AMERICAN BOARD OF FORENSIC TOXICOLOGY

DIPLOMATE EXAMINATIONS

Study Guide for Examination Preparation

Diplomate in Forensic Toxicology (DABFT-FT)
Diplomate in Forensic Alcohol Toxicology (DABFT-FA)
Diplomate in Forensic Drug Toxicology (DABFT-FD)

Examination Content Areas

Recommended References

Sample Questions

August 2018
STUDY GUIDE FOR EXAMINATION PREPARATION

Introduction

The ABFT Diplomate Examinations are discipline-focused and designed to challenge the Candidate’s mastery of fundamental concepts applied to the practice of the specialized areas of forensic toxicology. It is recommended that the Candidate successfully complete an in-house training program prior to sitting for an examination.

Examination questions incorporate a variety of topics specific to each discipline. Detailed content areas are provided in this guide for each of the three examinations, respectively.

Each Diplomate Examination consists of 130 single answer, multiple-choice questions, distributed over the content areas as shown below. Note that examples are provided for illustration only and should not be considered exhaustive.

Candidates will be given three hours to complete an examination.

I. Content Areas: Diplomate in Forensic Toxicology (DABFT-FT)

Laboratory Practice

Laboratory organization, policy, and management; regulatory issues and guidelines; laboratory accreditation; expert testimony; laboratory procedures and calculations; statistics; quality control and quality assurance

- **Management**
  - Responsibilities
  - Legal matters
    - Rules of Evidence (Frye, Daubert, Melendez-Diaz)
    - DUI / DUID laws
  - Laboratory security
  - Chain of custody

- **Quality Assurance/Quality Control**
  - Basic concepts
  - Statistics
  - Calculations
  - Corrective action
  - Documentation
  - Method validation
  - Control charts

- **Regulatory Oversight**
  - Standards/practice guidelines
  - Accreditation
    - ABFT
    - ISO 17025/15189
  - Privacy and Confidentiality
    - HIPAA
Expert Testimony

Basic Analytical Chemistry and Procedures

Basic principles and theory; separations; laboratory techniques and instrumentation; standardization; interferences; method development and validation

- Spectroscopy – Theory and Application
  - Colorimetry
  - Micro-diffusion
  - UV/VIS
  - IR/FTIR
  - Fluorescence

- Extractions – Theory and Application
  - SPE/SSE
  - Liquid/Liquid
  - pH/pKa

- Immunoassays – Theory and Application
  - General
    - Homogeneous
    - Heterogeneous
  - Cross-reactivity/sensitivity/specificity

- Chromatography – Theory and Application
  - TLC
  - GC
  - LC
  - Detectors (Non-MS)

- Mass Spectrometry – Theory and Application
  - Ionization techniques (EI, CI, ICP, Electrospray)
  - Mass discrimination (Tandem MS, TOF, Quadrupole, Ion Trap)
  - Interferences, suppression, and enhancement

- Other – Theory and Application
  - Capillary electrophoresis
  - AAS/OES
  - Breath alcohol testing

Drugs, Xenobiotics, and Other Toxicants-Foundational

Nomenclature, chemical structure, classification of drugs and poisons; pharmacology; pharmacokinetics and pharmacodynamics

- Ethanol/Other Volatiles
  - Pharmacokinetics
  - Pharmacodynamics

- Carboxyhemoglobin/Methemoglobin

- Cyanide

- Commonly Encountered Drugs
- Opiates/Opioids
- Cannabinoids
- Stimulants
  - Cocaine
  - Amphetamines
- Hallucinogens
- Sedative/Hypnotics
  - Barbiturates
  - Benzodiazepines
  - “Z” Drugs
- Psychotherapeutics
- Novel Psychoactive Substances

- Metals – Organic and Inorganic
- Environmental and Natural Toxicants
  - Pesticides
  - Noxious Gases
  - Venoms/Antivenins

**Drugs, Xenobiotics, and Other Toxicants – Interpretative**

Interpretation of therapeutic/toxic/lethal concentrations in body fluids and tissues; postmortem changes; mechanisms of toxicity, target organs, disposition of poisons, and systemic effects; effects of underlying disease; pharmacogenomics and drug interactions; toxidromes

- Ethanol/Other Volatiles
  - Pharmacodynamics
  - Disease states
  - Post-mortem generation
- Commonly Encountered Drugs
  - Post-mortem redistribution
  - *In-vitro* and *in-vivo* stability
- Metals-Organic and Inorganic
- Clinical Toxicology
  - Treatment of Common Poisonings
    - Antidotes
  - Therapeutic drug monitoring
- DUI/DUID Testing
  - Blood Alcohol
  - Breath Alcohol

**Forensic Pathology/Toxicology Specimens**

Pathological findings related to poisonings and drug overdose deaths; toxicology specimen procedures and practices

- Autopsy Findings
  - Pulmonary edema
  - Hepatic necrosis
Cardiac pathology
  • Postmortem chemistries
  • Specimens
    o Blood
    o Urine
    o Bile
    o Vitreous humor
    o Tissues
    o Hair/nails
    o Gastric contents
    o Decomposition

History

  • Poisoners and pioneers
  • Postmortem detection of poisons
  • Separation and detection methods
  • Instrumentation

Preparation for the Diplomate Examination in Forensic Toxicology should include review of the content areas cited above. Numerous toxicology references and resources are available, to include general laboratory practice and methods, commonly encountered drugs and poisons, regulatory issues, et al. The most current information is found in peer-reviewed journals, workshops, and meetings. Table 1 illustrates the percent contribution of examination content areas.

Table 1: Percent Contribution of Content Areas

<table>
<thead>
<tr>
<th>Content Area</th>
<th>Laboratory Practice</th>
<th>Analytical Procedures: Basic Chemistry</th>
<th>Drugs, Xenobiotics and Toxicants: Foundational</th>
<th>Drugs, Xenobiotics and Toxicants: Interpretative</th>
<th>Pathology and Specimens</th>
<th>Regulatory Issues</th>
<th>History</th>
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II. Content Areas-Diplomate in Forensic Alcohol Toxicology (DABFT-FA)

Laboratory Practice

Laboratory organization, policy and management; regulatory issues and guidelines; laboratory accreditation; expert testimony; laboratory procedures and calculations; statistics; quality control and quality assurance; breath and blood testing

  • Management
    o Responsibilities
    o Legal matters
      • Rules of Evidence (Frye, Daubert, Melendez-Diaz)
      • DUI/DUID laws
• Quality Assurance/Quality Control
  o Basic concepts
  o Statistics
  o Measurement of uncertainty
• Expert Testimony

**Basic Analytical Chemistry and Procedures**

Basic principles and theory; separations; laboratory techniques and instrumentation; standardization, interferences; method development and validation

• General chemistry of alcohols
• Wet Bath Simulators – Theory and Application
  o Partition ratio
  o Temperature
• Dry Gas – Theory and Application
  o Barometric pressure
  o Offset
• Blood Alcohol
  o Antemortem and postmortem
  o Whole blood
  o Serum
• Chromatography/Headspace Autosamplers – Theory and Application
  o Columns
  o Gases
  o Detectors
  o Peak shape
• Breath Alcohol/Breath Alcohol Instrumentation
  o Theory
  o Blood/Breath Ratio
  o Detector types
  o Electronics

**Ethanol Pharmacology and Pharmacokinetics – Foundational and Interpretative**

• Pharmacology
• Pharmacokinetics
• Calculations
  o Widmark
  o Retrograde Extrapolations

**Alcohol and Drugs**

• Common Drug-Ethanol Interactions
  o Synergistic effects
  o Additive effects
History

- Pioneers
- Evolution of breath testing

Preparation for the Diplomate Examination in Forensic Alcohol Toxicology should involve review of the content areas cited above. Numerous forensic alcohol toxicology references and resources are available, to include general laboratory practice and methods, medicolegal aspects, et al. The most current information is found in peer-reviewed journals, workshops, and meetings. Table 2 illustrates the percent contribution of examination content areas.

Table 2: Percent Contribution of Content Areas

<table>
<thead>
<tr>
<th>Certificant Category</th>
<th>Laboratory Practice</th>
<th>Analytical Procedures: Basic Chemistry</th>
<th>Pharmacology and Pharmacokinetics - Foundational</th>
<th>Pharmacology and Pharmacokinetics: Interpretative</th>
<th>Ethanol and Other Drugs</th>
<th>Regulatory Issues</th>
<th>History</th>
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III. Content Areas-Diplomate in Forensic Drug Toxicology (DABFT-FD)

Laboratory Practice

Laboratory organization, policy and management; regulatory issues and guidelines; laboratory accreditation; expert testimony; laboratory procedures and calculations; statistics; quality control and quality assurance

- Management
  - Responsibilities
  - Legal matters
  - Laboratory security
  - Chain of custody
- Quality Assurance/Quality Control
  - Basic concepts
  - Statistics
  - Calculations
  - Corrective action
  - Documentation
  - Method validation
- Regulatory Oversight
  - Accreditation
    - HHS/NLCP
    - CAP
    - State regulations
  - Privacy/Confidentiality
- HIPAA
  - Rules of Evidence (Frye, Daubert, Melendez-Diaz)
  - Expert Testimony

**Basic Analytical Chemistry and Procedures**

Basic principles and theory; separations; laboratory techniques and instrumentation; standardization; interferences; method development and validation

- Spectroscopy – Theory and Application
  - Colorimetry
  - UV/VIS
  - IR/FTIR
  - Fluorescence
- Extractions – Theory and Application
  - SPE/SSE
  - Liquid/Liquid
  - pH/pKa
- Immunoassays – Theory and Application
  - General
    - Homogeneous
    - Heterogeneous
  - Cross-reactivity/sensitivity/specificity
- Chromatography – Theory and Application
  - TLC
  - GC
  - HPLC
  - Detectors (Non-MS)
- Mass Spectrometry – Theory and Application
  - Ionization Techniques (EI, CI, ICP, Electrospray)
  - Mass Discrimination (Tandem MS, TOF, Quadrupole, Ion Trap)
  - Interferences, suppression, and enhancement

**Drugs, Xenobiotics, and Other Toxicants – Foundational**

Nomenclature, chemical structure, classification of drugs and poisons; pharmacology; pharmacokinetics and pharmacodynamics

- Commonly Encountered Drugs
  - Opiates/Opioids
  - Cannabinoids
  - Stimulants
    - Cocaine
    - Amphetamines
  - Hallucinogens
  - Sedative/Hypnotics
    - Barbiturates
    - Benzodiazepines
“Z” Drugs
  - Psychotherapeutics
  - Novel Psychoactive Substances

Regulated Drug Testing

- HHS/NLCP
  - Cut-offs
  - Specimen validity testing
  - Security
  - Sample handling
  - Screening and confirmation
  - Interpretation/MRO

History

- Separation and detection methods
- Workplace drug testing

Preparation for the Diplomate Examination in Forensic Drug Toxicology should include review of the content areas cited above. Numerous toxicology references and resources are available, to include general laboratory practice and methods, workplace drug testing, et al. The most current information is found in peer-reviewed journals, workshops, and meetings. Table 3 illustrates the percent contribution of examination content areas.

Table 3: Percent Contribution of Content Areas

<table>
<thead>
<tr>
<th>Content Area</th>
<th>Laboratory Practice</th>
<th>Analytical Procedures: Basic Chemistry</th>
<th>Drugs: Foundational and Interpretative</th>
<th>Workplace Drug Testing</th>
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</table>

Recommended References-All Examinations

The references provided below are intended to serve as a guide for examination preparation and are not exhaustive. Information may be common to several sources. Candidates are encouraged to access the most recent editions of each book cited. Books and journals should be used in conjunction with the Candidate’s training and practical experience.
Books


*Mandatory Guidelines for Federal Workplace Drug Testing Programs*, Federal Register. Substance Abuse and Mental Health Services Administration, Department of Health and Human Services

General Chemistry: Any introductory college/university text intended for science majors.

**Statistics:** Any introductory college/university text intended for science majors.

Laboratory Safety and Chemical Hygiene: Any manual appropriate for a toxicology laboratory.

**Journals**

- Forensic Toxicology
- Forensic Science International
- Journal of Forensic Sciences
- Journal of Analytical Toxicology
Sample Questions (All Diplomate Examinations)

Multiple Choice. Choose the best answer:

1. Morphine is/has:
   A. metabolized to codeine
   B. readily extracted from a strong alkaline solution
   * C. urinary metabolites to include morphine-3-glucuronide
   D. bio-transformed to 6-acetylmorphine
   E. readily extracted from a strong acid solution

2. The Federal Custody and Control Form (CCF) is comprised of 5 copies. Which of the following is **NOT** included in the CCF?
   * A. Duplicate Copy – sent to 2nd lab when retesting is requested by Donor
   B. MRO Copy – sent to the MRO
   C. Collector Copy – retained by collector
   D. Employer Copy – sent to Federal Agency
   E. Donor Copy – given to donor when collection is complete

3. Which of the following has the longest retention time on a 50% phenylmethyl or HP-17 liquid phase chromatography column?
   A. nicotine
   B. meperidine
   * C. strychnine
   D. diazepam
   E. phentermine

4. A specimen of known concentration used to verify a calibration is a:
   * A. calibrator
   B. control
   C. reference
   D. duplicate
   E. blank

5. A 200-pound male consumes six 12-ounce beers and two 1-ounce shots of whiskey (100 proof) between 9:00 pm and 11:00 pm. A breath alcohol test performed at 1:00 am would be expected to give an ethanol concentration range of (g/210 L):
   * A. 0.04-0.06
   B. 0.07-0.09
   C. 0.10-0.12
   D. 0.13-0.15
   E. 0.16-0.18