the corroboration of events
    b. relate physical evidence to a common origin
    c. exclude or exonerate a person from suspicion
    d. all of the above

Answers can be found in the references.