

Chemistry 4212 Instrumental Analysis Laboratory Spring 2019

COURSE SCHEDULE:

Section 1 (CRN: 21218) -

Lecture Monday 12:30 – 1:20 pm (CCSB 1.0202); Lab Monday 1:30 – 4:20 pm (CCSB G.0714)

Section 2 (CRN: 22147) -

Lecture Monday 12:30 – 1:20 pm (CCSB 1.0202); Lab Tuesday 1:30 – 4:20 pm

INSTRUCTOR:

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TEACHING ASSISTANT:

	Office	Email	Office Hours
Qin Gao	CCSB 2.0504	qgao@miners.utep.edu	By appointment. Please email the TA to set up an appointment
Aruna Narayanan	CCSB 2.0504	anarayanan2@miners.utep.edu	
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COURSE OBJECTIVES:

- To practice and improve your skills and knowledge in Instrumental analytical chemistry.
- To apply the knowledge and gain hands-on experience in subjects covered in the lecture.

COURSE DESCRIPTION:

These experiments are intended to illustrate the major analytical techniques described in the lecture. It should be taken with CHEM 4211.

A lecture will be given each week to outline the content of the lab starting with a presentation. It is important that you invest in good preparation BEFORE coming to lab by reading the lab manuals, doing the pre-lab exercises, and writing your own outlined procedure for each lab.

COURSE EVALUATION:

You will be graded on your overall grasp of the skills, concepts, and participation in the laboratory experiments and written exercises.

- 1) Pre-Lab Report/Attendance: 10 % (individual)
- 2) Presentations: 30 %
- 3) Lab Report: 30 % (by group)
- 4) Final Exam: 30 %

A: 90% - 100%, B: 80% - 89%, C: 70%-79%, D: 60%-69%, F: <60%

1. Pre-Lab Report: 10 % (individual)

A lab notebook is required for pre-lab notes and for recording data during experiments. The pre-lab report is intended to prepare you for the lab and therefore should be written in your lab notebook before you come to the lab. Should you struggle in the preparation of the pre-lab or with any of the calculations for each lab feel free to e-mail your TAs or the professors.

Notebook sections to include for each experiment are as follows.

- a) Title and date of the experiment. **(1 pt)**
- b) Source Reference: Give the initial source of the experiment—i.e., what your source of instructions is; e.g., handout or textbook reference. **(1 pt)**
- c) Purpose: State the purpose of the lab, usually ~1-2 sentences, in your own words. **(2 pt)**
- d) Structures/Reactions: Show the primary chemical reactions involved and/or structure of compound(s) central to the experiment. If this section is not applicable in the particular experiment, write “Not Applicable” in the report. **(1 pt)**
- e) Reagents/Hazards: List (e.g. via bullet-points or a table) the chemicals needed along with particular hazard information and other information necessary for the experiment (e.g., molecular weight, concentration, moles needed) **(1 pt)**
- f) Procedure: Summarize
 - the procedure to be followed (e.g., in bullet-points or numbered steps). NOTE: This should not be a copy of the procedure from the lab manual! However, this section must include enough information that another person could use your lab book to repeat the experiment without the textbook. It should be written in your own words in a stepwise manner (diagrams are encouraged).
 - changes or points of emphasis brought out in the pre-lab discussion may then be added to the procedural point in question.
 - the special equipment or non-standard glassware required, including illustrations as needed.
 - Measurements and Calculations to be taken during the experiment **(4 pt)**

2. Presentations: 30 %

Each group will present the designated content (details are included in the table of Tentative Schedule). The group-based presentation will be 5-7 min and 3-5 min of Q&A.

3. Lab Reports: Reports are turned in on group basis. Reports should be typed and are due on the day of next lab by 1:30 pm. A daily 10-point deduction will be applied if you fail to turn in your reports on time. Points for the reports will only be counted if you attend the lab. Any missed lab will result in a grade of zero on

that lab. Since there will be no make-up labs, you are allowed to drop one grade of the lab reports to accommodate any personal emergencies.

LABORATORY REPORT REQUIREMENTS:

An excellent lab reports should contain and will be graded on the following parts.

- a) Your name and your lab partners' name (1 pts), the effort of each individual in lab and the report (1 pts), and the date of the experiment (1 pts).
- b) The title of the experiment. (2 pts)
- c) The objectives of the experiment. State the purpose of the lab, usually ~1-2 sentences, in your own words. (5 pts)
- d) Introduction: A description of the **basic theory of the experiment and the system of the instrument**. (15 pts)
- e) Materials and Methods: (15 pts)
 - List all chemicals (including solvents) to be used. List formula weights for each substance and other useful information such as the physical properties, MSDS, etc. Find this information in the reference libraries, or on-line.
 - A clear and concise procedure statement. You may also use a flow chart to illustrate the procedure. Clearly state if any changes were made.
 - List any safety precaution that should be noted.
- f) Results and Discussion: (40 pts)
 - Data, numerical analysis, graphs, tables, etc.
 - Show appropriate calculations and clearly identify important answers. Always use units in your calculations. Be sure to indicate any uncertainties.
 - Describe experimental conditions, observations, and interesting finding. You may find references to support your hypothesis and statements.
- g) Conclusion: A conclusion statement summarizing the result and any conclusion. A summary statement about the data found and the determined results must be clearly stated. (10 pts)
- h) References (10 pts)

TENTATIVE SCHEDULE

Week	Date of Experiment	Title of the Experiment	Group	Content of Presentation
1.	1/21, 22	No Lab		
2.	1/28, 29	Safety and Introduction Instrument Tours	All	NA
3.	2/4, 5	Presentation	All	Theory and application of an instrument of your choice.
4.	2/11, 12	Spec 20 visible light spectrometer - CoCl ₂ and bromocresol green (BG)	Group 1	Experimental ¹
		Identifying an unknown compound by Infrared Spectroscopy	Group 2	
		A Cyclic Voltammetry Study of the Oxidation of Ascorbic Acid (Vitamin C) at a Glassy Carbon Electrode	Group 3	
5.	2/18, 19	Identifying an unknown compound by Infrared Spectroscopy	Group 1	Theory of the instrument ²
		A Cyclic Voltammetry Study of the Oxidation of Ascorbic Acid (Vitamin C) at a Glassy Carbon Electrode	Group 2	
		Spec 20 visible light spectrometer - CoCl ₂ and bromocresol green (BG)	Group 3	
6.	2/25, 26	A Cyclic Voltammetry Study of the Oxidation of Ascorbic Acid (Vitamin C) at a Glassy Carbon Electrode	Group 1	Applications ³
		Spec 20 visible light spectrometer - CoCl ₂ and bromocresol green (BG)	Group 2	
		Identifying an unknown compound by Infrared Spectroscopy	Group 3	

¹ Experimental: focusing on the procedures of the experiment of the week that your group will be doing

² Theory of the instrument: focusing on the instrument of the week that your group will be doing

³ Applications: focusing on other applications (1 or two examples) that could also be achieved by the instrument.

7.	3/4, 5	Measurement of caffeine in coffee beans with UV/vis spectrometer	Group 1	Experimental
		Determination of Chlorophyll in Olive Oil by UV-Visible and Fluorescence Spectroscopy	Group 2	
		Analysis of Trace Lead in Water by Anodic Stripping Voltammetry	Group 3	
8.	3/11, 12	Determination of Chlorophyll in Olive Oil by UV-Visible and Fluorescence Spectroscopy	Group 1	Theory of the instrument
		Analysis of Trace Lead in Water by Anodic Stripping Voltammetry	Group 2	
		Measurement of caffeine in coffee beans with UV/vis spectrometer	Group 3	
9.	3/18, 19	Spring Break		
10.	3/25, 26	Analysis of Trace Lead in Water by Anodic Stripping Voltammetry	Group 1	Applications
		Measurement of caffeine in coffee beans with UV/vis spectrometer	Group 2	
		Determination of Chlorophyll in Olive Oil by UV-Visible and Fluorescence Spectroscopy	Group 3	
11.	4/1, 2	Quantitation and Identification of organic metabolites in Urine by GC/MS	Group 1	Experimental
		Determination of Curcumin in commercial curry products by HPLC	Group 2	
		Chronoamperometry With a Planar Solid Electrode	Group 3	
12.	4/8, 9	Determination of Curcumin in commercial curry products by HPLC	Group 1	Theory of the instrument
		Chronoamperometry With a Planar Solid Electrode	Group 2	
		Quantitation and Identification of organic metabolites in Urine by GC/MS	Group 3	

13.	4/15, 16	Chronoamperometry With a Planar Solid Electrode	Group 1	Applications
		Quantitation and Identification of organic metabolites in Urine by GC/MS	Group 2	
		Determination of Curcumin in commercial curry products by HPLC	Group 3	
14.	4/22, 23	Analysis of Heavy Metals by ICP-OES	Group 1	Theory of the instrument
			Group 2	Experimental
			Group 3	Applications
15.	4/29, 30	Presentation	All	Your favorite experiment/ instrument
16.	5/6, 7	Final Exam (5/6) 12:30 pm – 1:20 pm		

LABORATORY SAFETY

The normal rules for lab safety apply. Protective eyewear must be worn at all time, as must closed shoes, socks and full leg coverage. Lab coats are recommended but not required.

Only limited hood space is available, so we'll have to share, and we may also need to use the hoods in other rooms. If you feel pushed into doing something unsafe because of lack of space or proper tools, please see me or the TA for help. Please practice safety.

- Safety eyewear must be worn during experiments.
- Open toed shoes are not allowed.
- Gloves should be worn when appropriate and recommended by the instructor.
- Long hair must be tied back so it will not accidentally fall into an experiment.
- No foods or drinks are allowed in the lab.
- You must wash your hands after dealing with chemicals or dirty glassware, and when you are done with the lab.
- Cell phones must be turned off or left at home. NO EXCEPTIONS

COURSE POLICIES:

- Goggles are required in the lab. No open toe shoes are allowed.
- The labs are long and you will need to use your time wisely.
- Every group will have an assigned drawer of lab wares. You are responsible for your drawer and its contents. Any items in the drawer found to be missing (or damaged beyond simple repair) at the end of the semester will have to be replaced by you (i.e. you must pay for it). A drawer check-in sheet will be provided.
- ABSENCE POLICY: The lab work in this class is intended to be performed during the scheduled lab hours. An **unexcused** absence is an automatic zero for any lab work that is missed. An **excused** absence may be granted by the Office of Student Affairs **only**. If you know that you will have an official university excused absence on a day that lab work is scheduled (university athletic event or religious holiday), you are required to make arrangements as early as possible **in advance of this date**.
- ACADEMIC HONESTY: Materials (reports, quizzes, exam or otherwise) submitted to fulfill academic requirements must represent a student's own efforts. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Violations will be taken seriously and will be referred to the Dean of Students Office for possible disciplinary action. Students may be suspended or expelled from UTEP for such actions.
- Others:
 - Always look behind you before beginning to move in a lab.
 - Speak loud and clear to warn others of an accident and or potential danger.
 - Know your safety options before you begin (sinks, shower, eyewash, gloves).
 - Know your path out of the lab, if it becomes necessary.

- Know where the fire extinguishers are.
- If an instructor is present during a fire, allow them to operate the fire extinguisher.
- Know what can go wrong and be prepared with a solution (a cure, an antidote).
- Research any chemical that is unfamiliar to you. Know its properties.
- Familiarize yourself with the first-aid supplies and their location.

WASTE

The sink drain is a one way hole. It's best to be very sure that it is OK to pour anything into a drain. Improper waste disposal is not only dangerous to you, but hazardous to the whole community. Unpredictable and dangerous (explosive) chemical reactions can occur. Follow the directions given to you on the boards or hoods for properly disposing chemical waste. Make sure to write down the name and the quantity of the waste put into the waste bottle.