AMERICAN BOARD OF CRIMINALISTICS

"Professional Competency Certification in Criminalistics"

Study Guide for the FSAT Examination

Introduction

Your study guide consists of a Job Description, a list of Knowledge, Skills, and Abilities (KSAs), References, and 50 Sample Question primer for the examination.

- The **Job Description** describes the education and background for student candidates.
- The **KSAs** have ten major sections. Sections I-IX cover the core knowledge and skills expected of student candidates. Section X, consisting of the specific, discipline related, in-depth, upper level knowledge, skills, and abilities. 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 fifty 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."

Please note that this study guide will be updated periodically.

Check for updates.

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Job Description

The student must be enrolled in a forensic science educational program. This examination is designed for graduating seniors and graduate students.

A qualified student candidate must be able to:

- Understand the major scientific principles behind forensic science analysis.
- Understand how to recognize, collect, secure, and preserve physical evidence.
- Understand how to perform physical, chemical, and/or biological analyses to locate and identify items having evidential value.
- Understand how to interpret and compare analytical data generated from the analyses of physical/chemical evidence and known exemplars.
- Understand how to 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.
- Understand the use of laboratory instrumentation.
- Observe safe practices to ensure the safety of analysts.
- Understand legal processes including courtroom testimony, relevant legal decisions and concepts.
- Recognize and employ quality assurance measures to ensure the integrity of the analyses.
- Understand the importance of impartial and ethical work practices.

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Knowledge, Skills, and Abilities (KSA)

I. History
   A. Evolution of practice (past practices)
   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

IV. QA/QC
   A. Accreditation, Certification, Standardization
      1. Laboratory accreditation
      2. Personnel certification
      3. Standardization
   B. QA/QC Application
      1. Definitions
      2. Validation and verification
      3. Controls and standard reference materials
      4. Proficiency Testing
   C. Document/Data Management
      1. Databases
      2. Case document preservation/integrity

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V. Safety
- A. Chemical Hygiene
  1. Safety labeling (MSDS)
- B. Universal Precautions
  1. Blood born pathogens
  2. Person protective equipment
- C. Hazardous Waste/Biohazardous Waste Handling
  1. Spill control

VI. Legal
- A. Decisions/laws
  1. *Frye*
  2. *Daubert* and related decisions
- B. Legal terminology
  1. Subpoena, deposition
- C. Court Testimony
  1. Voir dire/qualification
  2. Expert witness
- D. Procedural Law
  1. Search and seizure (4^{th} Amendment)
  2. Discovery

VII. Ethics
- A. 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
- B. Evidence Characteristics (Class/Individual)
  1. Identification
  2. Primary, secondary transfers
  3. Visible vs. latent evidence
- C. Evidence Preservation and Integrity
  1. Chain of custody
  2. Alteration/degradation
- D. Evidence Packaging
  1. Proper sealing
  2. Types of packaging

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IX. General Science Terms and Principles
- A. Definitions and applications
  1. Scientific Method
  2. Microscopy
  3. Instrumentation
- 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
- C. General Biology Concepts
  1. Cell structure
  2. Genetics
  3. 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. Central tendency
  2. Variation
  3. Population characteristics
- G. Stoichiometry
- H. Logic
- I. Metric System
  1. Metric to metric conversion
  2. Metric to English conversion

X. Theory and Application
- A. Forensic biology
  1. Analytical Techniques
  2. Instrumentation
  3. Data Interpretation
- B. Controlled substances
  1. Analytical Techniques
  2. Instrumentation
  3. Data Interpretation
- C. Trace analysis
  1. Analytical Techniques
  2. Instrumentation
  3. Data Interpretation

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D. Toxicology
    1. Analytical Techniques
    2. Instrumentation
    3. Data Interpretation

E. Latent fingerprints
    1. Analytical Techniques
    2. Instrumentation
    3. Data Interpretation

F. Questioned documents
    1. Analytical Techniques
    2. Instrumentation
    3. Data Interpretation

G. Fire debris
    1. Analytical Techniques
    2. Instrumentation
    3. Data Interpretation

H. Firearms/Toolmarks
    1. Analytical Techniques
    2. Instrumentation
    3. Data Interpretation

I. Pattern evidence
    1. Analytical Techniques
    2. Instrumentation
    3. Data Interpretation

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References

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.

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

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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.

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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 Code 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

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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

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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

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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

21. Which of the following pairs of compounds are enantiomers?

    a. psilocin and psilocybin
    b. LSD and Lampa
    c. d-cocaine and l-cocaine
    d. phentermine and methamphetamine

22. How will the Rf values for eluents most likely be affected if a TLC tank is not kept saturated with the developing solvent?

    a. They will increase.
    b. They will decrease.
    c. They will increase or decrease unpredictably.
    d. They will not be affected.

23. If the IR absorbance spectrum for a previously unidentified drug matches that of an l-amphetamine HCL standard, which of the following would be a justifiable conclusion?

    a. The unknown is l-amphetamine hydrochloride.
    b. The unknown could be d-amphetamine hydrochloride.
    c. The unknown could be l-amphetamine sulfate.
    d. The unknown could be methamphetamine hydrochloride.

24. With which one of the following drugs will the Marquis reagent *NOT* produce a colored reaction product?

    a. morphine
    b. mescaline
    c. amphetamine
    d. barbiturate

25. Which one of the following reagents would be most useful for visualization and differentiation of the various cannabinoids separated from a marijuana extract on a TLC plate?

    a. Ninhydrin and UV light
    b. Dragandorff reagent
    c. Fast blue 2B
    d. Fluram

26. Which one of the following terms names the functional group responsible for the absorption of ultraviolet or visible radiation?

    a. chromophore
    b. auxochrome
    c. bathochrome
    d. hypsochrome

27. The term "theoretical plate" refers to which one of the following parameters in gas chromatography?

    a. retention time
    b. polarity
    c. efficiency
    d. stationary phase thickness

28. 250 mg of heroin standard is dissolved in 25 mL of a solvent. 1mL of this solution is added to 5 mL of an internal standard solution and then diluted with more solvent to a final volume of 10 mL. What is the final concentration of the heroin standard?

    a. 0.10 mg/mL
    b. 0.25 mg/mL
    c. 1.00 mg/mL
    d. 2.50 mg/mL

29. What is an MSDS?

a. A document of chemical safety.
b. An instrument for chemical analysis.
c. A technique for testing DNA.
d. A type of explosive material.

30. In microscopy, which one of the following terms describes the relationship between retardation and thickness?

a. Aberration
b. Dispersion
c. Scattering
d. Birefringence

31. Which of the following statements BEST describes the phenomenon of pH?

a. The negative log of the hydrogen ion concentration.
b. The positive log of the hydrogen ion concentration.
c. The difference between the concentrations of the hydrogen ions and the hydroxyl ions
d. The titer of the hydrogen ions in solution.

32. Which of the following actions is not forbidden by the ABC Code 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.

33. Ohm's law interrelates potential (volts) to _____?

a. Power
b. Joules
c. Resistance
d. Conductance

34. What is the range of probabilities that two genes on the same chromosome will remain together after meiosis?

a. 5% to 25%
b. 1% to 99%
c. 25% to 75%
d. 50% to 99%

35. Which of the following assumptions is required in order to use the product rule

a. Hardy-Weinberg equilibrium
b. Dependent inheritance of the genetic markers
c. Independent inheritance of the genetic markers
d. Proper statistical sampling of the population

36. A nucleic acid must contain a nitrogenous base and which of the following?

I. Aromatic ring
II. 4-carbon ring
III. 5-carbon ring
IV. phosphate

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

37. What are the four nucleotides found in DNA?

a. thiamine, adenine, guanine, cysteine
b. alanine, guanine, cytosine, thiamine
c. cytosine, thymine, guanine, adenine
d. adenine, cysteine, thymine, guanine

38. Which of the following factors DO NOT affect the migration of DNA fragments through an electrophoretic system?

I. pore size
II. tracking dye
III. DNA shape

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

39. A three banded isoenzyme pattern with a 1:2:1 intensity ratio indicates a _____ protein.

a. monomeric
b. dimeric
c. trimeric
d. tetrameric

40. Consider the following data describing a genetic marker:

1-1 N = 120
2-1 N = 90
2-2 N = 60

The Probability of Discrimination (PD) for the genetic marker is described by the data above is:

a. 0.10
b. 0.29
c. 0.71
d. 0.90

41. What are organic compounds having the basic formula NH_2-R-COOH (where R = an aliphatic or aromatic side chain) that are polymerized to form peptides and proteins termed?

a. amino acids
b. enzymes
c. phospholipids
d. polysaccharides

42. Detection of p30 in a questioned stain would allow identification of semen from individuals who are classified as:

a. anemic
b. aspermic
c. nonsecretors
d. secretors

43. Which one of the following products would be expected to contain the **HIGHEST** concentration of aromatic hydrocarbons?

a. Paint thinner.
b. Gasoline.
c. Kerosene.
d. Coleman fuel.

44. The transfer of heat energy through a solid material by contact between its moving molecules is called:

a. Conduction.
b. Convection.
c. Radiation.
d. Direct flame impingement

45. Which of the following classes of compounds is the **MOST** indicative of gasoline?

a. Polynuclear hydrocarbons.
b. Aliphatic hydrocarbons.
c. Alicyclic hydrocarbons.
d. Aromatic hydrocarbons

46. Which of the following garments would be the most suitable for collection of trace evidence by using a tape lift technique?

a. Nylon shell windbreaker
b. Mohair sweater
c. Cotton/polyester blend dress shirt
d. Pair of blue denim trousers

47. Which of the following properties of synthetic fibers require the use of a polarized light microscope for their determination?

I. Sign of elongation
II. Birefringence
III. Extinction
IV. Modification ratio
V. Refractive index

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

48. What is phaeomelanin?

a. A reddish-brown to yellow pigment occurring in hair.
b. A sulfur-containing fibrous protein.
c. A condition of hair characterized by brittle hair with a clean break.
d. A brown pigment occurring in hair.

49. Which of the following elements would NOT normally be detected using conventional x-ray fluorescence or energy dispersive x-ray spectroscopic methods employing a beryllium window detector?

I. Lithium.
II. Chlorine.
III. Boron.
IV. Chromium

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

50. Which of the following is the most common type of external plasticizer found in the paint industry?

a. phosphates
b. butyl acrylate
c. phthalates
d. adipates