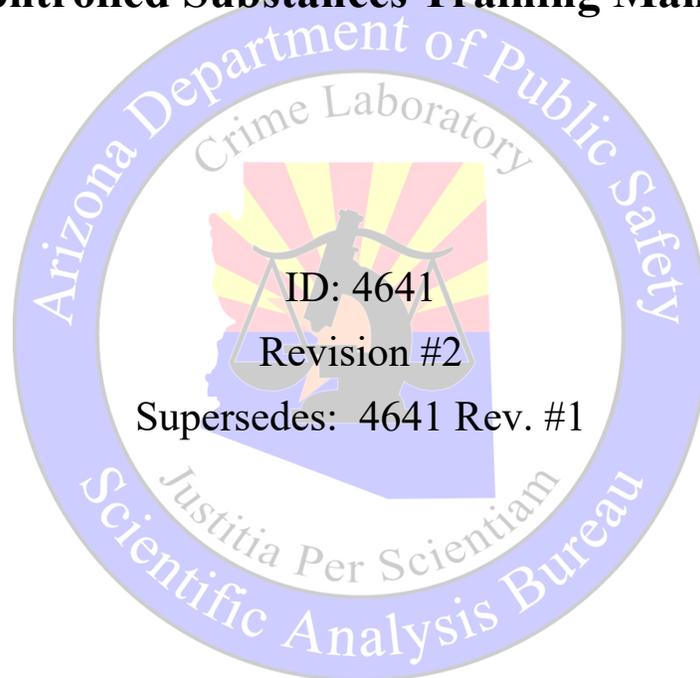


Arizona Department of Public Safety

Scientific Analysis Bureau

Controlled Substances Training Manual



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SAB Superintendent

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1 Controlled Substance Training Program Overview**1.1 Goal:**

To produce a qualified, professional, and competent Controlled Substance Analyst. By the end of training, the trainee will be proficient in the following areas:

- Be knowledgeable about common drugs of abuse.
- Accurately analyze controlled substance evidence.
- Know and understand applicable controlled substance laws and regulations.
- Know and apply laboratory protocols and policies.
- Use accepted practices of evidence handling and documentation.
- Write appropriately worded examination reports.
- Communicate effectively in court.

1.2 Scope:

This manual facilitates uniform training in controlled substance examination for forensic scientists of the Arizona Department of Public Safety Crime Laboratory. It outlines a formal training program and provides standardized criteria for establishing the competency of controlled substance trainees throughout the laboratory system. This course of instruction is designed to serve the following training needs:

- Entry level training for new employees who have taken college level chemistry and have acquired a basic grasp of chemistry.
- Refresher training for experienced forensic scientists.
- Remedial training for experienced forensic scientists.

The controlled substance training program, divided into 16 modules, is designed to cover the six main drug categories, instrumentation used in controlled substance analysis, applicable policies and procedures, safety, report writing and court testimony.

- Phase 1 - Sections 1-7, to qualify for marijuana/cannabis examination
- Phase 2 - Sections 8-10, to qualify for CNS stimulant examination
- Phase 3 - Sections 11-12, to qualify for narcotic analgesic and hallucinogen examination
- Phase 4 - Sections 13-14, to qualify for CNS depressant and anabolic steroid examination
- Phase 5 - Section 15-16, to prepare the trainee for oral board evaluation and court testimony

At the conclusion of each phase, 1-4, the technical lead will evaluate the trainee's written answers to the Study Questions for the relevant section(s), the trainee's answers on a written examination, the trainee's analysis of the competency unknowns and the corresponding feedback provided to the trainee.



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The trainee will not be approved for casework until both a mock trial and an oral board are satisfactorily completed. If the trainee is going to complete the entire training program prior to beginning casework only one mock court and one oral board are required. If the trainee is going to begin the corresponding casework after each phase of training, a mock court and an oral board are required after both Phase 1 and Phase 2.

It is required that Phase 5 be completed prior to any casework being performed.

The course is designed to be presented in a working forensic laboratory. It uses structured presentations, discussions, study questions, practical exercises and the observation of actual controlled substance casework and court testimony. The trainee will not only be interacting with one or more designated trainers, but also with other experienced controlled substance examiners. It is the trainer's responsibility to see that the most current training materials are available.

1.3 Length:

The training program is designed to produce a competent controlled substance analyst. The length of time to accomplish this is partly dependent on the trainee and will vary based on their ability to learn and retain the information. Generally, if the trainee does not perform any casework during the training period, the training program requires about six months to complete. If the trainee stops to work cases after each phase (1-4), the training program can require up to twelve months to complete.

1.3.1 The course syllabus is organized into fifteen major topics. The trainer shall determine the order in which the material shall be presented. Two or more course topics may be presented simultaneously, if desired. If the trainee has prior experience or training related to portions of the course material, the trainer, with approval from the technical leader, may elect to shorten or omit corresponding course presentations. The trainee will still be required to successfully complete a written examination and competency unknowns corresponding to the shortened or omitted presentations. The trainer, in such cases, may require work on fewer study questions, but must require work on all study questions marked as critical knowledge questions in the training manual. In the case of refresher or remedial training, the trainer may confine training to those areas of concern. If certain practical exercises are no longer relevant, the trainer, with approval from the technical leader, may reduce the number of practical exercise required.

1.4 Evaluation:

1.4.1 During periods of training, the trainee will meet weekly with the mentor, the discipline training coordinator and the trainee's supervisor. The trainee will be provided with written feedback regarding the previous week's training and expectations for the next week. The feedback will cover what was accomplished, any suggestions for improvement, any changes to the previously agreed upon expectations for the week and appropriate positive feedback.

1.4.2 All study questions will be reviewed by the trainer and either written or oral feedback provided to the trainee. The trainer must ensure that the trainee has a complete understanding of the bold questions and is comfortable with all the questions. The

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feedback will be provided to the trainee prior to the administration of the written exam for the corresponding phase of training.

- 1.4.3 The answers to the competency samples and all notes and instrument data associated with the samples will be reviewed by the trainer. Written feedback will be provided to the trainee prior to the trainee being authorized for casework in the corresponding drug categories. The written feedback will indicate if the correct answer has been obtained and include any suggestions in analysis approach or note taking.
- 1.4.4 The trainee will be provided with feedback within two days of each oral board and mock trial. The feedback will be provided by one or all of the technical lead, supervisor and quality assurance unit. The feedback will include positives and suggestions for improvement. The trainee will be provided with written feedback regarding any remediation that is necessary.

1.5 Successful Completion:

- 1.5.1 In order to successfully complete entry level training in controlled substance analysis, the trainee must:
- 1.5.1.1 Correctly identify all competency unknowns
 - 1.5.1.2 Perform satisfactorily on the Study Questions and Practical Exercises in the Training Manual
 - 1.5.1.3 Perform satisfactorily on written examinations; these shall cover any material in the Study Questions
 - 1.5.1.4 Perform satisfactorily in the oral board
 - 1.5.1.5 Perform satisfactorily in the mock court
- 1.5.2 Satisfactory performance on written Study Questions shall require:
- 1.5.2.1 Correct answers to most study questions
 - 1.5.2.2 Correct answers to all questions marked as critical knowledge questions in this manual
- 1.5.3 Satisfactory performance on written examinations shall require:
- 1.5.3.1 The trainee to answer questions from memory (closed book)
 - 1.5.3.2 The trainee to correctly answer 90% of exam questions
- 1.5.4 Satisfactory performance on analysis of competency unknowns shall require:
- 1.5.4.1 Correct identification of controlled substances for each of the unknowns; no false positives, no false negatives and no misidentifications
 - 1.5.4.2 Tentative identification of most of the non-controlled drugs in the unknowns
 - 1.5.4.3 Suitable analytical work to support findings
 - 1.5.4.4 Use of appropriate verbiage in reporting findings



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1.5.5 Satisfactory performance on the mock court and oral board shall require:

1.5.5.1 Appropriate responses to questions

1.5.5.2 Clear and persuasive delivery

1.5.5.3 Professional and credible demeanor

1.6 Personnel Involved in Training and the Applicable Minimum Requirements:

1.6.1 SAB Training Coordinator: Appointed by SAB Superintendent

1.6.2 Technical Lead: Appointed by SAB Superintendent

1.6.3 Discipline Training Coordinator: Appointed by technical lead. Must have at least 5 years of discipline experience.

1.6.4 Mentor: Selected by the Discipline Tech Lead, with input from the Discipline Training Coordinator. Must have Supervisor approval to be a mentor. Must be in good standing within the unit. Must have exhibited sufficient competence and sustained proficiency in the area in which guidance is provided. More than one mentor can be assigned to a trainee over the course of training; however, only one mentor can be assigned to a trainee at one time. A mentor may be assigned more than one trainee.

1.6.5 Trainer: Selected by Discipline Training Coordinator and is an employee in the discipline who has established competency and maintained proficiency in the area in which training is offered. Specific qualifications include:

1.6.5.1 The trainer must have personally completed equivalent training.

1.6.5.2 The trainer must have at least three years of experience analyzing controlled substances.

1.6.5.3 The trainer must have spent the last twelve months in controlled substance analysis and/or in supervision of controlled substance analysis.

1.6.6 Trainee: Employee in good standing with the department who has been authorized by the SAB Training Coordinator to begin training.

1.6.7 Supervisor: Trainee's Supervisor

1.6.8 Exceptions to these requirements shall be made only with technical leader approval.

1.7 Expectations:

1.7.1 All individuals involved in training, including the trainee, are expected to provide maximum effort and commitment to successfully achieve the training program goal.

1.7.2 All individuals involved in training, including the trainee, will provide documented feedback during training in order to efficiently and effectively achieve the training program goal.

1.7.3 If these expectations cannot be met, the SAB Training Coordinator will be notified immediately.

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1.8 Adjustments to Training Program

If training goals and/or expectations are not met, then changes to the training program and/or training personnel will be considered per section 6.2 of the SAB Quality Assurance Manual.

1.9 Forensic Scientists with Previous Experience

The discipline competency of forensic scientists with previous experience will be evaluated by the technical lead to determine if any parts of the training program can be omitted or shortened. The evaluation method will be thorough enough that the forensic scientist can demonstrate the continued competency in particular areas. A memo, including any supporting documentation, detailing the method of evaluation and the recommended training program adjustments shall be submitted to the SAB Training Coordinator for review and approval before training begins.

1.10 Training Records

The following records shall be retained in the trainee's training file:

- 1.10.1 Complete examination notes with findings and answer keys for all competency unknowns worked
- 1.10.2 Copies of all written Study Question answers (graded by instructor)
- 1.10.3 Written examination along with answer key
- 1.10.4 All certificates of completion or equivalent documents
- 1.10.5 Documentation of any additional testing or additional unknowns analyses

1.11 Transition into Casework

- 1.11.1 Experienced controlled substance analysts will closely monitor the newly qualified (or requalified) examiner's casework and written reports.
- 1.11.2 An experienced controlled substance analyst will accompany and monitor the newly qualified (or requalified) examiner's first court testimony.
- 1.11.3 If necessary, additional training will be used to address persistent or serious deficiencies seen in an examiner's analytical work, written reports or trial testimony.

1.12 Remediation

- 1.12.1 If a trainee performs unsatisfactorily on competency unknowns, written Study Questions, written examinations, oral board or mock court, he/she must be given additional instruction followed by further evaluation. Only upon successful completion of follow-up evaluation shall the trainee's performance be deemed to be successfully remediated.



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2 Module I - Lab and Safety Orientation

Below is a list of items that shall be reviewed with the trainee within the first weeks of training, before analytical training begins. Although review of the items below may be completed during new employee orientation, the items below have been identified as critical to the trainee's transition into the lab. Additional details about some of the items below (e.g., Lab Tour) may be found in the *New Employee Orientation Packet* located in the Supervisor's folder.

Once completed, the checklist below shall be retained in the trainee's training binder.

2.1 Lab Orientation

Introductions	Trainer	Trainee	Date Completed
SAB Superintendent			
Regional Lab Manager			
System Quality Manager			
Discipline Technical Lead			
Regional Safety Officer			
SAB Safety Officer			
SAB Training Coordinator			
Applicable General Orders			
1.2.10 DPS Mission, Values and Code of Ethics			
1.3.40 Organizational Structure, Technical Services			
2.1.10 Name, Address, and Telephone Information			
2.1.100 Harassment/Discrimination Prohibitions			
2.1.110 Contact with DOC Inmates			
2.1.120 Identification Credentials			
2.1.20 Conflict of Interest			
2.1.60 Professional Appearance Standards			
2.2.100 Performance of Essential Functions			
2.2.40 Complaints and Discipline Procedure Manual			
2.2.70 Employee Grievances			
2.3.10 Employee Assistance Program			
2.3.30 Drug-Free Workplace Program			
2.4.10 Annual and Holiday Leave Scheduling			
2.4.20 Sick Leave			
2.5.40 Performance Evaluations			
3.4.10 Safety and Loss Prevention Program			
4.1.60 Explosives and Bomb Threat incidents			
5.1.40 Smoking and Use of Tobacco			
5.1.80 Parking Assignment and Control			
5.2.110 Distracted Driving			



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5.2.20 Collisions and Incidents Involving Department Vehicles			
6.2.60 Internet Use			
7.3.20 Travel Reimbursement and Travel Charge Card			
SAB Manuals			
Quality Assurance Manuals			
General Procedures Manual			
Regional Lab Security Manual			
Unit Analytical Protocol			
Unit Training Manual			
General Orientation			
General Orders			
AZDPS Mission Statement			
SAB Mission Statement			
Work Schedule			
Timesheets			
Holidays			
Dress Code			
Expectations and Evaluations			
Verify Benefits			
Tour			
Lab			
Property and Evidence			
Things To Do			
Curriculum Vitae			
Statement of Qualifications			
ASCLD/LAB Guiding Principles (w/ SQM)			
DNA Sample			

2.2 Safety Orientation

Safety Manuals			
Chemical Hygiene Plan			
Exposure Control Plan			
General Procedures Manual 7.5 Master			
Chemical/Material Safety Data Sheets (MSDS)			
Inventory			
Safety Orientation			



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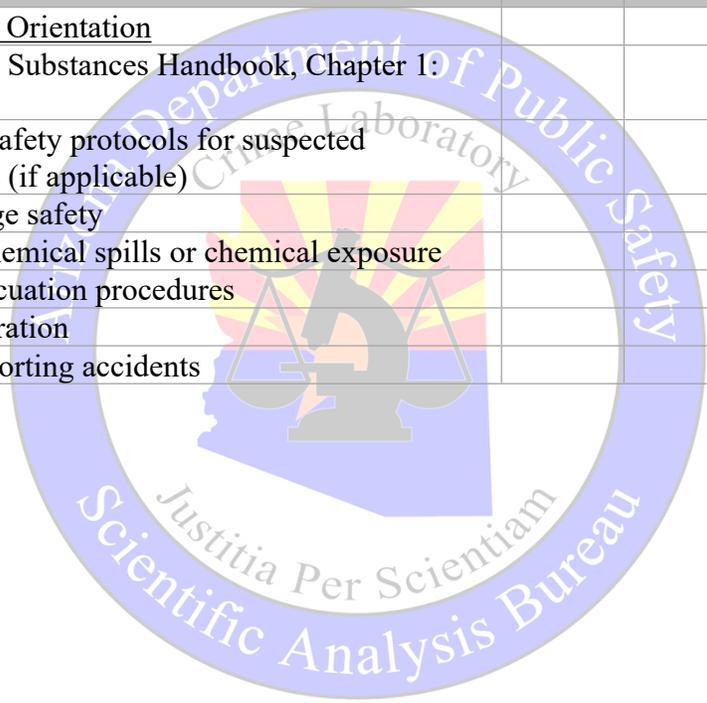
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Safety Videos			
MSDS/SDS			
AED Station			
Eyewash (Lab and Unit)			
Safety Shower (Lab and Unit)			
Fire Extinguishers (Lab and Unit)			
First Aid Kit (Lab and Unit)			
Hepatitis B Vaccination			
Biohazards, including Bloodborne Pathogens			
Sharps Containers			
Glass Waste			
<u>Unit Specific Safety Orientation</u>			
DPS Controlled Substances Handbook, Chapter 1: Safety			
Knowledge of safety protocols for suspected clandestine labs (if applicable)			
Chemical storage safety			
Response for chemical spills or chemical exposure			
Emergency evacuation procedures			
Fume hood operation			
Protocol for reporting accidents			



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3 Module II - Marijuana/Cannabis**3.1 Objectives**

- 3.1.1 The training will equip the trainee to:
 - 3.1.1.1 Be familiar with Marijuana plant material and related substances
 - 3.1.1.2 Select and conduct appropriate tests for Marijuana and related substances
 - 3.1.1.3 Identify Marijuana and related substances
 - 3.1.1.4 Appropriately report findings

3.2 Assigned Reading

- 3.2.1 To be assigned to trainee by discipline training coordinator at the beginning of this module.

3.3 Helpful Reading

- “A Study of False Positives in the Chemical Identification of Marijuana”, Microgram, Robert B. Hughes and Victor J. Warner Jr., Vol. IX No. 7, July 1976, pp 94-101 (also in Journal of Forensic Sciences Aug 1977)
- “An Improved Thin Layer Chromatographic Method for the Detection of Cannabinoids in Cannabis”, Forensic Science International, K. Lavanya and T. R. Bagg, Vol. 47 No. 2, Sept. 1990, pp 165-171
- “Analysis of Old Samples of Cannabis Sativa L.”, A.H. der Marderosian and S.N.S. Murthy, Journal of Forensic Sciences, Nov 1973
- Analytical Profiles of the Hallucinogens, CND Analytical, pp 85-87
- Botany: the Unstabilized Species, Marijuana in Science and Medicine, Gabriel G. Nahas, Raven Press, 1984, (Note: Marijuana in Science and Medicine is a rewrite of ‘Marijuana-Deceptive Weed’ by the same author), pp 3-36
- “Cannabinoid Composition and Gland Distribution in Clones of Cannabis Sativa L. (Cannabaceae)”, Jocelyn C. Turner, John Hemphill and Paul Mahlberg, Bulletin on Narcotics, Vol. XXX No. 1, Jan.-Mar. 1978, pp 55-66
- “Cannabis Intoxication and Mental Illness”, Marijuana in Science and Medicine, Gabriel G. Nahas, Raven Press, 1984, pp 263-306
- Cannabis, Manual of Cultivated Plants, Revised Edition, L. H. Bailey, Macmillan Publishing Co., 1949, page 341
- “Cannabis: Pharmacology and Interpretation of Effects”, Journal of Forensic Sciences, Andrew P. Mason and Arthur J. McBay, Vol. 30 No. 3, July 1985, pp 615-631
- Cannabis: Marijuana Identification Manual, Georgia Bureau of Investigation, Rev 1, 06222005, pp 1-36 & supplement (microscopic photographs)
- “Characterization of the Basic Fraction of Marijuana Smoke by Capillary GC/MS”, Franco Merli, Donald Wiesler, Michael Maskarinec, Milos Novotny, Dan Vassilaros and Milton Lee, Analytical Chemistry, Vol. 53, No. 12, October 1981, pp 1929-1935
- Chemistry, Metabolism, and Pharmacokinetics of the Cannabinoids, Marijuana in Science and Medicine, Gabriel G. Nahas, Raven Press, 1984, pp 37-108

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- “Chromatographic and Spectrographic Profiles of Cannabis of Different Origins, Part I”, Journal of Forensic Sciences, Rudolf Brenneisen and Mahmoud Elsohly, Vol. 33 No. 6, Nov. 1988, pp 1385-1404
- “Concerning the Duquenois Test for the Identification of Hashish and Marijuana”, Microgram, K.A. Kovar, M. Keck and Th. Krieger, Vol. XXII No. 7, July 1989, pp 127-130
- “Constituents of Cannabis sativa L. XXIV: The Potency of Confiscated Marijuana, Hashish, and Hash Oil over a 10 Year Period”, Journal of Forensic Sciences, Mahmoud A. Elsohly et al, Vol. 29 No. 2, Apr. 1984, pp 500-514
- “Delta-1-Tetrahydrocannabinolic acid, an Important Component in the Evaluation of Cannabis Products”, R.A. De Zeeuw, TH.M. Malingré & F.W.H.M. Merkest, Journal of Pharmaceutical Pharmacology, 1972, Vol. 24, pp 1-6
- “Detection and Analysis of Paraquat in Confiscated Marijuana Samples”, Carton, Turner, Cheng, Torres and Elsohly, Bulletin on Narcotics, Vol. XXX No. 4, Oct.-Dec. 1978, pp 47-56
- “Further Study and Results of Marijuana Identification”, Kenneth W. Goddard, San Bernardino Sheriff’s Department Crime Laboratory memo
- “Identification of Δ^1 -3,4 cis-Tetrahydrocannabinol in Marijuana”, R. Martin Smith and Kenneth D. Kempfert, Microgram, Vol. X, No. 5, May 1977, pp 63-71
- “Interrelationships of Glandular Trichomes and Cannabinoid Contents II, Developing Vegetation Leaves of Cannabis sativa L. (Cannabaceae)”, Bulletin on Narcotics, J. C. Turner et al, Vol. XXXIII No. 3, 1981, pp 63-71
- “Marijuana Chemistry”, Raphael Mechoulam, Science, 5 June 1970, Vol. 168, No. 3936, pp 1159-1166
- Marijuana Pharmacokinetics and Pharmacodynamics, Cocaine, Marijuana, Designer Drugs: Chemistry, Pharmacology and Behavior, (Chapter 10, C. Nora Chiang and Gene Barnett) Kinfe K. Redda et al, CRC Press, 1989, pp 113-126
- Marijuana, Basic Training for Forensic Drug Chemists, DEA, 2006
- Marijuana, Drug Identification Bible, 2006 Edition, pp 419-473
- Marijuana, The Botany and Chemistry of Hallucinogens, Richard Evans Schultes et al, Charles C. Thomas Publisher, 1973, pp 52-65
- Martindale, the Extra Pharmacopoeia, 29th Edition, the Pharmaceutical Press, pp 1553-1554
- “Mass Spectrometric Differentiation of Cannabinoid-Containing Samples”, Journal of Forensic Sciences, J. H. Liv and M. P. Fitzgerald, Vol. 25 No. 4, Oct. 1980, pp 815-820
- Toxicology and Pharmacology, Marijuana in Science and Medicine, Gabriel G. Nahas, Raven Press, 1984, pp 109-246
- “Notes on Marijuana Identification in Criminal Cases”, Michael H. Metzger, Clinical Toxicology, Vol. 8, No. 4, 1975, pp 465-473
- “Pyrolysis of Cannabinoids: A Model Experiment in the Study of Cannabis Smoking”, Bulletin on Narcotics, H. J. W. Spronck et al, Vol. XXX No. 3, July-Sept. 1979, pp 55-60
- “Synthetic Tetrahydrocannabinol”, Journal of Forensic Sciences, K. T. Churchill, Vol. 28 No. 3, July 1983, pp 762-772
- “The Botany & Chemistry of Cannabis”: Proceedings of a Conference organized by the Institute for the Study of Drug Dependence at the Ciba Foundation 9-10 April 1969, C.R.B. Joyce & S.H. Curry, Churchill: London, 1970

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- “The Decomposition of Acidic and Neutral Cannabinoids in Organic Solvents”, R.N. Smith and C.G. Vaughan, *Journal of Pharmaceutical Pharmacology*, 1977, Vol. 29, pp 286-290
- “The Effects of the Smoking Process on Cannabinols”, Antony Coutselinis & C. Miras, *Journal of Forensic Medicine*, Vol. 18, No. 3, July-September 1971, pp 108-113
- “The Forensic Identification of Marijuana: Some Questions and Answers”, J.I. Thornton and G.R. Nakamura, *Journal of Police Science and Administration*, 1973, Vol. 4 No. 1, pp 102-112
- “The Forensic Taxonomic Debate on Cannabis: Semantic Hokum”, E. Small, *Journal of Forensic Sciences*, Vol. 21 No. 2, April 1976, pp 239-251
- “The Furfural Test for Cannabis: An Evaluation and Modification”, *Bulletin on Narcotics*, C. A. Lau-Cam and J. McDonnell, Vol. XXX No. 2, Apr.-June 1978, pp 63-68
- “The Identification of Marijuana”, J.I. Thornton and G.R. Nakamura, *Journal of Forensic Science Society*, 1972, Vol. 12, pp 461-519
- The Medical Use of Cannabis, Marijuana in Science and Medicine, Gabriel G. Nahas, Raven Press, 1984, pp 247-262
- The Pharmacological Basis of Therapeutics, 8th Edition, Pergamom Press, pp 549-553
- “The Specificity of the Duquenois Color Test for Marihuana and Hashish”, C.G. Pitt, R.W. Hendron and R.S. Hsia, *Journal of Forensic Sciences*, Vol. 17, No. 4, Oct 1972, pp. 693-700
- “The Value of the Duquenois Test for Cannabis- A Survey”, Keith Bailey and D. Phil, *Journal of Forensic Sciences*, Vol. 24, No.4, May 1979, pp. 817-841
- “Trichomes of the Mulberry, Morus Nigra”, *Microgram*, Ralph S. Maloney and John I. Thornton, Vol. XV No. 5, May 1982, pp 78-79
- “Two Simple Colour Tests for Cannabis”, *Bulletin on Narcotics*, M.J. de Faubert Maunder, Vol. XXI, No. 4, October-December 1969, pp 37-43
- “When Friends or Patients Ask About... Marihuana”, Gabriel G. Nahas, *Journal of the American Medical Association*, Vol. 233, No. 1, July 1975, pp 79-80

3.4 Study Questions

(Questions in bold type are critical questions.)

1. **Describe the appearance and location of the three types of hairs on marijuana.**
2. What mineral accumulates in marijuana cystoliths?
3. **Is the occurrence of cystoliths unique to marijuana?**
4. Describe the venation of a marijuana leaf. (Use a sketch if needed.)
5. What is sinsemilla?
6. What plants other than marijuana are members of the family Cannabinaceae?
7. State at least two differences in the appearance of male and female marijuana plants.

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8. Is marijuana an annual or a perennial plant?
9. What part of the marijuana plant bears the most resin?
10. Describe the shape of the dicot leaves which a marijuana seedling puts forth before the characteristic palmate leaves appear.
11. **The Duquenois-Levine test is a test for what?**
12. **In this laboratory, what chemicals are used to make Duquenois reagent?**
13. What is the purpose of running a blank in the Duquenois-Levine test?
14. What is an advantage of using a petroleum ether extraction prior to running a Duquenois-Levine test?
15. What response does tobacco give to the Duquenois-Levine test?
16. List at least three factors concerning the condition of a marijuana sample which might make it give little or no response to the Duquenois-Levine test.
17. Assume a marijuana sample gives a very weak response to the Duquenois-Levine test. Suggest how the color response could be intensified to make the test more readable.
18. What spray reagent does this laboratory routinely use to locate cannabinoid spots on TLC plates?
19. Describe how one could test marijuana seeds for fertility in the laboratory.
20. **According to the “Drug Offenses” chapter of the Arizona Revised Statutes, what is the botanical origin of “cannabis” or “marijuana”?**
21. According to the same “Drug Offenses” chapter mentioned above, what is the basic difference between “cannabis” and “marijuana”?
22. What substance would satisfy the ARS statutory definition of “cannabis”, even if it had been manufactured, rather than plant-derived?
23. **What constitutes a usable quantity of marijuana?**
24. Suggest a situation in which a one pound quantity of marijuana would not be a usable quantity.

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25. Suggest a situation in which a 50 milligram quantity of marijuana would be a usable quantity.
26. A baggie with a tare weight of 1.00 gram contains 3.00 grams of leafy material which consists of marijuana and parsley in equal amounts. What weight should be reported as the "substance weight" of the item?
27. How is hashish oil used?
28. Give an example of a drug offense (under Arizona criminal statutes), for which usability is required for a quantity of controlled substance to be chargeable.
29. Give an example of a drug offense (under Arizona criminal statutes), for which usability is not required for prosecution.
30. Is usability a requirement for prosecution under Federal law?
31. Assume you are asked to test some brownies for the presence of marijuana. How should you examine them for marijuana?
32. List three clues that a cigarette might be laced with PCP or some other non-plant drug.
33. What precautions should one take when handling moldy marijuana?
34. Why should freshly picked marijuana plants not be packaged in plastic bags?
35. What are two problems one might encounter in identifying marijuana seedlings?
36. Name at least two commercial marijuana plant products.
37. Why is fresh hashish solid while fresh hashish oil is a liquid?
38. How can one distinguish hashish or kief from ground up marijuana?
39. Marijuana literature often refers to $\Delta 1$ THC, $\Delta 6$ THC, $\Delta 8$ THC and $\Delta 9$ THC. Which of these isomer designations apply to the same structure? (Match the identical isomers together.)
40. **Describe how the Duquenois-Levine test is done. Assume the specimen is marijuana with plenty of resin. Indicate at each step, what color result marijuana would give.**
41. List at least three physiological or psychological effects of marijuana use.
42. Is marijuana monoecious or dioecious? What does this mean?

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43. List four common cannabinoids.
44. What do the following street terms mean?
Roach -
Bong -
45. **Describe the appearance of a marijuana seed.**
46. What is the supposed advantage of smoking marijuana in a water pipe as opposed to smoking it in cigarettes?
47. Generally, marijuana grown for resin yield is grown to maturity as a crop consisting of:
(Select best answer.)
Female plants
Male plants
A 50-50 mix of male and female plants
48. Mention at least two features of marijuana stalks.
49. Under Arizona criminal drug statutes, statutory marijuana is:
- a dangerous drug
 - a narcotic drug
 - a regulated chemical
 - none of the above
50. **If the THC has been extracted from the plant marijuana, leaving the plant intact, is the plant still controlled? What test(s) should be done to prove this occurrence?**
51. **Is the hemp plant the same as marijuana?**
52. Does the male plant produce physiologically active resin?
53. **Based on the Protocol for Marijuana, list what tests are required for each of the following samples:**
- **Marijuana (as crushed plant material)**
 - **Marijuana plants**
 - **Hashish**
 - **Hashish oil**

Synthetic Cannabinoid Study Questions

1. **What is the slang term “spice” referring to?**

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2. **What is the ARS term “cannabimimetic substances” referring to?**
3. **Where in the ARS are the cannabimimetic substances listed? (examples: under narcotic drugs, dangerous drugs, peyote or marijuana)**
4. **True or False. Like all of the other substances in the ARS, every cannabimimetic substance is specifically listed. There are a finite number of cannabimimetic substances.**
5. If you came across a new synthetic cannabinoid in casework, how would you determine if it was controlled by the ARS?
6. **What is the minimum testing scheme under our current Controlled Substances Protocol for Chemical Identification of Organic Compounds? How does this apply to testing synthetic cannabinoids?**
7. **What is the minimum testing scheme for reporting “No narcotic or dangerous drugs detected”?**

3.5 Practical Exercises

- 3.5.1 Examine the plant materials provided by your training instructor. Conduct only microscopic and color tests on these materials. Closely record your microscopic observations and the results of your color tests. Which of these materials would you consider to be marijuana?
- 3.5.2 Obtain from your training instructor samples of marijuana, hashish, and hashish oil. Analyze these by TLC, extracting first with solvent if necessary.
- 3.5.3 Run a GC and/or GC/MS of the same samples in Exercise 3.5.2, and compare the results to those obtained by TLC: are they consistent?
- 3.5.4 Obtain a spice sample from your training instructor. Analyze by GC/MS and identify any cannabimimetic substances found.

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4 Module III - Laws and Regulations**4.1 Objectives**

4.1.1 The training will equip the trainee to:

4.1.1.1 Be familiar with ARS 13-3401 and its classification of controlled substances

4.1.1.2 Be familiar with the federal Controlled Substance Act and its schedules

4.1.1.3 Understand “usable quantity” as used in Arizona courts

4.1.1.4 Understand how “prescription-only” status is determined

4.2 Assigned Reading

4.2.1 To be assigned to trainee by discipline training coordinator at the beginning of this module.

4.3 Helpful Reading

4.3.1 “The Controlled Substance Act”, Drug Identification Bible, any edition

4.4 Study Questions**(Questions in bold type are critical questions.)**

1. What does ARS 13-3401 cover?
2. Is marijuana a narcotic or dangerous drug under ARS?
3. Is cannabis a narcotic or dangerous drug under ARS 13-3401?
4. Most of the controlled substances listed under “narcotic drug” are narcotic analgesics (opiates). Name two non-opiates in this list.
5. What four categories of controlled substances fall under the “dangerous drug” definition of ARS 13-3401?
6. What ARS classification do the following fall under?
 - Methamphetamine
 - Testosterone propionate
 - Pseudoephedrine (2 capsules)
 - Pseudoephedrine (100 grams)
 - Peyote
 - Hashish
 - Iodine
 - Gamma Butyrolactone
 - 1-Piperidinocyclohexane carbonitrile

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- Mescaline sulfate powder
7. Would a commercially prepared morphine sulfate injectable be a prescription-only preparation under ARS 13-3401? Why or why not?
 8. Heroin is not listed directly under the “narcotic drug” definition in ARS 13-3401. Why is it considered a statutory narcotic drug?
 9. What activities are included under the definition of “manufacture” in ARS 13-3401?
 10. Ethyl alcohol is mentioned under the definition of “vapor-releasing substance containing a toxic substance” in ARS 13-3401. Yet, a bottle of ethyl alcohol would not be considered a vapor-releasing substance containing a toxic substance. Why not?
 11. Explain the purpose of having threshold amounts for certain controlled substances under ARS 13-3401.
 12. For purposes of determining if threshold amount is reached, what does “weight” mean in ARS 13-3401?
 13. According to ARS 13-3401, what would be four criteria that would make a drug “prescription-only”?
 14. Why are some preparations of a drug in a given dose over-the-counter, while other preparations of the same drug in the same amount are prescription-only?
 15. List three acceptable references for determining prescription status of a commercial pharmaceutical. (See Protocol for Visual Identification)
 16. What is the significance of assigning a drug to Schedule I under the Controlled Substance Act?
 17. Give three examples of drugs which appear in more than one schedule of the Controlled Substance Act.
 18. What is the effect of classifying a drug preparation as an excluded product?
 19. Give two examples of excluded drug products.
 20. Give an example of when it may be necessary to report a drug by its federal schedule, rather than by its ARS classification.
 21. **Define “usable quantity” as it is used in Arizona courts.**

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5 Module IV - Analytical Protocols

The trainee is responsible for reading the assigned analytical protocols and being able to properly apply them in casework and in routine laboratory work. Some of these protocols will be discussed in the course of working on other related sections in the syllabus. (Example: The instrumental protocols will be incorporated into the training of Instrumental Methods of Analysis.) The trainer shall determine the best time to discuss any protocols not incorporated into other sections of the training.

There are also Controlled Substances Technical Information documents, which list analytical information pertaining to individual controlled substances, their forms, applicable tests and extraction procedures. These are separate from the Protocols.

5.1 Objectives

The trainee will know and properly apply the protocols pertaining to controlled substance analysis.

5.2 Assigned Reading

5.2.1 To be assigned to trainee by discipline training coordinator at the beginning of this module.

5.3 Helpful Reading

5.3.1 None at this time

5.4 Discussion

5.4.1 Each protocol should be discussed at least briefly with the instructor.

5.4.2 Cover the following protocols in detail since they are not covered elsewhere.

5.4.2.1 20 Sampling Procedure and Testing of Multiple Specimens

5.4.2.2 21 Threshold Processing of Evidence Guidelines

5.4.2.3 23 Protocol for Reagents

5.4.2.4 24 Authentication of Drug Standards

5.4.2.5 25 Protocol for Control of Drug Standards

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6 Module V - Evidence Handling and Documentation**6.1 Objectives**

6.1.1 To introduce the trainee to:

6.1.1.1 Prescribed procedures for handling controlled substance evidence

6.1.1.2 Prescribed procedures for documenting casework

6.2 Assigned Reading

6.2.1 To be assigned to trainee by discipline training coordinator at the beginning of this module.

6.3 Helpful Reading

6.3.1 None at this time

6.4 Study Questions**(Questions in bold type are critical questions.)**

1. Who are all of the evidence custodians or acting evidence custodians at your laboratory?
2. What is a DR number?
3. Describe what a control form is and how it is used.
4. **Explain chain of custody and how its integrity is protected.**
5. How should evidence be packaged and sealed when you receive it?
6. **Describe the minimum markings and seals one should put on evidence when processing it.**
7. Discuss what measures are routinely used to prevent contamination of evidence in the laboratory.
8. What types of controlled substance evidence may pose special health hazards?
9. Assume you open some evidence and find some of it is missing. What should you do?
10. What is the laboratory's policy on handling syringes?
11. **What is the laboratory's policy on allowing defense experts to access or analyze evidence?**
12. **What markings need to appear on every page of your notes?**

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13. Per laboratory policy, what is the correct way to make a correction in one's examination notes?
14. Discuss what information examination notes should contain.

6.5 Practical Exercises

6.5.1 Visit the Property/Evidence unit for your lab.

6.5.1.1 Meet the property custodian(s).

6.5.1.2 Observe the transfer of evidence to and from the Property/Evidence unit.

6.5.1.3 Discuss use of the control forms with trainer or designee.

6.5.2 Observe at least 40 controlled substance cases being examined by experienced controlled substance analysts. At least 20 of these should be marijuana cases and at least 20 of these should be cases with non-marijuana evidence. The trainee must keep a log of DR numbers of those controlled substance analyses observed. Take particular notice of:

6.5.2.1 How chain-of-custody paperwork is handled

6.5.2.2 Marking and sealing of evidence

6.5.2.3 Choice of analytical scheme for different types of controlled substance evidence

6.5.2.4 How various tests are conducted

6.5.2.5 How notes are taken

6.5.2.6 How data is interpreted

6.5.2.7 How evidence is kept secure

Ask lots of questions, and remember: do not handle anyone's evidence without their express consent.

6.5.3 Prepare an abbreviation key listing the abbreviations you plan to use later in casework documentation.

6.5.4 (Optional) Choose or design a note-taking worksheet you would like to use for your casework later.

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7 Moduel VI - Reports**7.1 Objectives**

7.1.1 The trainee will become able to:

7.1.1.1 Compose appropriately worded reports

7.1.1.2 Generate and edit reports in LIMS

7.1.1.3 Accurately proofread reports

7.2 Assigned Reading

7.2.1 To be assigned to trainee by discipline training coordinator at the beginning of this module.

7.3 Helpful Reading

7.3.1 None at this time

7.4 Study Questions**(Questions in bold type are critical questions.)**

1. True or False: Evidence will be examined by the DPS Crime Lab only after an “Agency Request for Scientific Examination” form has been completed and a DPS DR number assigned.
2. True or False: All cases must have a report issued using LIMS.
3. **True or False: The copy of the report initialed by reviewer(s) is the original and will be retained in the Laboratory files as part of the case record.**
4. An amended report must state which of the following?
 - “Amended Report” in the top right corner under the DR number
 - Refer to the original report including date of the report
 - In narrative form what specific changes have been made in relation to the original report
 - All of the above
5. When documenting a withdrawn analysis, the Examiner is required to record which of the following in the case notes?
 - Reason for the withdrawal
 - Name of the caller requesting withdrawal
 - All information obtained from the caller
6. A withdrawn report should list which of the following?
 - Name of the officer or county attorney requesting the withdrawal
 - Date the request was made



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- Agency the caller is from
- Type of analysis that is being withdrawn

7.5 Practical Exercises

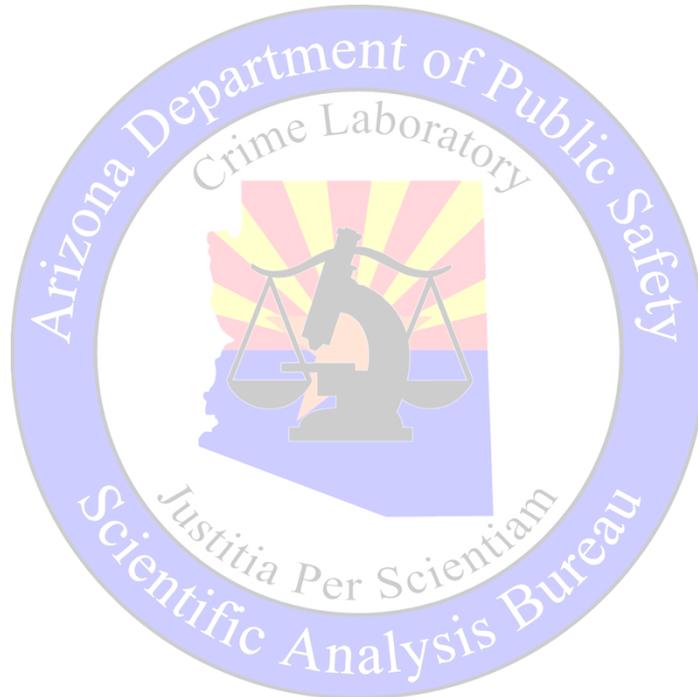
7.5.1 Read at least 3 reports of each of the following types, if available:

7.5.1.1 Drug analysis (Controlled Substances)

7.5.1.2 Amended Report

7.5.1.3 Withdrawal

7.5.2 Practice proofreading cases that need technical review. (Practice proofreading will not count as an actual technical review.)



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8 Module VII - Wet Methods of Analysis**8.1 Objectives**

8.1.1 The trainee will be equipped to skillfully:

8.1.1.1 Isolate controlled substances of interest from mixtures

8.1.1.2 Use and interpret color tests for controlled substances

8.1.1.3 Use and interpret microcrystal tests for controlled substances

8.1.1.4 Use and interpret TLC screens for controlled substances

8.2 Assigned Reading

8.2.1 To be assigned to trainee by discipline training coordinator at the beginning of this module.

8.3 Helpful Reading

"Color Tests", Clarke's Isolation and Identification of Drugs, 2nd Ed., pp 128-147

"Colour Tests", Moffat et al, Clarke's Analysis of Drugs and Poisons, Vol. I, 3rd Ed, Pharmaceutical Press, 2004, Chapter 19

"Extraction Techniques" Basic Training for Forensic Drug Chemists, DEA, pp 4-21 to 4-38

"Microcrystal Technique", Basic Training for Forensic Drug Chemists, DEA, pp 4-13 to 4-20

"Spot Tests", Basic Training for Forensic Drug Chemists, DEA, pp 4-1 to 4-11

"Thin Layer Chromatography" Clarke's Isolation and Identification of Drugs, 2nd Ed, pp 160-177

"Thin Layer Chromatography" Pradyot Patnaik, Dean's Analytical Chemistry Handbook, 2nd Ed., McGraw-Hill, 2004, pp 5.92-5.105

"Thin Layer Chromatography" Ray Liu, Daniel Gadzala, Handbook of Drug Analysis: Applications in Forensic Laboratories, American Chemical Society, 1997, "pp 61-70

"Thin Layer Chromatography", Basic Training for Forensic Drug Chemists, DEA, pp 4-39 to 4-49

"Thin Layer Chromatography", Handbook of Drug Analysis, pp 61-70

"Thin Layer Chromatography", Mofat et al, Clarke's Analysis of Drugs and Poisons, Vol. I, 3rd Ed, Pharmaceutical Press, 2004, Chapter 27

Report: "The Use of Visual Screening Tests for Drugs and Poisons in Toxicological Analysis" H.M. Stevens, Home Office Central Research Establishment, Report 437

8.4 Study Questions**(Questions in bold type are critical questions.)**

1. List the following substances in order of increasing polarity: Chloroform, water, ethanol, hexane and ethyl ether.
2. **For each of the following molecular structures, indicate whether it is an acidic, basic, neutral or amphoteric drug.**

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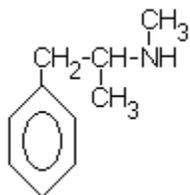
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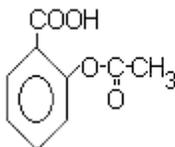
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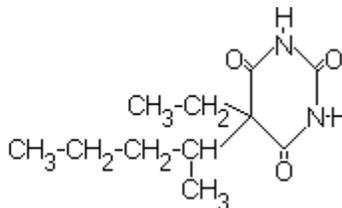
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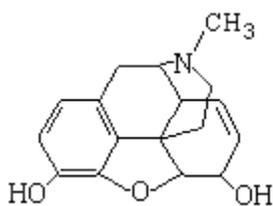
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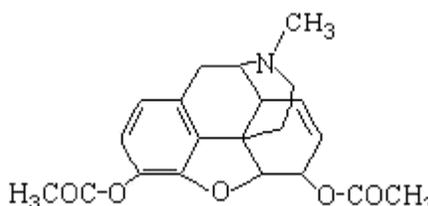
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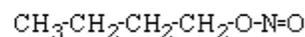
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(d)



(e)



(f)

3. **Basic drugs react with _____ to form salts.**
4. A capsule was encountered which contained aspirin, butalbital (a barbiturate) and caffeine (a weakly basic drug). Propose a simple liquid/liquid extraction scheme, which would recover free butalbital along with free caffeine in the organic phase, but eliminate aspirin.
- 4a. Propose an additional step, which would eliminate caffeine, but retain butalbital in the organic phase.
5. **Which of the following are acidic drugs and which are basic?**
- **Methamphetamine**
 - **Heroin hydrochloride**
 - **Penicillin V potassium**
 - **Chlorpheniramine maleate**
 - **Secobarbital**
 - **Acetylsalicylic acid**
 - **Phendimetrazine bitartrate**
 - **Thiopental sodium**
6. **Match each of the following extraction mediums to best complete the following statements: Water, chloroform, hexane, ethanol, 0.1N H₂SO₄ and 0.1N NaOH**
- _____ appreciably dissolves most free drugs AND their salts.
 - _____ appreciably dissolves most drug salts, but NOT most free drugs.

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- _____ appreciably dissolves most free drugs, but NOT their salts.
 - _____ dissolves basic drugs, but NOT acidic drugs.
 - _____ dissolves acidic drugs, but NOT basic salts.
 - _____ dissolves most free drugs having very low polarity, but NOT free drugs having moderate or high polarity.
7. You have the following materials: A quantity of cocaine hydrochloride, a separatory funnel, some 0.1N H₂SO₄, some concentrated NH₄OH and some CHCl₃. Describe how you could use these to obtain some cocaine base.
8. Assume you have propoxyphene base in chloroform. Knowing that propoxyphene HCl is very soluble in chloroform, suggest 2 ways to convert this propoxyphene base to the hydrochloride salt.
9. What reagents are combined to make the Marquis reagent?
10. Name at least 4 color test reagents from the Controlled Substances Analytical Protocol Manual that contain concentrated sulfuric acid.
11. Name a color test for:
- Barbiturates
 - Cocaine
 - Indoles
 - Heroin
 - Methamphetamine
12. Describe how one would conduct a hanging drop test for methamphetamine, using gold chloride reagent.
13. An analyst has determined he has propoxyphene that is either the d or l enantiomer. Describe how he could use gold bromide crystal reagent and appropriate standard(s) to determine the enantiomer.
14. For each of the following TLC locators, indicate what substances each might be useful for locating:
- Iodoplatinate spray
 - Fast blue BB spray
 - Iodine vapor
 - Fluorescence quenching (on fluorescent plate)
15. What is “edge effect” in thin layer chromatography and how can one avoid problems with it?

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16. What is R_f in TLC?**8.5 Practical Exercises**

- 8.5.1 Run a drop of cocaine pre-dissolved in 0.1N HCl into a drop of aqueous chloroplatinic acid reagent. (Observe variation in crystals across concentration gradient.)
- 8.5.2 Examine crystals formed by ephedrine sulfate treated with aqueous 5% AgNO₃. Then examine crystals formed by dilute H₂SO₄ added to 5% AgNO₃. (What is the AgNO₃ actually forming crystals with? How could a possible error in interpretation of results be avoided?)
- 8.5.3 Add 1 drop of aqueous chloroplatinic acid reagent to the following 3 samples:
- 8.5.3.1 Sample A - Ephedrine
- 8.5.3.2 Sample B - dl-Methamphetamine
- 8.5.3.3 Sample C - Mixture of ephedrine and dl-methamphetamine
(Observe problem of interference with the mixture in sample C)
- 8.5.4 Use a hanging drop (volatility) test on samples A, B and C above, by adding 1 drop 5% aqueous NaOH to sample, then collecting evolving vapors in a hanging drop of chloroplatinic acid. (Observe no interference problem for methamphetamine crystals from the ephedrine / methamphetamine mixture. Why not?)
- 8.5.5 Do a mixed crystal test to distinguish d-propoxyphene from l-propoxyphene. Sketch or describe crystals produced by chiral propoxyphene and racemic propoxyphene for the reagent used.
- 8.5.6 Analyze opium by TLC, spotted several times, varying from light to heavy across the plate. Run it versus neat standards of opium alkaloids.
- 8.5.7 Make a mixture of cocaine and lidocaine, and analyze this by TLC using 2 different mobile phases and compare results.
- 8.5.8 Dry extract an acetaminophen tablet with methanol. Filter and evaporate the filtrate, then analyze the extract by IR.
- 8.5.9 Design and use a liquid/liquid extraction scheme to isolate methamphetamine base from dimethylsulfone, a neutral substance. Use GC, GCMS or IR to verify a successful separation.

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9 Module VIII - Instrumental Methods of Analysis

This section of training addresses the use of the following instrumental techniques:

- UV/visible spectroscopy
- Infrared spectroscopy
- Gas chromatography
- Gas chromatography-mass spectrometry
- X-ray fluorescence spectroscopy*

*Training in the use of X-ray fluorescence spectroscopy will only be required for those persons who will be engaged in elemental analysis, such as for clandestine drug laboratory casework.

9.1 Objectives

9.1.1 Training for any of the above instruments will equip the trainee to:

- 9.1.1.1 Know the major components of the instrument and the theory behind its operation
- 9.1.1.2 Be familiar with operating protocols for the instrument
- 9.1.1.3 Be able to prepare and analyze samples on the instrument
- 9.1.1.4 Understand the limitations of the instrumental method
- 9.1.1.5 Reliably interpret instrumental data
- 9.1.1.6 Be able to do routine minor maintenance on the instrument

9.2 Assigned Reading

9.2.1 To be assigned to trainee by discipline training coordinator at the beginning of this module.

9.3 Helpful Reading

In addition to those items listed below, the appropriate instrument manual (book or CD) should be read and available for reference.

9.3.1 UV/Vis

“Ultraviolet and Visible absorption spectroscopy”, Rouessac and Rouessac, Chemical Analysis: Modern Instrumentation Methods and Techniques, Wiley & Sons, 2000, Chapter 11

“Ultraviolet, Visible and Fluorescence Spectrophotometry”, Moffat, et al, Clarke’s Analysis of Drugs and Poisons, Vol. I, 3rd Ed., Pharmaceutical Press, 2004, Chapter 21

“Ultraviolet, Visible and Fluorescence Spectroscopy”, Clarke’s Isolation and Identification of Drugs, 2nd Ed, pp 221-236

“UV and Visible Spectroscopy”, Chemical Analysis, Modern Instrumentation, Methods & Techniques, pp189-218

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“UV Spectrophotometry”, Basic Training for Forensic Drug Chemists, DEA, pp 5-1 to 5-15

“UV-Visible Spectrophotometry”, Handbook of Drug Analysis, pp 173-176

9.3.2 IR

“Forensic Applications of Infrared Spectroscopy”, Forensic Science Handbook, Vol. III, pp 73-141

“Infrared Spectroscopy”, Chemical Analysis, Modern Instrumentation, Methods & Techniques, pp 161-186

“Infra-red Spectroscopy”, Moffat, et al, Clarke’s Analysis of Drugs and Poisons, Vol. I, 3rd Ed., Pharmaceutical Press, 2004, Chapter 22

“Infrared Spectroscopy”, Rouessac and Rouessac, Chemical Analysis: Modern Instrumentation Methods and Techniques, Wiley & Sons, 2000, Chapter 10

“IR Spectrophotometry”, Basic Training for Forensic Drug Chemists, DEA, pp 5-17 to 5-29

Advanced ATR Correction Algorithm (Application Note: 01153), Simon Nunn and Koichi Nishikida, Thermo Electron Corporation, Madison, WI, USA:
www.thermo.com

Fundamentals of Fourier Transform Infrared Spectroscopy, Brian C. Smith, CRC Press, 1996, Chapters 1-4

9.3.3 GC

“Chromatographic Methods”, Handbook of Drug Analysis”, pp 129-145

“Gas Chromatography”, Chemical Analysis, Modern Instrumentation, Methods & Techniques, pp 3-37

“Gas Chromatography”, Clarke’s Isolation and Identification of Drugs, 2nd Ed pp 178-200

“Gas Chromatography”, Moffat, et al, Clarke’s Analysis of Drugs and Poisons, Vol. I, 3rd Ed., Pharmaceutical Press, 2004, Chapter 28

“Gas Chromatography”, Forensic Science Handbook, Vol. II, pp 39-65

“Gas Chromatography”, Rouessac and Rouessac, Chemical Analysis: Modern Instrumentation Methods and Techniques, Wiley & Sons, 2000, Chapter 2

“Gas-Liquid Chromatography”, Basic Training for Forensic Drug Chemists, DEA, pp 5-31 to 5-47

9.3.4 MS

“Electron Ionization, Up Close and Personal”, Kenneth L. Busch, Mass spectrometry Forum, Spectroscopy 10(8), October 1995, pp 39-42

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“Forensic Applications of Mass Spectrometry”, Forensic Science Handbook, Vol. I, pp 93-138

“Mass Spectrometry”, Chemical Analysis, Modern Instrumentation, Methods & Techniques, pp 289-315

“Mass Spectrometry”, Clarke’s Isolation and Identification of Drugs, 2nd Ed, pp 251-263

“Mass Spectrometry”, Moffat, et al, Clarke’s Analysis of Drugs and Poisons, Vol. I, 3rd Ed., Pharmaceutical Press, 2004, Chapter 26

“Mass Spectrometry”, Handbook of Drug Analysis, pp 195-222

“Mass Spectrometry”, Rouessac and Rouessac, Chemical Analysis: Modern Instrumentation Methods and Techniques, Wiley & Sons, 2000, Chapter 16

Introduction to Mass Spectrometry, J. Throck Watson, Lippincott-Raven, 1997, Chapters 1, 2, 4, 6, 7, 14-16, 19

9.3.5 XRF

“X-ray fluorescence spectrometry”, Rouessac and Rouessac, Chemical Analysis: Modern Instrumentation Methods and Techniques, Wiley & Sons, 2000, Chapter 13

“X-Ray Methods”, Patnaik, Pradyot (Ed.), Dean’s Analytical Chemistry Handbook, Second Edition, pp 9.1 through 9.15. McGraw-Hill, 2004

A Practical Guide for the Preparation of Specimens for X-ray Fluorescence and X-ray Diffraction Analysis, Burke, Victor E.; Jenkins, Ron; Smith, Deane K. (Eds.), Wiley-VCH, 1998

Introduction to X-Ray Spectrometric Analysis, Bertin, Eugene P., Plenum Press, New York-London, 1978

Oxford ED2000 Operator’s Manual (sections 1, 2, 4, 6, 7 and 8)

Sample Analysis using the ED2000 XRF (See Performance Check Manual)

Validation for ED2000 XRF (See Validation/Standards Manual)

X-Ray Fluorescence Spectrometry, Vol. 152, Jenkins, Ron, Second Edition, John Wiley & Sons, Inc., 1999

9.4 Study Questions

(Questions in bold type are critical questions.)

9.4.1 UV (if applicable)

1. What structural feature of a molecule will make it a UV absorber?
2. **Draw a schematic of a UV/Vis –Diode Array spectrophotometer and explain the function of each major component.**

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3. How does a diode-array instrument differ from one with a monochromator?
4. State at least three advantages of UV/Vis as a screening test for street drugs and at least two limitations for the same.
5. Define the following:
 - Fluorescence
 - Phosphorescence
 - Chromophore (oxochrome)
 - Conjugation
 - Hypsochromic effect
 - Bathochromic effect
 - λ_{\max}
 - ϵ_{\max}
6. **Why are buffer solutions often used for UV/Vis work?**
7. The absorption of UV/visible light is caused by which of the following?
 - Excitation of electrons to a higher energy state.
 - Excitation of molecules to a higher vibrational energy state
 - Excitation of molecules to a higher rotational energy state.
8. Write out Beer's Law as an equation and explain each term.
9. What is the relationship between % transmittance and absorbance?
10. What lamp(s) does your UV/Vis use and what spectral range does each cover?
11. What is the dispersive element in your UV/Vis instrument?
12. What is used as a calibration standard for your UV/Vis?

9.4.2 IR

1. What property of a compound will make it an IR absorber?
2. What is Fourier Transform and how does it apply to IR spectroscopy?
3. **Draw a schematic of an FTIR spectrophotometer and explain the function of its major components.**
4. Draw a schematic of a Michelson interferometer and explain how it works.

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5. Explain how a dispersive infrared instrument differs from a nondispersive one.
6. Discuss advantages/disadvantages of FTIR as compared to dispersive IR.
7. State the make and model for the IR spectrophotometer(s) used at your laboratory for controlled substance analysis.
8. What type IR source and what type detector are used in your IR spectrophotometer(s)?
9. Why are aerosol fluorochlorocarbon dusters not suitable for cleaning IR spectrophotometers?
10. What material is used as a calibration standard when performance checking your IR instrument(s)?
11. What is the purpose of running a background spectrum on an FTIR?
12. What causes a rising baseline when analyzing powder samples in KBr pellets?
13. **Which of the following would be difficult to differentiate by their infrared spectra?**
 - **Cis and trans isomers**
 - **Unsubstituted long chain alkanes of different molecular weight**
 - **Enantiomers**
 - **Diastereomers**
 - **Ring isomers**
14. Define the following:
 - ATR
 - Dipole moment
 - Wavenumber
 - Monochrometer
 - Interferometer
 - Interferogram
 - Centerburst
 - Apodization
 - Deconvolution
 - Fingerprint region
 - Polymorphism
15. How do transmittance and ATR spectra for the same compound differ in appearance? Why the difference?

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16. Compare GCMS to IR as identification techniques, stating advantages and disadvantages of each technique.

9.4.3 GC

- 1. Draw a schematic of a GC with FID detector and explain the function of each major component and the function of each gas line.**
2. Define the following:
 - Carrier gas
 - Mobile phase
 - Stationary phase
 - Retention time
 - Relative retention time
 - Linear velocity
 - Flow rate
 - Split ratio
 - Backflash
 - Carry over
 - Internal standard
 - Column bleed
- 3. What is split injection and why is it used?**
4. Explain the function of the purge flow in an inlet.
5. Explain how a flame ionization detector works. Explain the function of the make-up gas flow in an FID.
6. What make and model GC(s) does your lab use for controlled substance analysis? (Include also GC's attached to mass spectrometers.) List inlet type, column type, and carrier gas and detector type, for each instrument.
7. How and why are new GC columns conditioned before use?
8. What is "gas saver" mode, and how does it work?
9. Give at least two reasons why some substances may not be amenable to analysis by GC.
10. State two problems that may arise from injecting too much sample on a GC.

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11. What are the components of the test mix your laboratory uses to performance check your GC/FID(s) and GCMS(s)?

12. What is the most serious consequence of continuing to operate a GC with a bad air leak?

13. List routine maintenance tasks for a GC.

9.4.4 MS

1. Explain the theory behind the use of electron impact mass spectroscopy as an identification tool.

2. Explain the function of the following components of a mass spectrometer:

- **Filament**
- **Repeller**
- **Drawout**
- **Entrance lens**
- **Quadrupole assembly**
- **High Energy Dynode**
- **Electron multiplier**

3. Describe the mass spectrometer(s) your lab uses for controlled substance analysis, stating:

- The make and model
- Ionization mode (EI, CI, etc.)
- The type of mass analyzer
- The type of detector
- The type of vacuum pumps used

4. Define the following:

- Base peak
- Molecular ion
- Relative abundance
- Absolute abundance
- Mass/charge ratio
- AMU
- Dalton
- Millitorr
- Isotopic ion
- Solvent delay

5. State at least two indications that the inlet on a GCMS is dirty.

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6. What is the “nitrogen rule”?
7. **State at least two reasons for tuning a mass spectrometer.**
8. For EI ionization, explain how ions are formed in the ion source and then accelerated.
9. **What is PFTBA and what three ions (m/z) does your lab use to tune against, using PFTBA as a tuning standard?**
10. Compare electron impact ionization (EI) with chemical ionization (CI) in mass spectrometry as follows:
 - How is each type of ionization produced?
 - How would the mass spectrum of the same compound compare for each ionization method used?
 - What is each method’s advantage over the other?
11. How can a mass spectrometer tuning report indicate a serious air leak?
12. Why does the mass spectrometer operate under vacuum?
13. **Explain how a quadrupole mass analyzer works.**
14. What is SIM? What is it used for? How does it differ from scanning mass spectrometry?
15. List routine preventative maintenance tasks that should be periodically done on a mass spectrometer. (Do not include GC.)

9.5 Practical Exercises

9.5.1 UV/Vis

1. Run aspirin or acetaminophen in 0.1N H₂SO₄, then in 0.1N NaOH. Note pH shift.
2. Run cocaine in successive concentrations in 0.1N H₂SO₄.
3. How does the overall shape of the spectrum change with overloading?
4. How does λ_{\max} shift with overloading?
5. Run a mixture that is about one part caffeine and nine parts ephedrine in 0.1N H₂SO₄.
6. Are the spectral features of ephedrine visible against caffeine interference?
7. Run a spectrum of tetracycline in 0.1N H₂SO₄.

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8. Does this require lots of dilution to get absorbance to around 1.0?
9. Generate and print out annotated spectra in the same format as used in casework.
10. Run a performance check using a holmium oxide filter.

9.5.2 IR

1. Run sample specimens using both transmittance and reflectance sampling techniques.
2. Generate and print out a spectrum using the same format as used in casework.
3. Run a library search on a spectrum.
4. Run performance verification on the instrument.

9.5.3 GC/FID

1. Practice manual injections with a blank spiked with an internal standard.
2. Run a performance test mix on a GC and compare the data to previous test mix runs.
3. Run the same test mix under different temperature/pressure programs. Compare the data.
4. Practice diluting known controlled substance material to a suitable concentration for GC analysis.
5. Run methamphetamine both as a salt and as the free base. Compare results.
6. Inject an overloaded sample and note the effect on the chromatogram.
7. Use automated injection if the GC is so equipped.
8. Change a septum and inlet liner.

9.5.4 GCMS

1. Tune the mass spectrometer. Compare to previous tune reports.
2. Run a performance test mix. Compare to previous test mix runs.
3. Set up a sample table and run a batch of known samples.
4. Do manual data editing (redraw spectra, chromatograms, etc.)

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5. Use some data editing macro commands on the data.
6. Analyze opium or hashish oil and identify the components.
7. Run methamphetamine, then phentermine. Compare library searches of these.

9.5.5 XRF

1. Perform a peak calibration for the XRF using the multi-element sample defined for this purpose. Print the results and compare to previous calibrations.
2. Prepare a blank sample cup and obtain spectra under a variety of fixed conditions. At a minimum obtain blank spectra for the following fixed conditions: General (both air and vacuum) and Very Heavy Elements (both air and vacuum). Identify any peaks present in the spectra, label the spectra and save. What differences are observed among the four conditions listed above?
3. Prepare samples of red phosphorus and iodine and analyze under General (air) and Very Heavy Elements (air) fixed conditions, label peaks and save. Note the presence of both K and L bands for iodine and their relative intensities.
4. Using a multi-element standard disk containing lead, arsenic and strontium, obtain a spectrum under General (air) fixed conditions. Label all lead bands and compare with instrument library of krypton. Note how lead bands overlap closely with those of arsenic and krypton.

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10 Module IX - CNS Stimulants**10.1 Objectives**

NOTE: Besides covering CNS stimulants, this block of instruction will also include some coverage of common diluents.

10.1.1 The training will equip the trainee to:

10.1.1.1 Be familiar with common CNS stimulants and related substances

10.1.1.2 Select and conduct appropriate tests for controlled substances of interest

10.1.1.3 Identify CNS stimulants or other substances of interest

10.1.1.4 Appropriately report findings

10.2 Assigned Reading

10.2.1 To be assigned to trainee by discipline training coordinator at the beginning of this module.

10.3 Helpful Reading

“Cocaine”, Basic Training for Forensic Drug Chemists, DEA, pp 6-1 to 6-23

“Cocaine”, Drug Identification Bible, 2002 Ed, pp 543-577 and 723-740

Analytical Profiles of Cocaine, Local Anesthetics and Common Diluents, CND Analytical, pp 1-11

“Cocaine”, Martindale, the Extra Pharmacopoeia, 29th Ed, the Pharmaceutical Press pp 1213-1215

“Cocaine and Local Anesthetics”, the Pharmacological Basis of Therapeutics, 8th Ed, pp 311-329

“Cocaine and Local Anesthetics”, Cuttings Handbook of Pharmacology, 7th Ed pp 595-603

“The Cocaine Diastereomers”, A.C. Allen et al, Journal of Forensic Science, JFSCA. Vol. 26, 1, Jan 1981, pp 12-26

“Impurities and Artifacts of Illicit Cocaine”, T. Lukaszewski and W. Jeffery, Journal of Forensic Sciences, JFSCA, Vol. 25, No. 3, July 1980, pp 499-507

“Anhydroecgonine Methyl Ester in Cocaine Seizures”, Frank Medina III, Microgram, Vol. XII, No. 7, July 1979 pp 139-144

Cocaine Abuse and Addiction, www.nida.nih.gov/researchreports/cocaine

“Methyl Esters of Ecgonine: Injection-Port Produced Artifacts from Cocaine Base (Crack) Exhibits”, John Casale, Journal of Forensic Sciences, Vol. 37, No. 5, Sept 1992, pp 1295-1310

“The Preparation of d-Pseudococaine from l-Cocaine”, J. Siegel and R. Cormier, Journal of Forensic Sciences, JFSCA, Vol. 25, No. 2, April 1980, pp 357-365

“Sample Differentiation: Cocaine Example”, L. Baugh and R. Liu, Forensic Science Review, Vol. 3, No. 2, Dec 1991, pp 102-115

“Cocaine: Legal and Technical Defenses”, Dominic Gentile, The National College of Criminal Defense Lawyers and Public Defenders, pp 249-298

“The Cocaine Diastereomers”, A.C. Allen et al, Journal of Forensic Sciences, JFSCA, Vol. 26, No. 1, Jan 1981, pp 12-26

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- “Identification of cis- and trans-Cinnamoylcocaine in Illicit Cocaine Seizures”, James M. Moore, *Journal of the Association of Official Analytical Chemists*, Vol. 56, No. 5, 1973, pp 1199-1205
- “Occupational Exposure to Cocaine Involving Crime Lab Personnel”, Sam D. Le et al, *Journal of Forensic Sciences*, Dec. 1991, pp 959-968
- “Stimulants”, *Basic Training for Forensic Drug Chemists*, DEA, pp 6-75 to 6-82
- “Amphetamine/Methamphetamine”, *Drug Identification Bible*, 2002 Ed, pp 519-539 and 705-718
- Analytical Profiles of Amphetamine and Related Phenethylamines, *CND Analytical*, pp 1-26
- “Stimulants”, *Cuttings Handbook of Pharmacology*, 7th Ed pp 509-512
- “Methamphetamine”, (an overview), www.methamphetamineaddiction.com
- “Effects of D-Methamphetamine” *USDOJ National Drug Intelligence Center*, 96-C0109-003
- “Methamphetamine Synthesis via HI/Red P Reduction of Ephedrine”, Harry F. Skinner, *Forensic Science International*, 48 (1990) 123-134
- Analytical Profiles of Methylaminorex and Designer Analogs, *CND Analytical* pp 1-6
- “A Field Test for Phenyl-2-Propanone”, Wilmer Kiser, *Microgram*, Vol. XV, No. 8, Aug 1992
- “Novel Separation Procedure for Phentermine/Methamphetamine Mixtures”, Edwina Ard, *Microgram*, Vol. XVI, No. 10, Oct 1983
- “Structural Elucidation of Low Molecular Weight Primary and Secondary Amines (via Phenylisothiocyanate Derivatives)”, A. Allen and D. Cooper, *Microgram*, Vol. XII, No. 2, Feb 1979
- “Microcrystalline Identification of Drugs of Abuse: The ‘White Cross Suite’”, E. Julian and E. Pkein, *Journal of Forensic Sciences*, *JFSCA*, Vol. 26, No. 2, April 1981, pp 358-367
- “Differentiation of Side Chain Positional Isomers of Amphetamine”, Wm Soine et al, *Journal of Forensic Sciences*, *JFSCA*, Vol. 29, No. 1, Jan 1984, pp 177-184
- “Differentiation of Illicit Phenyl-2-Propanone Synthesized from Phenylacetic Acid with Acetic Anhydride Versus Lead (II) Acetate”, Andrew Allen et al, *Journal of Forensic Sciences*, *SFSCA*, Vol. 37, No. 1, Jan 1992, pp 301-322
- “Phenylacetone Synthesis and Clandestine Laboratories”, Ekis, Dupre’ and Courtney, *SWAFS Journal*, Vol. 12, No. 1, April 1990, pp 19-23
- “Laboratory Analysis of Clandestine Lab Chemicals, Reaction Mixtures, and Raw Products”, M. Courtney and T. Ekis, *SWAFS Journal*, Vol. II, No.1, April 1989, pp 16-30
- Methamphetamine (synthesis routes), *Clandestine Laboratory Guidebook*, pp 110-116
- “Impurities in Illicit Drug Preparations: Amphetamine and Methamphetamine”, Verweij, *Forensic Science Review*, Vol. I, No. 1, June 1989, pp 2-11
- “Cathinone, a Natural Amphetamine”, Peter Kalix, *Pharmacology & Toxicology* 1992, 70, pp 77-86
- “Spectral Characteristics of Chlorphentermine Isomers”, Jeffrey Hufsey, *Microgram*, Vol. XI, No. 9, Sept 1978, pp 173-180
- “The Identification of Cathinone and Methcathinone”, Terry Dal Cason, *Microgram*, Vol. XXV, No. 12, Dec 1992, pp 313-329
- “Rapid TLC Identification Test for Khat (*Catha edulis*)”, T. Lehmann et al, *Forensic Science International*, 45 (1990) pp 47-51

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- “GC-MS Identification of Chiral Derivatives of the Alkaloids of Khat”, M.J. Belle et al, Forensic Science International, 61, 193, pp 53-64
- “Methamphetamine Synthesis via Hydriotic Acid/Red Phosphorus Reduction of Ephedrine”, Harry Skinner, Forensic Science International, 48 1990, pp 123-134
- “Effects of D-Methamphetamine”, Margaret Potter, U.S. Department of Justice National Drug Intelligence Center, 96-C0109-003, Dec 1996
- “Products Used in Creating Methamphetamine”, U.S.D.O.J National Drug Intelligence Center publication pp 7, 8
- “Hazards of D-Methamphetamine Production”, Brett McCrea, U.S. Department of Justice National Drug Intelligence Center, 95-C0109-002, June 1995

10.4 Study Questions**(Questions in bold type are critical questions.)**

1. Name 3 CNS stimulants that are NOT classified as dangerous drugs under Arizona Revised Statutes.
2. Describe how methamphetamine can be synthesized, using pseudoephedrine, red phosphorus and iodine as starting materials.
3. Draw the molecular structure of methamphetamine.
4. What is the molecular weight of methamphetamine base?
5. Name at least 5 effects of methamphetamine.
6. Name 3 key starting materials for making methamphetamine via the “Nazi” method.
7. Is the levo-methamphetamine in Vick’s Inhalers controlled? Explain.
8. What is the diastereomer of phenylpropanolamine?
9. Which enantiomer is cathine?
10. **Which of the following give a blue response to a sodium nitroprusside/sodium carbonate test?**
 - **Amphetamine**
 - **Methamphetamine**
 - **Propylhexedrine**
 - **Caffeine**
11. Phenylacetone is another name for _____.

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12. Which of the following give an orange to brown response to the Marquis test?

- Amphetamine
- Methamphetamine
- Propylhexedrine
- Caffeine
- Niacinamide

13. Give 3 accepted medical uses for methamphetamine.

14. Indicate whether the following are very soluble or essentially insoluble:

Methamphetamine HCl in: 0.1N H₂SO₄
EtOH
CHCl₃
Hexane

Methamphetamine base in: 0.1N H₂SO₄
EtOH
CHCl₃
Hexane

15. Indicate what drug would be produced by each of the following reactions:

Precursor	Reaction	Product
Phenylpropanolamine	Reduction with Red P and I ₂	
Ephedrine	Oxidation by KMnO ₄	
Pseudoephedrine	Reduction with Red P and I ₂	
Phenylpropanolamine	Oxidation by K ₂ Cr ₂ O ₇	

16. Which of the following would have an EI mass spectrum having a base peak of 58 m/z?

- Methcathinone
- Amphetamine
- Phenylpropanolamine
- Methamphetamine
- Norpseudoephedrine
- Phentermine

17. The EI mass spectrum of methcathinone most resembles the mass spectrum of which of the following?

- Amphetamine
- Phenylpropanolamine
- Ephedrine/pseudoephedrine
- Methamphetamine

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18. According to Arizona Revised Statutes, Title 13, what is the threshold weight for methamphetamine?
19. What is khat and what 2 psychoactive components does it contain?
20. List at least 5 alkaloids of the coca plant and/or common manufacturing impurities associated with crude cocaine. Do not include deliberate diluents.
21. What is the botanical name for the coca plant?
- 22. Explain the chemical difference between cocaine hydrochloride and “crack”?**
23. How are cocaine hydrochloride and “crack” each normally used?
24. How is “crack” made?
25. Is cocaine an acidic, basic, neutral or amphoteric drug?
- 26. How would powdered cocaine hydrochloride respond to each reagent in the Scott test?**
- 27. How would “crack” respond to each reagent in the Scott test?**
28. List at least 3 substances that give a purple response to a Chen’s test.
29. List 5 possible physiological or psychological effects of cocaine use.
30. Describe 2 tests for starch.
31. Describe at least 3 tests that would differentiate NaCl from NaHCO₃.
32. Describe 2 tests for sucrose.
33. Describe a crystal test for cocaine and the resulting crystals, if testing a sample of pure cocaine HCl.
34. What is the accepted medical use for cocaine?
35. Which type of alkaloid is cocaine?
 - An isoquinoline alkaloid
 - A xanthine alkaloid
 - A phenanthrene alkaloid
 - A tropane alkaloid

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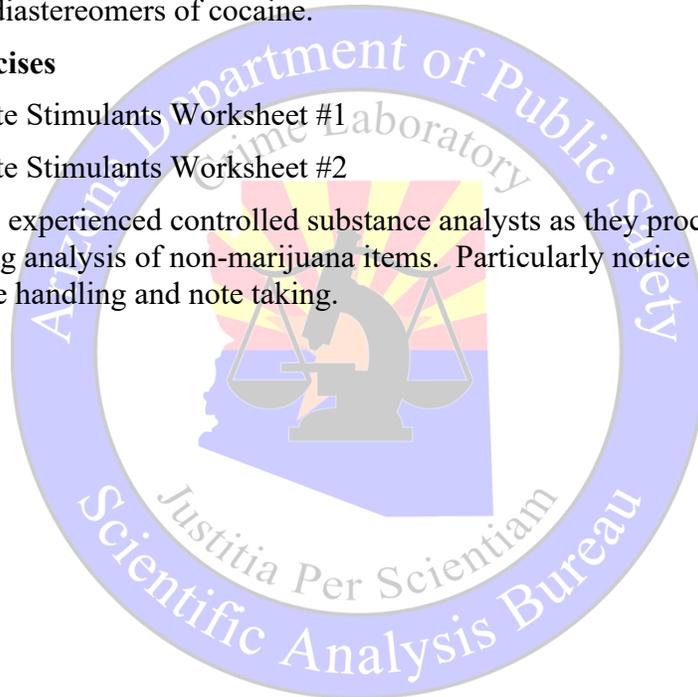
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36. What is the molecular weight of cocaine base?
37. **Why is infrared spectroscopy required if a sample is to be reported as cocaine base?**
38. GCMS analysis of street cocaine often shows a trace of 2 elutants in the chromatogram, which have identical mass spectra. Their spectra include a base peak of 82 m/z, a second most abundant ion at 182 m/z and an apparent molecular ion at 329 m/z. What are these 2 elutants?
39. **What are the ARS threshold weights for cocaine salt and cocaine base?**
40. Name the diastereomers of cocaine.

10.5 Practical Exercises

- 10.5.1 Complete Stimulants Worksheet #1
- 10.5.2 Complete Stimulants Worksheet #2
- 10.5.3 Observe experienced controlled substance analysts as they process at least 20 cases involving analysis of non-marijuana items. Particularly notice analytical technique, evidence handling and note taking.





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10.6 Stimulants Worksheet #1

- Test the substances listed below with the color test reagents indicated and record their responses. Remember, Co(SCN)_2 and SnCl_2 are two steps of the same test.

COCAINE AND LOCAL ANESTHETICS

Substance	H_2SO_4	Marquis	Sodium Nitroprusside/ Na_2CO_3	Chen's	2% Co(SCN)_2	SnCl_2
Benzocaine						
Cocaine base						
Cocaine HCl						
Lidocaine						
Mepivacaine						
Procaine						
Tetracaine						

PHENETHYLAMINES

Amphetamine						
Dimethylamphetamine						
Ephedrine						
Methamphetamine						
Phentermine						
Phenylpropanolamine						
Pseudoephedrine						

MISC STIMULANTS

Caffeine						
Methylphenidate						
Phendimetrazine						
Phenmetrazine						
Propylhexedrine						

DILUENTS

Dimethylsulfone (MSM)						
Inositol						
Mannitol						
Niacinamide						
Starch						



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- Run a Scott test on cocaine base and on cocaine HCl, both standard grade and crude (from casework), and record the responses. (If the trainee anticipates utilizing the Scott test regularly, the test should also be run on other local anesthetics as well.)

Drug	Scott Test Step I	Scott Test Step II	Scott Test Step III
Cocaine Base			
Cocaine HCl			

- Why do cocaine base and cocaine HCl respond differently to the Scott test?
- Add a drop of mercuric iodide reagent to some starch and note the color response.
- Obtain a capsule which contains ephedrine, pseudoephedrine or phenylpropanolamine in small pellets. Perform Marquis and Chen's tests on the pellet contents both before and after grinding it to a powder. Does grinding the pellets improve test response?
- OPTIONAL: Try any of the following color tests. Refer to the protocol for color tests for procedures.
 - Copper Sulfate/Sodium Carbonate test for lidocaine
 - Liebermann's test for various drugs*
 - Molisch test for reducible carbohydrates (e.g. sucrose)
 - Sanchez test for procaine or benzocaine
 - Silver nitrate test for Cl⁻, Br⁻, HCL salts and HBr salts
 - Starch test for iodine/iodide

*See Color Test Responses for Oxidizing Color Reagents in the back of the Controlled Substances Analytical Protocols Manual.

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10.7 Stimulants Worksheet #2

1. Screen both crude and pure methamphetamine by GC/FID or by UV/Vis. Did interfering substances affect the results for the crude sample?
2. Run methamphetamine base, then methamphetamine HCl on GCMS. Did the HCl component affect the chromatography?
3. Compare the mass spectra of amphetamine, methamphetamine and dimethylamphetamine. Can you explain why they have base peaks of 44, 58 and 72 m/z respectively?
- 3a. Can you predict without looking, what the base peak for N-ethylamphetamine would be?
4. Prepare a mixture of methamphetamine HCl, caffeine and mannitol. Isolate the methamphetamine by use of a base to hexane extraction. Also extract the same mixture using a base to chloroform extraction. Run GC or GCMS on the free base extracts. How do they compare for purity?
- 4a. Convert the methamphetamine in the hexane extract into the hydrochloride salt. Dry this and run an IR. Does it give a good spectrum compared to that of a standard?
5. Run an IR on some dimethylsulfone. Compare to a previously run standard spectrum.
6. Prepare a mixture of methamphetamine and cocaine. Put this through a base to hexane extraction. Pre-clean an aluminum weighing dish with a few drops of acetone and a Kim Wipe. Evaporate the extract in the dish using enough heat to drive off the methamphetamine base. Run an IR to get a spectrum of the cocaine base obtained. How clean does it seem to be?
7. Free base some methcathinone HCl and run it on GCMS. Compare its spectrum to that of ephedrine and pseudoephedrine. How would you differentiate them by GCMS?
8. Run IRs on pure cocaine base and on pure cocaine HCl. Compare the two spectra.
9. Prepare a mixture of cocaine base with smaller amounts of caffeine, lidocaine HCl and niacinamide. Dry extract this with hexane and evaporate.
- 9a. Run GC or GCMS to see how clean the recovered cocaine base is.
- 9b. Run an IR on the recovered cocaine base and compare to a standard.

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11 Module X - Narcotic Analgesics (Opiates)**11.1 Objectives**

11.1.1 The training will equip the trainee to:

11.1.1.1 Be familiar with common narcotic analgesics and related substances

11.1.1.2 Select and conduct appropriate tests for controlled substances of interest

11.1.1.3 Identify narcotic analgesics or other substances of interest

11.1.1.4 Appropriately report findings

11.2 Assigned Reading

11.2.1 To be assigned to trainee by discipline training coordinator at the beginning of this module.

11.3 Helpful Reading

Analytical Profiles of the Narcotic Analgesics, CND Analytical, pp 1-17

The Pharmacological Basis of Therapeutics, 8th Ed, Goodman & Gilman, pp 485-518, 531-534, 925
"Narcotic Analgesics", Cutting's Handbook of Pharmacology, 7th Ed, Csaky & Barnes, pp 343, 622-643, and 720-721"Analgesics and Antipyretics", Remington's Pharmaceutical Sciences, 18th Ed pp 1097-1100, 1104-1109"Opiate Antagonists", Remington's Pharmaceutical Sciences, 18th Ed, Mack Press, pp 1097-1104, 1349-1350"Opiates", Basic Training for Forensic Drug Chemists, DEA pp 6-83 to 6-104"Heroin", Drug Identification Bible, 2002 Ed pp 585-605 and 746-763"The Opium Poppy and Other Poppies", U.S. Treasury Dept Bureau of Narcotics"Drugs of Abuse: Narcotics", Drug Enforcement, Spring 1975, pp 8-13"Drugs of Abuse: Narcotics", Drug Enforcement, July 1979, pp 16-17"The Scarlet Poppy", Drug Enforcement, August 1977, pp 17-19Martindale, The Extra Pharmacopoeia, 29th Ed. pp 1294-1321Drug Abuse, A Manual for Law Enforcement Officers, Smith, Kline & French LaboratoriesToxicology Mechanisms and Analytical Methods, Vol. II, Stewart & Stolman pp 209-211, 229-242, 242-261"The Analysis of Heroin", Bulletin on Narcotics, April-June 1953 - Handout"Cleanup for IR of Alpha-methyl Fentanyl", Microgram, May 1981May's Chemistry of Synthetic Drugs, pp 160-163"Extraction of Propoxyphene from Pharmaceutical Mixtures", Microgram, June 1979"A Direct Synthesis of O-6 Monoacetylmorphine from Morphine", Canadian Society of Forensic Science Journal, Wing-Wah Sy et al, Vol. 18 No. 2, June 1985, pp 86-91 (See also letter to the editor in Vol. 18 No. 4, Dec. 1985, p 183 regarding this article)"Acetylated Acetaminophen", Microgram, Katherine T. Churchill, Vol. XXIV No. 6, June 1991, pp 144-149

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- “Comparative Analysis of Illicit Heroin Samples”, *Forensic Science International*, M. Chiarotti et al, Vol. 50 No. 1, Jul/Aug 1991, pp 47-55
- “Decomposition of Thebaine with Acetic Anhydride and Acetyl Chloride”, *Microgram*, Charlos B. Teer, Vol. XI No. 6, June 1978, pp 102-106
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J. Stall and Roland E. Dolle III, Vol. XI, Oct. 1978, pp 197-200
- “Variations in the Infra-Red Spectra of Heroin Base”, Journal of Forensic Sciences, Mark Ravreby
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11.4 Study Questions**(Questions in bold type are critical questions.)**

1. List at least 3 effects commonly produced by use of narcotic analgesics.
2. Give 2 examples of narcotic antagonists. Give 2 medical uses for them.
3. Name a morphine derivative which ARS specifically excludes from prosecution as a statutory narcotic drug.
4. What plant species is the source of opium?
5. List at least 5 opium alkaloids.

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6. Pethidine is another name for _____.
7. Amidone is another name for _____.
8. Isonipecaine is another name for _____.
9. **Name a narcotic analgesic for which an enantiomer determination must be done before reporting as a narcotic drug.**
10. Name an amphoteric narcotic analgesic.
11. List at least 3 manufacturing impurities commonly found in heroin. Do not include deliberate diluents.
12. What is an antitussive? Give an example of a non-narcotic antitussive and a narcotic antitussive.
13. State 3 actions associated with NSAIDs. Give 2 examples of drugs that are NSAIDs.
14. Which of the following would be very soluble in chloroform?
 - Codeine phosphate
 - Dextropropoxyphene napsylate
 - Meperidine HCl
 - Methadone HCl
 - Morphine sulfate
15. State a technique for preventing or breaking emulsions when extracting syrups.
16. Which of the following are structurally related to morphine?
 - Fentanyl
 - Hydromorphone
 - Levorphanol
 - Meperidine
 - Methadone
 - Nalbuphine
 - Acetaminophen
17. Calculate the molecular weight of morphine sulfate. You may use any of the following information:

Mol. Wt. morphine base	285
Mol. Wt. sulfuric acid	98
Atomic Wt. H	1
Atomic Wt. C	12

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Atomic Wt. N	14
Atomic Wt. O	16
Atomic Wt. S	32

18. Suggest a color test and the expected response for screening the following drugs:

- **Acetaminophen**
- **Aspirin**
- **Codeine**
- **Heroin**
- **Meperidine**
- **Morphine**
- **Propoxyphene**

19. What is MPTP and what adverse physiological effect does it produce?

20. Compared to other narcotic analgesics, fentanyl analogs are noted for what?

- Their high potency
- Their effectiveness as narcotic antagonists
- Their incompatibility with aspirin and other salicylates
- Their tendency to decompose at typical GC temperatures

21. Which of the following can be effectively extracted into hexane as a free base?

- Aspirin
- Codeine
- Meperidine
- Propoxyphene

22. What is APAP?

23. What is ASA?

24. What is the normal precursor for making heroin and what process converts it to heroin?

11.5 Practical Exercises

11.5.1 Complete Narcotic Analgesics Worksheet #1

11.5.2 Complete Narcotic Analgesics Worksheet #2

11.5.3 Analyze crude heroin by TLC

11.5.4 Analyze the following by GCMS:

11.5.5 Opium or crude heroin



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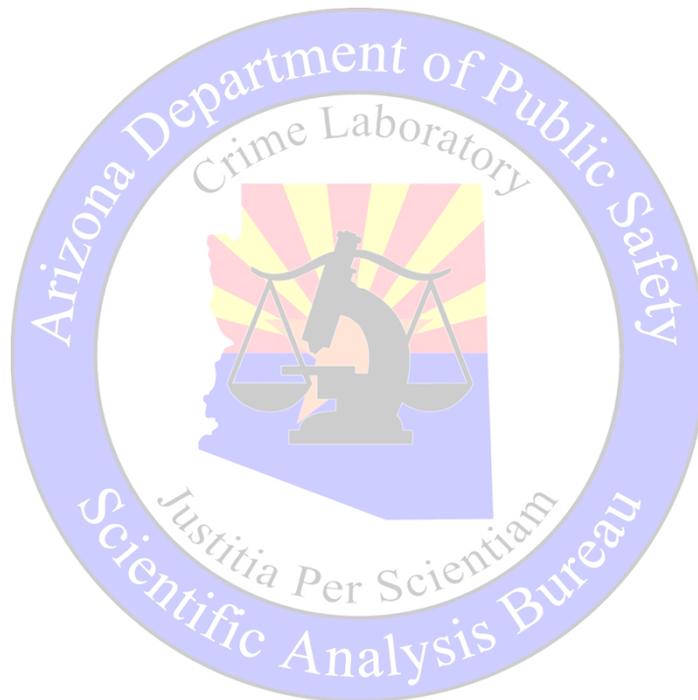
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11.5.5.1 Aspirin

11.5.5.2 A hydrocodone/acetaminophen tablet or an oxycodone/acetaminophen tablet



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11.6 Narcotic Analgesics Worksheet #1

- Record the color responses for the following substances with the color test reagents indicated. Co(SCN)_2 and SnCl_2 are first and second steps of the same test. See Protocol for Color Tests

DRUG	H_2SO_4	Marquis	Froehde's	Mecke's	HNO_3	Co(SCN)_2	SnCl_2
Codeine Std							
Codeine Syrup (unextracted)							
Codeine Syrup (extracted)							
Tylenol w/Codeine (or equivalent)							
Heroin Std							
Crude Heroin							
Crude Heroin In aqueous soln Approx 10 mg/ml							
Hydrocodone Std							
Oxycodone Std							
Oxycodone/APAP or Oxycodone/ASA Tablet							
Oxycodone extracted from tablet							
Morphine Std							
Opium Std							
Nalorphine Std							
Naloxone Std							
d-Propoxyphene Std							
Meperidine Std							
Methadone Std							
Guaifenesin Std							
Acetaminophen							
Aspirin							

Also try and record response for methadone standard, using the hot HNO_3 color test described in the methadone monograph or the color test protocol.



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11.7 Narcotic Analgesics Worksheet #2

- Use check marks or X's to indicate the classification and activity of the following drugs.

	Opium alkaloid	Semi-synthetic Opiate	Synthetic opiate	Narcotic Activity	Narcotic Antagonist Activity	Uses or significance other than pain relief (specify)	ARS Narcotic	Non-controlled
Acetaminophen								
Acetylcodeine								
Apomorphine								
Aspirin								
Codeine								
Dextro-methorphan								
Dextro-propoxyphene								
Diphenoxylate								
Fentanyl								
Guaifenesin								
Hydrocodone								
Hydromorphone								
Hydromorphone								
Levorphanol								
Meperidine								
Methadone								
Morphine								
Nalbuphine								
Nalorphine								
Naloxone								
Noscapine								
O ⁶ -Monoacetyl-morphine								
Oxycodone								
Papaverine								
Pentazocine								
Thebaine								

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12 Module XI - Hallucinogens**12.1 Objectives**

12.1.1 Training will equip the trainee to:

12.1.1.1 Be familiar with common hallucinogens and related substances

12.1.1.2 Select and conduct appropriate tests for controlled substances of interest

12.1.1.3 Identify hallucinogens or other substances of interest

12.1.1.4 Appropriately report findings

12.2 Assigned Reading

12.2.1 To be assigned to trainee by discipline training coordinator at the beginning of this module.

12.3 Helpful Reading

Analytical Profiles of Substituted 3,4-Methylenedioxyamphetamines Vol. I, CND Analytical pp 1-23

Analytical Profiles of the Hallucinogens, CND Analytical, pp 1-4, 47-49, 68-71 and 99-104"Hallucinogens", Basic Training for Forensic Drug Chemists, DEA pp 6-105 to 6-115"LSD", Drug Identification Bible, 2002 Ed pp 609-616 and 768-773"MDMA", Drug Identification Bible, 2002 Ed pp 666-676 and 796-804"PCP", Drug Identification Bible, 2002 Ed, pp 678-679 and 805-809"Peyote", Drug Identification Bible, 2002 Ed, pp 680-684 and 810-814"Psilocybe Mushrooms", Drug Identification Bible, 2002 Ed, pp 685-696 and 815-818"Psychedelics", The Pharmacological Basis of Therapeutics, 8th Ed pp 553- 558"Ketamine", Drug Identification Bible 2002 Ed pp 764-767"Ergoline Alkaloidal Constituents of Hawaiian Baby Wood Rose, *Argyrea nervosa*", Jew-Ming Chao and Ara H. Der Marderosian, Journal of Pharmaceutical Sciences, April 1973, Vol. 62, No. 4, pp 588-591"Vision Quest", Kevin Krajick, Newsweek, June 15, 1992, pp 62-63"On the Drug Scene: New Rival for Heroin", U.S. News & World Report, August 8, 1977"The Deadly 'Angel Dust'", Matt Clark with Susan Agrest, Newsweek, March 13, 1978, pp 34

"Trendy Drugs of Abuse: Rohypnol, GHB, Ketamine, MDMA & LSD-- & the Rave Phenomenon, A Public/Personal Safety Message", Trinka Porrata, September 20, 1999 (handout)

"An Overview of Club Drugs, Drug Intelligence Brief", Drug Enforcement Administration, February 2000, pp 1-10 (handout)

12.4 Study Questions**(Questions in bold type are critical questions.)**

1. List three possible effects of LSD.
2. The Colorado River toad secretes what hallucinogen?

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3. Morning glory seeds and Hawaiian baby woodrose seeds are natural sources of which of the following?
 - Ergotamine
 - Lysergic acid amide
 - Paramethoxyamphetamine
 - Psilocyn

4. **Which of the following would give an inky blue color in response to the sodium nitroprusside/sodium carbonate test?**
 - MDA
 - MDMA
 - MDEA

5. **Which of the following is a ring isomer of psilocyn?**
 - Bufotenine
 - Ibogaine
 - DET
 - Mescaline

6. **The Weber test is a test for _____.**

7. **A red or purple response to a pDMAB test (Van Urk or Ehrlich) is indicative of _____.**

8. What are “window panes”?

9. Describe an extraction suitable for extracting Psilocybe mushrooms for GCMS.

10. Which of the following substances can give thermal decomposition products at typical GC temperatures?
 - PCC
 - N-Hydroxy-MDA
 - Psilocybin
 - LSD

11. Which of the following would give a dark purple response to conc. H₂SO₄ and a dark purplish-black response to a Marquis test?
 - LSD
 - MDA
 - Mescaline
 - Psilocyn

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- Psilocybin
12. Why is it important to not report peyote as mescaline?
 13. According to ARS 13-3401, peyote is any plant of the genus _____.
 14. State two common means of consuming peyote.
 15. Give a common chemical name for PCP.
 16. List four possible effects of PCP.
 17. **Because of statutory wording in ARS, which of the following would require ring isomer determination for prosecution?**
 - MDA
 - MDMA
 - MDEA
 - N-Hydroxy-MDA
 18. A clandestine drug laboratory was found to have the following chemicals on hand: bromobenzene, magnesium turnings, piperidine, cyclohexanone and potassium cyanide. What controlled substance could be synthesized from these chemicals?
 19. Most controlled hallucinogens are classed under what federal controlled substance schedule?
 20. In addition to hallucinogenic properties, the MDA compounds also display what other properties?
 - Anti-emetic properties
 - CNS depressant properties
 - CNS stimulant properties
 - Opiate-like properties
 21. What is “ecstasy”?
 22. MDMA is a short name for _____.
 23. LSD is a short name for _____.
 24. Name a hallucinogenic controlled substance that is classed as a depressant by ARS 13-3401.
 25. The Weber test uses which of the following reagents?
 - Concentrated nitric acid
 - Diphenylamine

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- Alpha-naphthol
 - Fast Blue B Salt
26. Name two hallucinogens that give green Marquis test responses.
27. What is DOM?
28. What is synesthesia?
29. LSD is noted for which property?
- High polarity
 - Ability to sublime upon moderate heating
 - Bright colors of LSD salts
 - High potency
31. What controlled substance is commonly extracted from the veterinary products Ketalar or Ketaject for illicit use?

12.5 Practical Exercises

12.5.1 Analyze MDMA, or MDEA using:

12.5.1.1 H₂SO₄ color test

12.5.1.2 Marquis color test

12.5.1.3 Sodium Nitroprusside/Sodium Carbonate color test

12.5.1.4 GC or UV/Vis screen (free base for GC)

12.5.1.5 Dry-extract MDMA or MDEA from tablets or from a mixture of starch with MDMA or MDEA. Then run IR on dried extract.

12.5.2 Run TLC of MDA vs. N-hydroxy-MDA. If they do not resolve well, try another mobile system.

12.5.3 Analyze some LSD tablets or blotters using:

12.5.3.1 The pDMAB color test

12.5.3.2 Extraction followed by TLC of sample vs. LSD and LAMPA

12.5.3.3 Extraction followed by GCMS

12.5.3.4 Do your results clearly distinguish LSD from LAMPA? How?

12.5.4 Analyze a mushroom specimen known to contain psilocyn and/or psilocybin. Use:

12.5.4.1 The pDMAB color test

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12.5.4.2 The Weber color test

12.5.4.3 TLC

12.5.4.4 Extraction followed by GCMS for psilocyn

12.5.5 Analyze a specimen of peyote, following the Protocol for Analyzing Peyote. Include use of GCMS to show presence of mescaline.

12.5.6 Analyze some mescaline standard using:

12.5.6.1 Marquis color test

12.5.6.2 GC or UV screen

12.5.6.3 GCMS

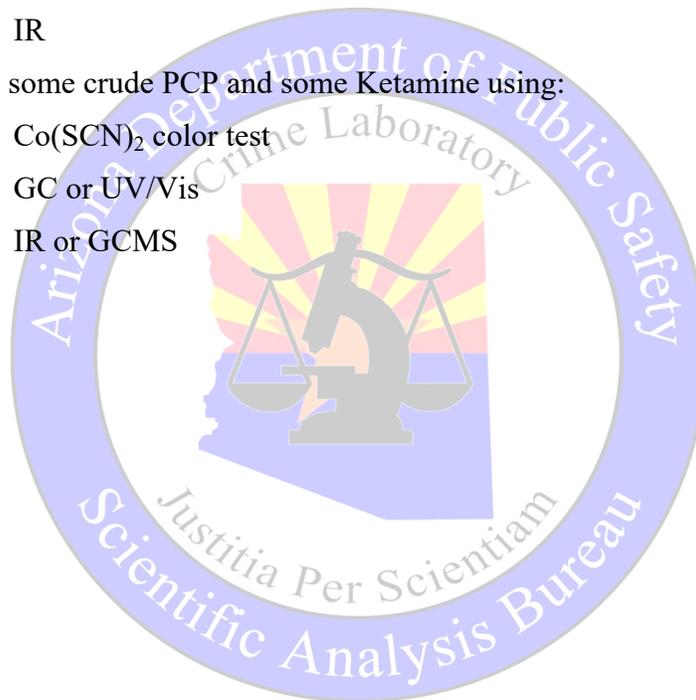
12.5.6.4 IR

12.5.7 Analyze some crude PCP and some Ketamine using:

12.5.7.1 Co(SCN)₂ color test

12.5.7.2 GC or UV/Vis

12.5.7.3 IR or GCMS



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13 Module XII - CNS Depressants**13.1 Objectives**

13.1.1 Training will equip the trainee to:

13.1.1.1 Be familiar with common CNS depressants and related substances

13.1.1.2 Select and conduct appropriate tests for controlled substances of interest

13.1.1.3 Identify hallucinogens or other substances of interest

13.1.1.4 Appropriately report findings

13.2 Assigned Reading

13.2.1 To be assigned to trainee by discipline training coordinator at the beginning of this module.

13.3 Helpful Reading

"An Examination of Acid-Base Equilibria of 1,4-Benzodiazepines by Spectrophotometry", Barrett, Smyth & Davidson, Journal of Pharm. Pharmac., 1973, Vol. 25, pp 387-393

"Isolation and Identification of Clorazepate", Microgram, Vol. 17, April 1984, pp 55-61

"The Extraction and Analysis of Salts of Clorazepate", Microgram, Vol. 10, October 1977, pp 136-142

"A Microchemical Test for the Detection of Anthranilic Acid and N-Acetylanthranilic Acid in Methaqualone/Mecloqualone Exhibits", Microgram, Vol. XIV, Nov 1981, pp 161-163

"A Simple Procedure to Avoid the Anomalous IR Spectral Patterns of Diazepam", Microgram, Vol. XXI, Aug 1988, pp 140-143

"Barbituric Acid Derivatives, Butylvinol and Heptobarbital", Microgram, Vol. XII, Sep 1979, pp 161-169

"Depressants", Basic Training for Forensic Drug Chemists, DEA pp 6-45 to 6-73

"Extraction and Identification of 1,4-Benzodiazepines", Microgram, Vol. XIII, June 1980, pp 104-111

"GHB", Drug Identification Bible 2002 Ed pp 741-745

"Hypnotics and Sedatives", Seth K. Sharpless, The Pharmacological Basis of Therapy, Chapter 9, 1970, pp 98-120

"Hypnotics and Sedatives", The Pharmacological Basis of Therapeutics, 8th Ed pp 345-369

"Identification of Chlordiazepoxide and Amitriptyline in Limbitrol Tablets", Microgram, Vol. XVI, Jul 1983, pp 111-114

"Identification of Ephedroxane: A New Drug of Abuse?", Microgram, Vol. XXV, Mar 1992, pp 49-56

"Identification of Potassium Salts of Clorazepate by X-Ray Diffractometry", Journal of Forensic Sciences, Vol. 25, July 1980, pp 660-670

"Identification of Some Chemical Analogs and Positional Isomers of Methaqualone", Journal of Forensic Sciences, Vol. 26, Oct 1981, pp 793-833

"Identification of Some Interferences in the Analysis of Clorazepate", Journal of Forensic Sciences, Vol. 28, July 1983, pp 655-682

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- “Isatoic Anhydride as a Precursor for Methaqualone”, J. Hufsey, Microgram, Vol. XIII, No. 2, Feb 1980, pp 30-32
- “Positive and Negative Ion Mass Spectrometry of 24 Benzodiazepines”, Forensic Science International, Vol. 35, 1987, pp 165-179
- “Screening Test for Methyprylon”, Microgram, Vol. VIII, Aug 1975, p 122
- “Sedatives and Hypnotics”, Remington’s Pharmaceutical Sciences, 18th Ed pp 1057-1059, 1063-1064 and 1067-1071
- “Sexual Assault and Substance Abuse: A Devastating Combination”, Paul Henry Danylewich, RCMP Gazette, 1997, Vol. 59, No. 9, pp 25-28
- “The Analysis of Clobazam”, Microgram, Vol. XV, Nov 1982, pp 201-206
- “The Extraction and Infrared Identification of Gamma-Hydroxybutyric Acid (GHB) from Aqueous Solutions”, Chappell, Meyn and Ngim, Journal of Forensic Science, January 2004, Vol. 49, No 1, pp 52-59
- “The Identification of GHB”, Microgram, Vol. XXIV, Jul 1991, pp 172-179
- “The Identification of Nitromethaqualone”, Microgram, Vol. XV, July 1982, pp 105-120
- “The Isolation and Identification of Precursors and Reaction Products in the Clandestine Manufacture of Methaqualone and Mecloqualone”, Journal of Forensic Sciences, Vol. 30, Oct 1985, pp 1022-1047
- “The Reactivity of Gamma-hydroxybutyric acid (GHB) and Gamma-butyrolactone (GBL) in Alcoholic Solutions”, Hennessey, Moane and McDermott, Journal of Forensic Science, November 2004, Vol. 49, No 6, pp 1220-1229
- Analytical Profiles of Benzodiazepines, CND Analytical pp 1-20
- Analytical Profiles of the Barbiturates and Other Depressants, CND Analytical pp 1-16
- Cutting’s Handbook of Pharmacology 7th Ed pp 647-662

13.4 Study Questions**(Questions in bold type are critical questions.)**

1. For each of the following, indicate whether it is a barbiturate, benzodiazepine, carbamate or other:
 - Butalbital
 - Alprazolam
 - Diphenhydramine
 - Carisoprodol
 - Salicylamide
 - Meprobamate
 - Hydroxyzine
 - Diazepam
 - Phenobarbital
 - Chlordiazepoxide

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2. Describe the color test for carbamates found in the Controlled Substances Analytical Protocol Manual, indicating what reagents are used and what color response is given by carbamates.
3. **What color does the Dille-Koppanyi color test yield for barbiturates?**
4. What color does the Zwikker's color test yield with barbiturates?
5. Describe the m-dinitrobenzene color test found in the Controlled Substances Analytical Protocol Manual. What drugs is this test used for? What color response do they give?
6. **Which of the following is true?**
 - **Barbiturates form salts with acids.**
 - **Barbiturates form salts with bases.**
 - **Barbiturates do not form salts.**
7. Which of the following is true?
 - Benzodiazepines are usually found as salts of acids.
 - Benzodiazepines are usually found as salts of bases.
 - Benzodiazepines are usually found as free drugs.
8. List at least three medical uses for barbiturates and/or benzodiazepines.
9. What is the active ingredient in Rohypnal ("Roofies")?
10. What is the active ingredient in Valium?
11. Name at least three compounds which are antihistamines.
12. Clorazepate preparations are not suited for direct analysis by GCMS. Give at least two reasons why.
13. Scopolamine occurs in which of the following:
 - Jimson weed?
 - Hawaiian baby woodrose?
 - Datura stramonium?
14. Suppose you have a capsule containing butalbital, codeine and aspirin. Suggest a liquid/liquid extraction scheme, which would isolate butalbital by itself in the organic phase.
15. Indicate for each of the following structures whether the compound is a barbiturate, benzodiazepine or carbamate.

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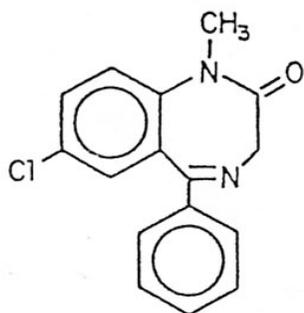
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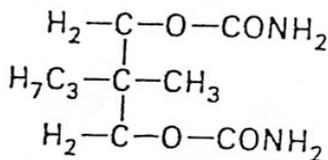
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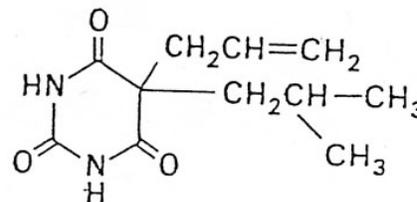
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(a)

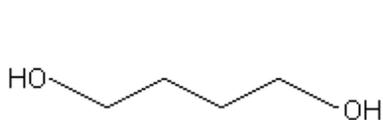


(b)

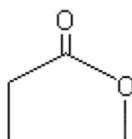


(c)

16. What federal Controlled Substances Act schedule(s) does GHB fall under?
17. Identify each of the following compounds below:



(a)



(b)



(c)

18. Describe how one might synthesize GHB using readily available consumer products.
19. Name at least one color test in the DPS Analytical Protocol Manual that is useful for screening powders for GHB.
20. **An analyst decided to identify GHB by using a sodium hydroxide to chloroform extraction and running the extract on GCMS. Give at least two reasons why this is not a good analytical approach.**
21. Why is ethanol or methanol a bad choice of injection solvent when using GCMS with BSTFA/TMCS derivitization?
22. A bottle of water is suspected of being laced with GHB. Describe an analysis which would be suitable for identifying GHB in such a solution.
23. GHB is which of the following:
- An acidic drug?
 - A basic drug?
 - An amphoteric drug?

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24. A neutral aqueous solution contained equal concentrations of GHB and GBL. It was then rendered strongly acidic by adding HCl. Which of the following best describes the resulting solution?
- The resulting solution contains GHB with little or no GBL.
 - The resulting solution contains GBL with little or no GHB.
 - The GHB concentration and the GBL concentration remain equal.
25. What property of GHB can sometimes make it difficult to get good IR spectra, even when submitted powder specimens are fairly pure?

13.5 Practical Exercises

- 13.5.1 Run Dille-Koppanyi and/or Zwikker's test on one or more barbiturates.
- 13.5.2 Obtain a Fiorinal capsule or prepare a mixture similar to its contents. Fiorinal contains: 50 MG butalbital, 325 MG aspirin and 40 MG caffeine. Perform a liquid/liquid extraction sequence that will isolate butalbital in the organic phase. Analyze the extract by GCMS.
- 13.5.3 Analyze amobarbital and pentobarbital by GCMS and compare mass spectra.
- 13.5.4 Run GCMS on diazepam, chlordiazepoxide and oxazepam. (Be sure to run the chlordiazepoxide as a free base on a clean inlet liner.) Answer the following:
- 13.5.4.1 Did each drug give a molecular ion?
- 13.5.4.2 Did any drug decompose to some extent?
- 13.5.4.3 How was the chromatography for each drug?
- 13.5.5 Run the m-dinitrobenzene/NaOH color test and the MeOH/5% NaOH color test on the following benzodiazepines: diazepam, clonazepam and flunitrazepam. Compare the responses to those indicated in section 12 of DPS Controlled Substances Handbook.
- 13.5.6 Color test some GHB and some GBL using one or more of the color tests mentioned in the GHB monograph of the DPS Analytical Protocols Manual.
- 13.5.7 Derivatize some GHB with some BSTFA/TMCS derivitizing agent and run the derivative on GCMS. (See GHB monograph for details.)
- 13.5.8 Analyze some GHB sodium salt standard by IR, being careful to keep it from absorbing moisture.
- 13.5.9 Run GCMS on carisoprodol and compare the spectrum obtained with that of a standard run on the same instrument.
- 13.5.10 Optional – Run a carbamate color test on carisoprodol and note the color response.

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14 Module XIII - Anabolic Steroids**14.1 Objectives**

14.1.1 Training will equip the trainee to:

14.1.1.1 Be familiar with common anabolic steroids and related substances

14.1.1.2 Select and conduct appropriate tests for controlled substances of interest

14.1.1.3 Identify anabolic steroids or other substances of interest

14.1.1.4 Appropriately report findings

14.2 Assigned Reading

14.2.1 To be assigned to trainee by discipline training coordinator at the beginning of this module.

14.3 Helpful Reading

Analytical Profiles of the Anabolic Steroids, Vol. I, CND Analytical, pp 1-31

“Drugs Athletes Use to Enhance Performance”, M.A. Goldwire, www.meniscus.com

“Anabolic steroids”, Drug Identification Bible, 2002 Ed, pp 719-722

Martindale, the Extra Pharmacopoeia, 29th Ed, pp 1383-1384

“The Analysis and Identification of Steroids”, Journal of Forensic Science, Vol. 37, No. 2, Mar 1992, pp 488-502

“Anabolic Steroids - Analysis of Dosage Forms from Selected Case Studies from the Los Angeles County Sheriffs Scientific Services Bureau”, Journal of Forensic Sciences, Vol. 36, July 1991, pp 1079-1088

“Anabolic Steroids - Commercial Products”, Microgram, Vol. XXIV, Nov. 1991, pp 268-281

“Anabolic Steroids”, Microgram, Vol. XXIV, May 1991, p 1

“Analysis of Anabolic Steroids”, Microgram, Vol. XXII, May 1989, pp 74-91

Formulation Information for Selected Trade Name Anabolic Steroid Products, Microgram, Vol. XXV, No. 5, May 1992, pp 134-140

“Steroids: A Selected Bibliography (An Update)”, Microgram, Vol. XXV, Aug. 1992, pp 206-209

“Steroids: A Selected Bibliography”, Microgram, Vol. XXIV, July 1991, pp 163-167

“The Analysis and Identification of Steroids”, Journal of Forensic Sciences, Vol. 37, Mar 1992, pp 488-502

Uses and Abuses of Anabolic Steroids by Athletes, Cocaine, Marijuana, Designer Drugs: Chemistry, Pharmacology and Behavior, (Chapter 17, Sayed M. H. Al-Habet et al) Kinfe K. Redda et al, CRC Press, 1989, pp 211-232

14.4 Study Questions

1. What do the following mean as they relate to steroid abuse?

- “Cutting”
- “Cycling”
- “EPO”

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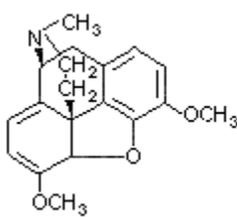
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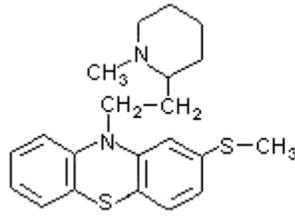
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- “Posing oils”
- “Pyramiding”
- “Stacking”

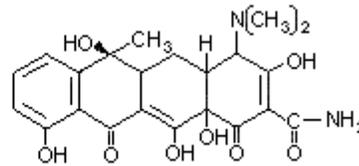
2. Which of the following is a steroid?



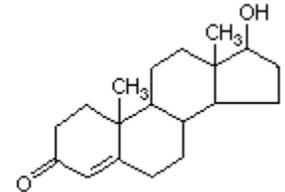
(a)



(b)



(c)



(d)

3. Nandrolone is another name for which compound?

- 1-Dehydrotestosterone
- 19-Nortestosterone
- Norethandrolone
- Dihydrotestosterone

4. Steroid esters are usually prepared for use in which form?

- Aqueous injectables
- Oily injectables
- Oral tablets or capsules
- Gels, patches or implants

5. Which of the following would testosterone propionate be appreciably soluble in?

- Water
- Methanol
- Chloroform
- Hexane

6. Which of the following is NOT a dangerous drug under ARS 13-3401?

- Dehydroepiandrosterone (also known as prasterone)
- Methandrostenolone
- Methyltestosterone
- Androstenedione

7. The molecular weight of testosterone is 288. The molecular weight of propionic acid is 74. The correct molecular weight of testosterone propionate would be:

- 344
- 362
- 400

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8. List at least three health risks associated with steroid abuse.
 9. How can aromatization interfere with the effects steroid abusers want from the anabolic steroids they consume?
 10. Give two reasons why anabolic steroid abusers often include diuretics (drugs which increase urine output) with their steroid consumption.
 11. Describe a method by which steroid abusers sometimes consume anabolic steroids obtained as veterinary implant pellets.
 12. Sustanon 250, also called Sostanon 250, contains what?
 - Stanozolol
 - Boldenone undecylenate
 - A mixture of methenolone acetate and methenolone enanthate
 - A mixture of four testosterone esters
 13. Name a steroid that contains nitrogen.
 14. Give an example of an anabolic steroid prepared as an aqueous suspension.
 15. Give an example of an anabolic steroid prepared as veterinary implant pellets.

14.5 Practical Exercises

14.5.1 Run color tests on standards of the following steroids and complete the color response table:

Steroid	H₂SO₄	Marquis	Mecke's	Dille-Koppanyi
Fluoxymesterone				
Methandriol				
Methandrostenolone				
17 α -Methyltestosterone				
Stanozolol				

14.5.2 Obtain a specimen of "Sten" (an oily steroid injectable) or make its equivalent. Composition is as follows: 37.5 MG testosterone cypionate, 12.5 MG testosterone propionate and 10 MG dehydroisoandrosterone (prasterone) per ML vegetable oil.

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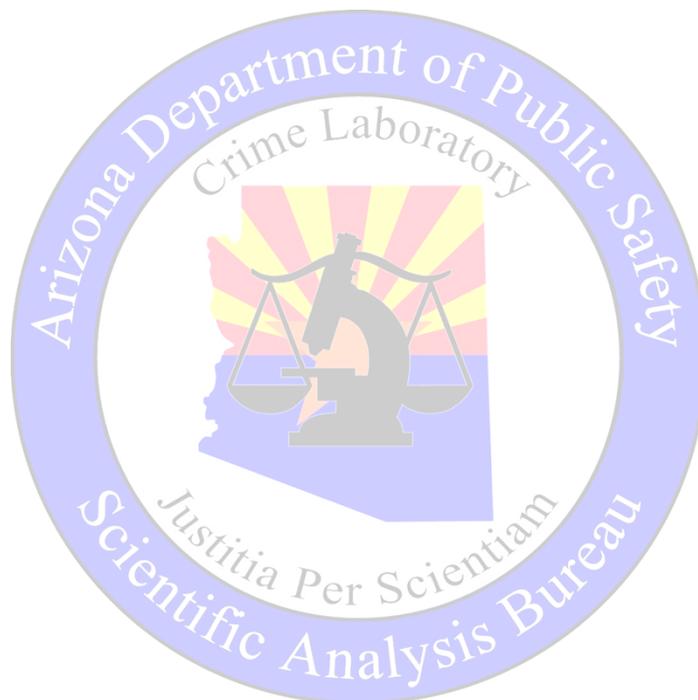
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- 14.5.3 Do a methanolic extract of this oily solution and analyze the methanolic extract by TLC. Try using UV quenching on a fluorescent TLC plate for spot location. Also try fuming the plate with iodine vapor for spot location. If the first mobile phase does not resolve all four drugs, try a second mobile phase. Run GCMS on the extract and identify as many steroids and vegetable oil components as possible.
- 14.5.4 Run an IR spectrum of stanozolol.
- 14.5.5 Analyze an oxymetholone standard by GCMS. Did you find an extra elutant with a molecular weight of either 346 or 360? If so, what was it? (Note: This extra elutant may or may not form, depending on inlet conditions.)



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15 Module XIV - Oral Board Examination

The trainee must successfully complete an oral board examination. This examination consists of: drug analysis procedures, knowledge of the applicable drug statutes, controlled substance analytical protocols, evidence handling and instrumentation. The trainee will also be assessed on general procedural knowledge and critical thinking. If there are evident areas for improvement upon completion of the oral board examination, the trainee will be given remediation exercises provided by the discipline training coordinator based on feedback from the CS supervisor and CS technical lead.

15.1 Expectations

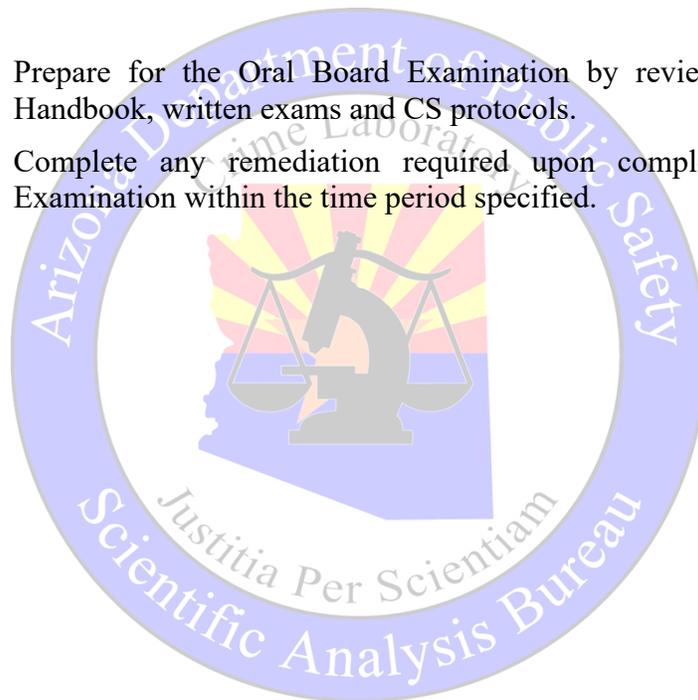
15.1.1 Successfully Complete the Oral Board Examination

15.1.2 Complete any remediation required upon completion of the Oral Board Examination

15.1.3 Tasks

15.1.3.1 Prepare for the Oral Board Examination by reviewing study questions, CS Handbook, written exams and CS protocols.

15.1.3.2 Complete any remediation required upon completion of the Oral Board Examination within the time period specified.



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16 Module XV - Court and Court Testimony**16.1 Objectives**

- 16.1.1 Familiarize the trainee with courtroom procedure
- 16.1.2 Equip the trainee to effectively present testimony on direct examination
- 16.1.3 Equip the trainee to persuasively defend his/her findings on cross-examination

16.2 Assigned Reading

- 16.2.1 To be assigned to trainee by discipline training coordinator at the beginning of this module.

16.3 Helpful Reading

- “Legal Aspects of Forensic Science”, Kurzmak, N.T., Forensic Science Handbook, Prentice-Hall, 1982, pp 1-27
- “On Being a Good Expert Witness in a Criminal Case”, Kogan, J.D., Journal of Forensic Sciences, Vol. 23, No. 1, 1978, pp 190-200
- “The Ethical Obligations of the Forensic Scientist in the Criminal Justice System”, James E. Starrs, Journal of the AOAC, 1971, Vol. 54, No. 4, pp 906-914
- “The Role of the Forensic Expert in a Criminal Trial”, Stanley A. Cohen (handout)

16.4 Study Questions**(Questions in bold type are critical questions.)**

1. Define the following:
 - Continuance
 - Cross examination
 - Deposition
 - Duces tecum
 - Frye Test
 - Grand jury
 - Indictment
 - Mistrial
 - Voire dire

2. Which of the following does a defense attorney have the right to obtain?
 - A copy of the written examination report?
 - An interview with the forensic scientist who worked the case
 - A copy of the forensic scientist’s examination notes
 - A copy of any chain of custody records
 - Copies of calibration and repair records for instruments used

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3. **A defense attorney with his own expert wants to come to the crime lab to look at and re-analyze some evidence you previously examined. Describe what is and is not permitted under General Procedures Manual 4.6.**
4. How does the burden of proof in a criminal trial differ from that in a civil trial?
5. **According to General Procedures Manual 1.9, what may a forensic scientist do to resolve a conflict between a subpoena and a scheduled time off?**
6. **Under General Procedures Manual 3.8, who is normally responsible to see that evidence is transported to court?**
7. **Write out an explanation of how the following instruments work that a jury could understand. Provide an analogy for each.**
 - a. GC/MS
 - b. GC/FID
 - c. FTIR
8. **Write out an explanation of measurement uncertainty that would be appropriate for a jury. Provide an analogy to help the jury understand.**

16.5 Practical Exercises

- 16.5.1 Describe, in writing, your experience, education and other training that qualifies you as an expert in controlled substance analysis.
- 16.5.2 Practice describing how a GCMS works, using language that a layperson can understand.
- 16.5.3 Pretend you are testifying on a simple one-item marijuana case involving a usable quantity. Rehearse how you would answer such questions as:
 - 16.5.3.1 State your qualifications as an expert.
 - 16.5.3.2 How do you recognize this exhibit?
 - 16.5.3.3 Explain how evidence is routinely submitted to the crime lab and what documentation there is for transfers of custody.
 - 16.5.3.4 Describe what type of information is on a Request for Examination form and how the form is used.
 - 16.5.3.5 How did you make sure that the evidence was secure all the time it was in your custody?
 - 16.5.3.6 What indication do you have that the evidence has not been tampered with since you last had it?
 - 16.5.3.7 What type microscope did you use for the microscopic examination?

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- 16.5.3.8 Do you know the make and model of the microscope?
- 16.5.3.9 Describe the microscopic examination you do. What microscopic features do you need to find to conclude that a specimen is marijuana?
- 16.5.3.10 Describe the modified Duquenois Levine test and the color responses marijuana would give at each step.
- 16.5.3.11 How do you know your test reagents were functioning properly?

16.5.4 Assuming this was a typical 1 gram quantity of marijuana, why would it be a usable quantity?

16.5.5 Observe other forensic scientists testifying in court.

16.6 Mock Court

Participate in a mock trial, with the trainee as the state's expert witness and laboratory staff acting as judge, defense attorney, prosecutor and jury. This should observe standard court protocols, provide realistic examination and cross examination, and finish with feedback for the trainee.

16.6.1 Expectations

- 16.6.1.1 Successfully pass a mock trial

16.6.2 Tasks

- 16.6.2.1 Complete a Controlled Substances case for Mock Court
- 16.6.2.2 Meet with the "Prosecutor" assigned to the case and become prepared as an expert witness
- 16.6.2.3 Provide a CV to the Court
- 16.6.2.4 Prepare with the Discipline Training Coordinator for the Mock Court
- 16.6.2.5 Complete any remediation required upon completion of the Mock Court within the time period specified

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17 Module XVI - Competency Unknowns**17.1 Instructions For All Competency Unknowns**

- 17.1.1 You are asked to detect and identify any controlled substances present in the accompanying set of unknowns. This is an open book exercise; you may consult books, training notes or other published or compiled materials while pursuing the analyses.
- 17.1.2 The focus here is on your ability to identify controlled substances following DPS laboratory protocols. Proceed with the same care you would use for examining case evidence. Since this is not a case, you do not need to note substance quantities, packaging or usability. You must, however, develop a set of examination notes that clearly indicate what tests were done, what extractions or sample preparations were used and what the test responses were. Enclose printouts from your instrumental work.
- 17.1.3 For marijuana/cannabis unknowns sets, testing and reporting shall only be for marijuana or cannabis materials. The trainee need not identify other substances in those sets. If the trainee is also covering cannabimimetic materials during marijuana training the unknown set will contain these materials and they must be identified.
- 17.1.4 For other unknowns sets, try to recognize all of the controlled drugs and most of the non-controlled drugs present. If tests indicate any non-controlled substances, indicate such in notes. It is not necessary to conclusively identify any non-controlled substances.
- 17.1.5 It is not necessary to identify starches, sugars or inorganic substances in the set.
- 17.1.6 Do not do any quantitative analysis on these unknowns.
- 17.1.7 Don't report finding a controlled substance if you aren't sure of its identity. It is better to not report a controlled substance than to misidentify one in your conclusions.
- 17.1.8 Generate a scientific analysis report, under the case number provided by your trainer, of your findings using LIMS. Report each controlled substance found, with its ARS statutory name and drug classification (e.g. "Heroin, a narcotic drug"). It is not necessary to address usability. Do not include non-controlled substances on the report. It is sufficient for them to be mentioned in the notes. If no controlled substance was found for an unknown, report "No narcotics or dangerous drugs detected".
- 17.1.9 Initial and serially number all pages of the examination notes. Submit complete notes with the report and the unknown set to the instructor when finished.
- 17.1.10 Your work will be evaluated for:
- 17.1.10.1 Correct identification and reporting of any controlled substances present
 - 17.1.10.2 Use of appropriate analytical schemes
 - 17.1.10.3 Compliance with DPS Crime Laboratory analytical protocols
 - 17.1.10.4 Compliance with DPS Crime Laboratory note-taking/documentation practices
 - 17.1.10.5 Quality of instrumental work



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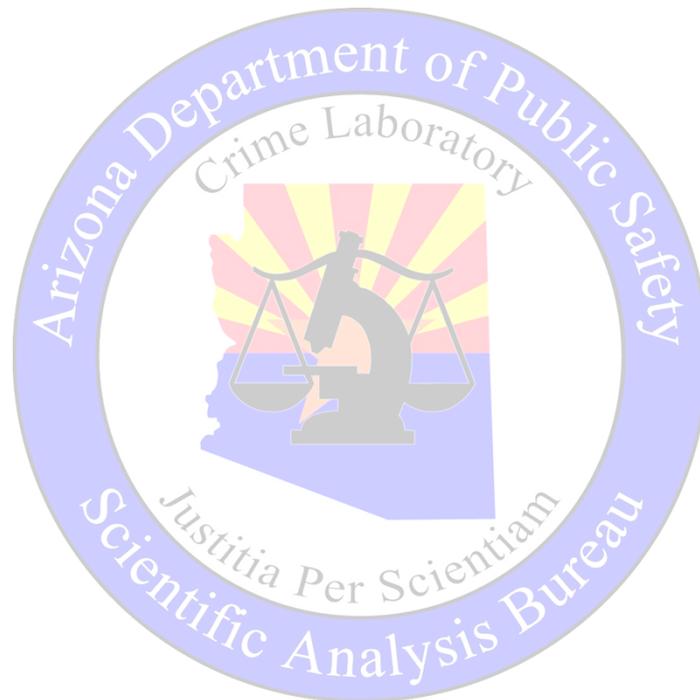
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17.1.10.6 Skill in analyzing problematic specimens

17.1.11 Your performance on these unknowns is important. Take your time. Be careful.
Good luck!



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18 Casework Authorization

Upon successful completion of all each phase of training, including any remediation, the technical lead will submit a Casework Authorization Packet to the SAB Training Coordinator. If the packet is in order, then the SAB Training Coordinator will recommend to the SAB System Quality Manager that the trainee be authorized to perform casework in the appropriate drug category.

18.1 Casework Authorization Packet consists of the following:

1. The Discipline Training Coordinator Memo:

The Discipline Training Coordinator will provide a memo to the technical lead stating that the trainee has completed all of the requirements of the training program **and** recommend that the trainee be signed off to do Controlled Substance casework within the scope of the training. This memo will detail the various areas of training covered for the trainee along with describing any previous experience that the trainee had, where applicable.

2. Completed Controlled Substance Training Overview Checklist
3. All completed Oral Board/ Mock Court Evaluations
4. Additional documentation, if needed (e.g., previous experience documentation)

A Qualtrax Casework Authorization workflow will be initiated and the Casework Authorization packet will be uploaded into the workflow. The SAB Quality Manager will authorize the trainee to perform analysis in the appropriate drug category and will notify the trainee once this authorization is complete.

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Appendix A Controlled Substances Training Overview Checklist

TOPIC	DATE(S)	TRAINER
2. LAB AND SAFETY ORIENTATION		
3. MARIJUANA/CANNABIS		
Competency work: Marijuana/Cannabis Unknowns		
Review Answers: Marijuana/Cannabis Study Questions		
Written Exam: Marijuana and Cannbinoids		
Marijuana Mock Trial		
Marijuana Oral Board		
4. LAWS AND REGULATIONS		
Review Answers: Laws and Regulations Study Questions		
5. ANALYTICAL PROTOCOLS		
6. EVIDENCE HANDLING AND DOCUMENTATION		
Review Answers: Evidence Handling and Documentation Study Questions		
7. REPORTS		
Review Answers: Report Study Questions		
8. WET METHODS OF ANALYSIS		
Review Answers: Wet Methods Study Questions		
9. INSTRUMENTAL METHODS OF ANALYSIS		
Review Answers: UV/Vis Study questions		
Review Answers: IR Study Questions		
Review Answers: GC/FID Study Questions		
Review Answers: GC/MS Study Questions		
Review Answers: XRF Study Questions (if applicable)		
10. CNS STIMULANTS		
Competency Work: Stimulants Unknowns		
Review Answers: Stimulants Questions		
Written Exam: Stimulants		
Stimulant Mock Trail		
Stimulant Oral Board		
11. NARCOTIC ANALGESICS		
Review Answers: Narcotic Analgesics Study Questions		
12. HALLUCINOGENS		
Competency Work: Narcotic Analgesics & Hallucinogens Unknowns		
Review Answers: Hallucinogens Study Questions		
Written Exam: Narcotic Analgesics & Hallucinogens		
13. CNS DEPRESSANTS		
Review Answers: Depressants Study Questions		
14. ANABOLIC STEROIDS		



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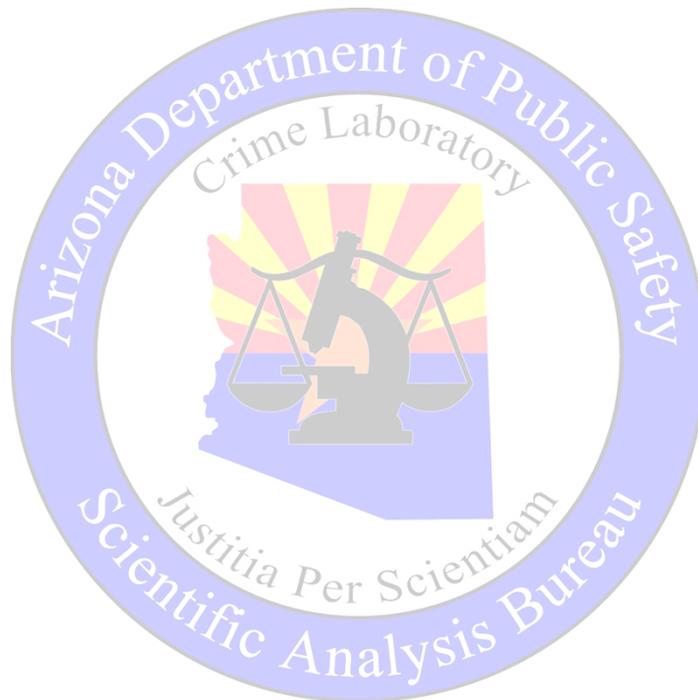
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Competency Work: Depressants & Anabolic Steroids Unknowns		
Review Answers: Anabolic Steroids Study Questions		
Written Exam: Depressants & Anabolic Steroids		
15. COURT AND COURT TESTIMONY		
Review Answers: Court and Court Testimony Study Questions		





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Appendix B Training Progress Report Sample

Discipline	Trainee	Mentor	Date
Discipline Training Coordinator		Supervisor	
Discipline Tech Lead		SAB Training Coordinator	
PREVIOUS WEEK'S ACCOMPLISHMENTS			
REASON PREVIOUS WEEKS EXPECTATIONS WERE NOT MET, IF APPLICABLE			
CURRENT WEEKLY EXPECTATIONS			
ESTIMATED PERCENT COMPLETE			
IS THERE CONCERN FOR THE TRAINEE'S PROGRESS? IF YES, PLEASE EXPLAIN			
STRENGTH TRAINEE CAN CONTINUE TO DEVELOP			
FOCUS FOR CURRENT WEEK			
ACKNOWLEDGEMENT OF TRAINING PROGRESS REPORT*			
Discipline Training Coordinator		Trainee	SAB Training Coordinator
Discipline Tech Lead		Mentor	Supervisor
Estimated Completion Date			



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Appendix C Oral Board/Mock Court Evaluation Sample

TRAINEE:

DATE OF EVALUATION:

SCOPE:

ORAL BOARD MOCK COURT (choose one)

ATTENDEES:

REMEDATION TOPICS: VERBAL WRITTEN ORAL BOARD MOCK COURT

DATE REMEDIATION COMPLETE: _____

COMMENTS:

SIGNATURES:

TRAINEE: _____

DATE: _____

TRAINING COORDINATOR: _____

DATE: _____

PLEASE INCLUDE A COPY OF THIS COMPLETED FORM IN THE TRAINING PACKET SUBMITTED TO SAB QUALITY ASSURANCE



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Appendix D Checklist for Completed Training

TRAINEE: _____

TOPIC	DATE(S)	TRAINER
2. SAFETY		
Discussion/Orientation <ul style="list-style-type: none"> <input type="checkbox"/> Chemical storage <input type="checkbox"/> Chemical Hygiene Plan <input type="checkbox"/> Exposure Control Plan <input type="checkbox"/> Response to chemical spills/exposures <input type="checkbox"/> Emergency evacuation procedures <input type="checkbox"/> Fume hood operation <input type="checkbox"/> MSDS <input type="checkbox"/> Hepatitis B vaccination <input type="checkbox"/> Procedure for reporting accidents Introduce safety officer and/or safety training officer Walk Through showing locations of: <ul style="list-style-type: none"> <input type="checkbox"/> Fire extinguishers <input type="checkbox"/> First aid kits <input type="checkbox"/> MSDS <input type="checkbox"/> Exits <input type="checkbox"/> Eyewashes and/or drench hoses <input type="checkbox"/> Safety showers <input type="checkbox"/> Chemical spill equipment <input type="checkbox"/> Safety protocol manuals and other safety literature 		
3. MARIJUANA/CANNABIS		
Presentations <ul style="list-style-type: none"> <input type="checkbox"/> Introduction to Marijuana <input type="checkbox"/> Botany and Taxonomy <input type="checkbox"/> Analysis of Marijuana Resin <input type="checkbox"/> Miscellaneous Marijuana Issues <input type="checkbox"/> Plants of Forensic Interest 		
Review Answers: Marijuana/Cannabis Study Questions		
Competency work: Marijuana/Cannabis Unknowns		
Marijuana Mock Trial		
Marijuana Oral Board		

TOPIC	DATE(S)	TRAINER
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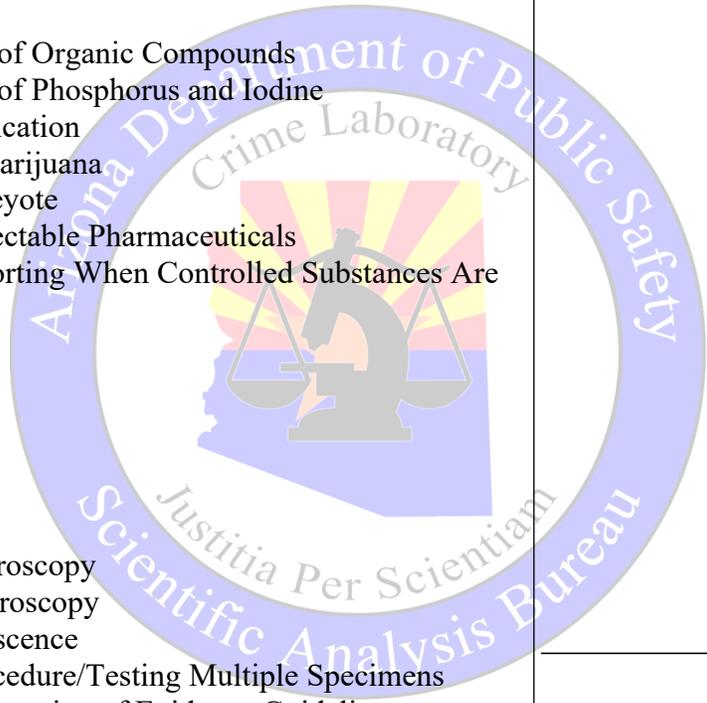
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4. LAWS AND REGULATIONS		
Presentations <ul style="list-style-type: none"> <input type="checkbox"/> Classification of Drugs under ARS <input type="checkbox"/> The Controlled Substance Act <input type="checkbox"/> Determination of Prescription-only status 		
Review Answers: Laws and Regulations Study Questions		
5. ANALYTICAL PROTOCOLS		
Discussions <ul style="list-style-type: none"> <input type="checkbox"/> Determining Quantity <input type="checkbox"/> Measurement Uncertainty Estimation <input type="checkbox"/> Usability <input type="checkbox"/> Identification of Organic Compounds <input type="checkbox"/> Identification of Phosphorus and Iodine <input type="checkbox"/> Visual Identification <input type="checkbox"/> Analysis of Marijuana <input type="checkbox"/> Analysis of Peyote <input type="checkbox"/> Tampered Injectable Pharmaceuticals <input type="checkbox"/> Analysis/Reporting When Controlled Substances Are Not Detected Not Detected <ul style="list-style-type: none"> <input type="checkbox"/> Color Tests <input type="checkbox"/> Crystal Tests <input type="checkbox"/> TLC <input type="checkbox"/> Extractions <input type="checkbox"/> GC/FID <input type="checkbox"/> GC/MS <input type="checkbox"/> UV/Vis Spectroscopy <input type="checkbox"/> Infrared Spectroscopy <input type="checkbox"/> X-Ray Fluorescence <input type="checkbox"/> Sampling Procedure/Testing Multiple Specimens <input type="checkbox"/> Threshold Processing of Evidence Guidelines <input type="checkbox"/> Analysis of Submitted Core Samples <input type="checkbox"/> Reagents <input type="checkbox"/> Authentication of Drug Standards <input type="checkbox"/> Control of Drug Standards <input type="checkbox"/> Case Review <input type="checkbox"/> Case Records/Documentation 		



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6. EVIDENCE HANDLING AND DOCUMENTATION		
Presentations <ul style="list-style-type: none"> <input type="checkbox"/> Chain of Custody <input type="checkbox"/> Markings and Seals <input type="checkbox"/> Security/Access <input type="checkbox"/> Note-Taking <input type="checkbox"/> Retention of Evidence 		
Review Answers: Evidence Handling/Notes Study Questions		
7. REPORTS		
Presentations <ul style="list-style-type: none"> <input type="checkbox"/> Different Types of Reports <input type="checkbox"/> Writing Reports in LIMS <input type="checkbox"/> Case Review 		
Review Answers: Report Study Questions		
8. WET METHODS OF ANALYSIS		
Presentations <ul style="list-style-type: none"> <input type="checkbox"/> Isolation of Controlled Substances <input type="checkbox"/> Gravimetric Extraction <input type="checkbox"/> Color Tests <input type="checkbox"/> Microcrystal Tests <input type="checkbox"/> Thin Layer Chromatography (TLC) 		
Review Answers: Wet Methods Study Questions		
9. INSTRUMENTAL METHODS OF ANALYSIS		
Presentations <ul style="list-style-type: none"> <input type="checkbox"/> UV/Vis Spectroscopy <input type="checkbox"/> IR/FTIR Spectroscopy <input type="checkbox"/> GC/FID <input type="checkbox"/> GC/MS <input type="checkbox"/> XRF (only for persons who will do elemental analysis) 		
Review Answers: UV/Vis Study questions (if applicable)		
Review Answers: IR Study Questions		



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Review Answers: GC/FID Study Questions		
Review Answers: GC/MS Study Questions		
Review Answers: XRF Study Questions (if applicable)		
10. CNS STIMULANTS		
Presentations <ul style="list-style-type: none"> <input type="checkbox"/> Introduction to CNS Stimulants <input type="checkbox"/> Phenethylamine Stimulants <input type="checkbox"/> Cocaine and Local Anesthetics <input type="checkbox"/> Aminopropiophenones <input type="checkbox"/> Miscellaneous Stimulants <input type="checkbox"/> Common Diluents <input type="checkbox"/> Inhalants <input type="checkbox"/> Reporting Pill and Powder Cases 		
Review answers: Stimulants Study Questions		
Competency Work: Stimulants Unknowns		
Written Exam: Stimulants		
Stimulant Mock Trail		
Stimulant Oral Board		
11. NARCOTIC ANALGESICS		
Presentations <ul style="list-style-type: none"> <input type="checkbox"/> Introduction to Narcotic Analgesics <input type="checkbox"/> Opium and Semi-synthetic Opiates <input type="checkbox"/> Synthetic Opiates <input type="checkbox"/> Non-controlled Analgesics 		
Review Answers: Narcotic Analgesics Study Questions		
12. HALLUCINOGENS		
Presentations <ul style="list-style-type: none"> <input type="checkbox"/> Introduction to Hallucinogens <input type="checkbox"/> Substituted Phenylalkylamine Hallucinogens <input type="checkbox"/> Indole Hallucinogens <input type="checkbox"/> PCP Analogs and Inhalants 		



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Review Answers: Hallucinogens Study Questions		
Competency Work: Narcotic Analgesics & Hallucinogens Unknowns		
Written Exam: Narcotic Analgesics & Hallucinogens		
13. CNS DEPRESSANTS		
Presentations <ul style="list-style-type: none"> <input type="checkbox"/> Introduction to CNS Depressants <input type="checkbox"/> Barbiturates <input type="checkbox"/> Benzodiazepines <input type="checkbox"/> GHB and Related Compounds <input type="checkbox"/> Miscellaneous Depressants 		
Review Answers: Depressants Study Questions		
14. ANABOLIC STEROIDS		
Presentations <ul style="list-style-type: none"> <input type="checkbox"/> Introduction to Anabolic Steroids <input type="checkbox"/> Practices of Steroid Abusers <input type="checkbox"/> Chemistry of Anabolic Steroids <input type="checkbox"/> Analysis of Anabolic Steroids 		
Review Answers: Anabolic Steroids Study Questions		
Competency Work: Depressants & Anabolic Steroids Unknowns		
Written Exam: Depressants & Anabolic Steroids		
16. COURT AND COURT TESTIMONY		
Presentations <ul style="list-style-type: none"> <input type="checkbox"/> Discovery <input type="checkbox"/> Defense Experts <input type="checkbox"/> The Court System <input type="checkbox"/> Trial Procedure <input type="checkbox"/> Effective Testimony <input type="checkbox"/> "Usability" 		
Review Answers: Court/Testimony Study Questions		



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Appendix E Revision History

Section(s) Revised/Reviewed	Date	Issuing Authority
New document to reflect new training structure and current Controlled Substances procedures.	January 2016	SAB Superintendent
CSTM Rev 2 Significant Changes: Removed AutoOpen Macro Minor grammatical and formatting changes	Sept 2018	SAB Superintendent

