

CHEM 4351
Forensic Chemistry Laboratory
Spring 2015 Course Syllabus

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Laboratory Schedule: 6:00-9:50pm T,R, CHEM 280

Office Hours: F 10:00-11:00AM, Hickory 282

T,R 3:00-4:00PM, Hickory 004

Error Analysis and Propagation (Jan 20, 22, 27, 29)

Lab 1: Error Analysis

Purpose: This lab is designed to help the student understand the uncertainty in evidence and processing. It will also give the student the necessary tools to articulate propagation of error of their analysis. This lab will lay the groundwork for documentation throughout the rest of the course and introduce Quality Assurance.

Lab 2: Accurate Solution Prep

Purpose: The goal of this lab is to gain an understanding of the importance of accurately and precisely preparing analytical solutions.

Separations (Feb 3, 5, 10, 12, 17,19)

Lab 1: Thin-Layer Chromatography (TLC) – Analysis of Lipstick

Purpose: This lab will focus on the analysis of specific dyes by solid-liquid chromatography. The student will learn to extract a lipstick smear, process, and compare dyes with TLC.

Lab 2: High Performance Liquid Chromatography (HPLC) – Ink Analysis and Dating

Purpose: This lab is intended to illustrate HPLC's uses for document ink analysis. The student will learn how to process a document and analyze the ink for chemical changes to determine correction of the document and dating.

Lab 3: Gas Chromatography (GC) – Analysis of Plasma for Ethanol and other VOCs

Purpose: The goal of this lab is to determine the concentration of volatiles, specifically ethanol, from a synthetic plasma solution. The student will learn how to process a plasma sample and prepare an aqueous injection for GC analysis.

Lab 4: Gel Electrophoresis – Analysis of DNA Fragments

Purpose: Introduce the students to Electrophoretic Separation of DNA and RNA fragments. The students will learn how to make gels, and compare results to a database record.

Mass Spectrometry (Feb 24, 26, March, 3, 5, 10, 12)

Lab 1: Electrospray Ionization (ESI) MS – Analysis of a Protein Mixture

Purpose: The intention of this lab is to separate a protein mixture, excise, and quantitate. The student will learn the proper way to handle evidence through multiple steps and days, and retain analytical accuracy.

Lab 2: Tandem MS-MS to identify Drugs of Interest

Lab 3: MALDI-Time-of Flight (TOF) – Analysis of an Unknown Animal Protein

Purpose: The goal of this lab is to utilize the matrix-assisted laser-desorption ionization source (MALDI) with time-of-flight mass spectrometry for the analysis of an unknown protein sample. The student will learn how to employ MASCOT and other online protein/MS databases.

Lab 4: Gas Chromatography (GC) – Analysis of Arson Accelerants

Purpose: The objective of this lab is to determine accelerants from a burned fiber source. The student will learn to prepare a head space sample for analysis with a GC.

Midterm Exam – March 24, 2015

Chemical Techniques (March 26, 31, April 2, 7, 9)

Lab 1: Organic Chemical Spot Tests

Purpose: The objectives here are to instruct the students in the use common field spot tests for organic and gunshot residue. These chemistries will be introduced to help the students gain an understanding of the power and limitations of these quick tests.

Lab 2: Soil Examination

Purpose: To instruct the students in commonly utilized techniques for soil comparison analysis. This includes microscopy, pH, color, and density gradient measurements.

Lab 3: Inductively-Coupled Plasma

Purpose: To determine the absolute concentration of toxic metals in common items.

Spectroscopy (April 14, 16, 21, 23, 28, 30)

Lab 1: UV-Vis Spectroscopy - Analysis Food Dyes

Purpose: To introduce the student to common UV-Visible spectroscopy as applied to the analysis of food dyes. This lab will expand the student's knowledge of the use of dyes in food, as well as the commonality of the used dyes.

Lab 2: ATR-IR Spectroscopy - Analysis of Synthetic Fiber

Purpose: The goal of this lab is to use multiple instrumental methods to analyze a synthetic fiber. UV-Vis analysis for Dyes, Microscopy for fiber length and twist, and Fourier Transform Infrared Spectroscopy (FTIR) for synthetic composition will be employed to isolate the fiber sample.

Lab 3: Fluorescence Spectroscopy – Analysis of Petroleum

Purpose: The purpose of this lab is to utilize fluorescence as a screening tool to characterize and quantize petroleum waste or evidence. The student will compare an unknown sample to known petroleum references, and quantitate the amount present.

Lab 4: Atomic Emissions – Analysis of Trace Metals

Purpose: The objective of this lab is to determine the metal composition of bullet lead. The student will learn to distinguish bullet lots and manufacturers from analytical differences in their elemental composition.

Makeup Lab for University Closings (May 5)

Final Exam – May 12, 2015 6:00pm-8:00pm

Required Exam for FS Students: All students in the UNT Forensic Science Program are required to take the Forensic Science Aptitude Test (FSAT) which will be administered in the Forensic Chemistry course of the Spring semester. Please submit to Dr. Verbeck a check for \$50 made out to “ABC Registrar” and the completed Request for ABC Examination Sheet Form by January 29th. Any student who does not sit for the exam will not receive their Forensic Science certification.

Suggested Readings **

1. Forensic Science Handbook, Vol 1,2,3, R. Saferstein, Ed., Pearson Prentice Hall.
2. Skoog, Holler, and Nieman, Principles of Instrumental Analysis, Saunders College Publishing.
3. Karger, Snyder, and Horvath, An Introduction to Separation Science, John Wiley and Sons Publishing.
4. Cannon, J., Pharmacology for Chemists, Oxford University Press.

**Note: The Suggested Readings will be on hold at the library or in my office.

Grading Policy:

2 Lab Exams (300 pts/each) and 17 Lab Reports (100 pts/each).
Your final grade will be a sum of each lab and final exam divided by 23. (Total = 1700+600= 2300)

Guaranteed Course Grade: A-90.0%, B-80.0%, C-70.0%, D-60.0%, F<60.0%

Lab Notebook:

Your lab notebook is an analytical notebook and will be graded as such. The notebook must contain page numbers (not written in by you). It will be completed with black or blue ink only. All correction in the notebook will be marked out with a single line and initialed and dated. Any figures taped into the notebook will be initialed across an edge, touching insert, tape, and notebook page. The notebook will include your procedure, data, results, and conclusions. The notebook will be collected twice during the semester and labs graded. Remember, this is an analytical lab. All numbers will have the correct significant figures and units, and all graphs and tables will be properly labeled.

Additional Information:

1. According to University policy, the grade of I (incomplete) cannot be given as a substitute for a failing grade in a course.
2. Statement of ADA Compliance: The chemistry department cooperates with the Office of Disability Accommodations to make reasonable accommodations for qualified students with disabilities. If applicable, please present your request along with an official written verification from the ODA before the end of the first week of classes.