

Syllabus

CHEM 3421 Inorganic Quantitative Analysis— Fall 2021
Department of Chemistry and Biochemistry, Angelo State University



Instructor:

Name : Dr. Shanmugapriya Dharmarajan
Office : CAV 204A
Office hours : MWF 08:00 to 09:00 AM, TR 09:30 to 10:30 AM or by appointment
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Course Description:

Credit : 4 hours credit (Lecture and lab)
Pre-requisite : Passing grade in CHEM 1411
Website : [Blackboard](#)

Meeting Time and Location:

Course delivery : Face-to-face
Lecture times : MWF 11:00 – 11:50 AM [in CAV 223]
Lab times : R 02:00 PM – 04:50 PM [in CAV 211 and CAV 206]

Course Material:

Textbook : Quantitative Chemical Analysis, 10th ed., Daniel C. Harris (Macmillan Achieve eBook recommended)
Online homework : Macmillan Achieve (You can buy the access code to Macmillan Achieve from the ASU Bookstore or using a link posted on Blackboard)
Lab materials : Lab manual (pdf) will be posted on Blackboard
Lab notebook : The Laboratory Notebook (carbonless, spiral) is required
Technology requirement : TopHat, Bb Collaborate, and Respondus Lockdown Browser Monitor
Other materials : Safety goggles, Scientific calculator

Course Objectives:

This course will emphasize the basic concepts of quantitative analytical chemistry using wet methods and some instrumental methods, conceptual understanding of aqueous solution dynamics, analytical method choices, technical skill, statistical analysis involving computer usage, and communication of results. Specific topics include statistical data and error analysis, chemical equilibrium, acid/base chemistry, volumetric analysis (acid/base, precipitation, redox), gravimetric analysis, electrochemistry, and spectrophotometry.

Learning Outcomes:

- Develop an awareness of the fundamental steps required to perform a quantitative chemical analysis and an understanding of the role that each step plays, its importance and its logical place in the sequence of steps that comprise a chemical analysis.
- Develop an understanding of the application of chemical equilibrium to quantitative analysis in order that students may assess the feasibility of a method and be able to troubleshoot analytical methods.
- Use the principles of stoichiometry and dimensional analysis to do the computations necessary to convert the data of a chemical analysis into meaningful quantitative information. Train students to use spreadsheets for a wide range of scientific calculations.
- Learn how to use statistical methods in data analysis to estimate the precision and accuracy of analytical results.
- Develop physical laboratory skills needed to perform precise and accurate quantitative analyses. Students will be introduced to principles of working safely with chemicals in the laboratory and chemical hygiene. Improve student ability to plan, implement, record, and report experimental work effectively.
- Understand the importance of the application of quantitative chemical analysis to other sciences and that the principles learned in this course are essential to the quality of experimental work done in other science disciplines.
- Students should be familiar with methods of standardization and calibration required to achieve required levels of accuracy and will be introduced to the concept and application of quality control in analytical measurements.

Evaluation:

Student learning outcomes will be evaluated by test questions and by the grading of lab notebook, reports and other assignments.

A = 900 to 1000 points; B = 800 to 899 points; C = 700 to 799 points; D = 600 to 699 points; F = below 600 points

Point Distribution:

Item	Points
Assignment/Homework	150 points
Lab reports (10 X 30 points)	300 points
Quizzes (4 X 25 points)	100 points
Exams (3 X 100 points)	300 points
Final exam	150 points
Classroom participation	50 points (Bonus)
Total	1000 points

Student Responsibilities:

Attendance: You are expected to attend the in-person lectures and labs. You will get points for participating in the lecture quizzes through TopHat. You cannot make-up the missed TopHat points. The student is responsible for making-up any other work missed under the following conditions:

- Unavoidable emergency absences (illness, death in the immediate family, etc.): You must contact the instructor before the absence with a valid, and verifiable excuse.
- Planned absences (university related): You must get the instructor's approval to make-up the missed work prior to the absence. The reason for the absence should be the participation in university sponsored events.

Homework, Assignments and Quizzes: There will be an Achieve online homework for each chapter and their points may vary. The due dates and number of attempts will be mentioned before each assignment. For some chapters ungraded adaptive learning assignments may also be given.

There will be a total of 4 paper-based in-class 30-min quizzes. Each worth 25 points. The quiz grades will be posted on Blackboard, and students will have three days after receiving the graded quiz to inform the instructor about any error.

Exams: There will be three midterm exams and each worth 100 points. The Final Exam is cumulative and it is worth 150 points. The midterm exams would focus more on new materials (materials covered after the previous exam).

Exams can be made-up only at the following circumstances:

- Previous arrangements are made with the instructor
- Serious illness (a physician note is required)
- Death in the immediate family

Laboratory: Laboratory work is an essential part of a science course. Students should make every effort to participate fully in the laboratory experience. Students should approach the lab as if it were a research project. Every effort should be made to obtain quality results, record the experimental work completely at the time the work is done, evaluate the quality of the work and take steps to improve results when needed and possible. Material from lab experiments may be covered on lecture exams.

A separate lab manual (pdf) for each experiment will be posted on Blackboard. A hand-written lab report (pre-lab writeup, observation, and post-lab writeup) is required for each lab experiment. The format and due dates for the reports will be discussed in the class.

Course and University Policies:

All students are required to follow the policies and procedures presented in these documents:

- [Angelo State University Student Handbook](#)¹
- [Angelo State University Catalog](#)²

Office Hours / Email Communication: Students can walk-in to the regular office hours. If you cannot make it during those hours, please make an appointment by email. Students are expected to frequently check their Angelo State email account and the Blackboard course website announcements for important communication from the instructor. Use CHEM3421 in the subject line of your emails to enable proper filtering. The instructor will only answer e-mails that are sent from an ASU e-mail account. The instructor will respond to legitimate e-mails within 24-48 hours during the week and may not respond until after weekends or holidays if messages are received on any of such days. More general questions will be addressed in the following lecture.

Copyright: All handouts, videos, quizzes, exams and lecture material are copyrighted by Shanmugapriya Dharmarajan. Free (no cost) copying and distribution of these materials among Angelo State University students are allowed. Any other distribution, including distribution for a fee or sharing online are not allowed without my written consent.

Academic Integrity: Students are expected to maintain complete honesty and integrity in all work. Any student found guilty of any form of dishonesty in academic work is subject of disciplinary action and possible expulsion from ASU.

The College of Science and Engineering adheres to the university's [Statement of Academic Integrity](#).³

Accommodations for Students with Disabilities: ASU is committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs or activities of the university, or be subjected to discrimination by the university, as provided by the Americans with Disabilities Act of 1990 (ADA), the Americans with Disabilities Act Amendments of 2008 (ADAAA) and subsequent legislation.

Student Disability Services is located in the Office of Student Affairs, and is the designated campus department charged with the responsibility of reviewing and authorizing requests for reasonable accommodations based on a disability. It is the student's responsibility to initiate such a request by contacting an employee of the Office of Student Affairs, in the Houston Harte University Center, Room 112, or contacting the department via email at ADA@angelo.edu. For more information about the application process and requirements, visit the [Student Disability Services website](#).⁴ The employee charged with the responsibility of reviewing and authorizing accommodation requests is:

Dr. Dallas Swafford

Director of Student Disability Services

Office of Student Affairs

325-942-2047

dallas.swafford@angelo.edu

Houston Harte University Center, Room 112

Incomplete Grade Policy: It is policy that incomplete grades be reserved for student illness or personal misfortune. Please contact faculty if you have serious illness or a personal misfortune that would keep you from completing course work. Documentation may be required. See ASU Operating Policy 10.11 [Grading Procedures](#)⁵ for more information.

Plagiarism: Plagiarism is a serious topic covered in ASU's [Academic Integrity policy](#)⁶ in the Student Handbook. Plagiarism is the action or practice of taking someone else's work, idea, etc., and passing it

off as one's own. Plagiarism is literary theft.

In your discussions and/or your papers, it is unacceptable to copy word-for-word without quotation marks and the source of the quotation. It is expected that you will summarize or paraphrase ideas giving appropriate credit to the source both in the body of your paper and the reference list. Papers are subject to be evaluated for originality. Resources to help you understand this policy better are available at the [ASU Writing Center](#).⁷

Student Absence for Observance of Religious Holy Days: A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. See ASU Operating Policy 10.19 [Student Absence for Observance of Religious Holy Day](#)⁸ for more information.

Title IX at Angelo State University: Angelo State University is committed to providing and strengthening an educational, working, and living environment where students, faculty, staff, and visitors are free from sex discrimination of any kind. In accordance with Title VII, Title IX, the Violence Against Women Act (VAWA), the Campus Sexual Violence Elimination Act (SaVE), and other federal and state laws, the University prohibits discrimination based on sex, which includes pregnancy, and other types of Sexual Misconduct. Sexual Misconduct is a broad term encompassing all forms of gender-based harassment or discrimination and unwelcome behavior of a sexual nature. The term includes sexual harassment, nonconsensual sexual contact, nonconsensual sexual intercourse, sexual assault, sexual exploitation, stalking, public indecency, interpersonal violence (domestic violence or dating violence), sexual violence, and any other misconduct based on sex.

You are encouraged to report any incidents involving sexual misconduct to the Office of Title IX Compliance and the Director of Title IX Compliance/Title IX Coordinator, Michelle Miller, J.D. You may submit reports in the following manner:

Online: [Incident Reporting Form](#)⁹

Face to Face: Mayer Administration Building, Room 210

Phone: 325-942-2022

Email: michelle.miller@angelo.edu

Note, as a faculty member at Angelo State, I am a mandatory reporter and must report incidents involving sexual misconduct to the Title IX Coordinator. Should you wish to speak to someone in confidence about an issue, you may contact the University Counseling Center (325-942-2371), the 24-Hour Crisis Helpline (325-486-6345), or the University Health Clinic (325-942-2171). For more information about resources related to sexual misconduct, Title IX, or Angelo State's policy please visit the [Title IX website](#).¹⁰

Information about COVID-19: Please refer to ASU's [COVID-19 \(Coronavirus\) Updates](#)¹¹ web page for current information about campus guidelines and safety standards as they relate to the COVID-19 pandemic.

Modifications to the Syllabus: This syllabus, including grade evaluation and course/lab schedule, is subject to modification on potentially short notice based on developing circumstances.

Tentative Lecture Schedule – Dates subject to change

Week #	Monday	Wednesday	Friday
1	23-Aug Syllabus review Introduction to Achieve Introduction to Analytical Chemistry	25-Aug Ch 1: Chemical Measurements	27-Aug Ch 1: Chemical Measurements
2	30-Aug Ch 3: Experimental Error	1-Sep Ch 3: Experimental Error	3-Sep Ch 4: Statistics
3	6-Sep Holiday – No Class	8-Sep Quiz 1	10-Sep Ch 4: Statistics
4	13-Sep Ch 4: Statistics	15-Sep Ch 27: Gravimetric and Combustion Analysis	17-Sep Ch 27: Gravimetric and Combustion Analysis
5	20-Sep Ch 18: Spectrophotometry	22-Sep Exam 1	24-Sep Ch 18: Spectrophotometry
6	27-Sep Ch 6: Chemical Equilibrium	29-Sep Ch 6: Chemical Equilibrium	1-Oct Ch 7: Titrations
7	4-Oct Ch 7: Titrations	6-Oct Quiz 2	8-Oct Ch 7: Titrations
8	11-Oct Ch 9: Monoprotic Acid-Base Equilibria	13-Oct Ch 9: Monoprotic Acid-Base Equilibria	15-Oct Ch 9: Monoprotic Acid-Base Equilibria
9	18-Oct Ch 10: Polyprotic Acid-Base Equilibria	20-Oct Exam 2	22-Oct Ch 10: Polyprotic Acid-Base Equilibria
10	25-Oct Ch 10: Polyprotic Acid-Base Equilibria	27-Oct Ch 11: Acid-Base Titrations	29-Oct Ch 11: Acid-Base Titrations
11	1-Nov Ch 11: Acid-Base Titrations	3-Nov Quiz 3	5-Nov Ch 8: Activity and the Systematic Treatment of Equilibrium
12	8-Nov Ch 8: Activity and the Systematic Treatment of Equilibrium	10-Nov Ch 8: Activity and the Systematic Treatment of Equilibrium	12-Nov Ch 14: Fundamentals of Electrochemistry
13	15-Nov Ch 14: Fundamentals of Electrochemistry	17-Nov Exam 3	19-Nov Ch 14: Fundamentals of Electrochemistry
14	22-Nov Ch 15: Electrodes and Potentiometry **Last day to drop**	24-Nov Thanksgiving holiday – No Class	26-Nov Thanksgiving holiday – No Class
15	29-Nov Ch 15: Electrodes and Potentiometry	1-Dec Quiz 4	3-Dec Ch 15: Electrodes and Potentiometry
16	6-Dec	8-Dec Final Exam – 10:30 AM to 12:30 PM	

Tentative Lab Schedule

Date	Lab	Points
26-Aug	No Lab	
2-Sep	Lab 0: Lab check in, Excel exercise (Ch 2), buret reading statistics	No points (Practice lab report)
9-Sep	Lab 1: Calibration of Volumetric Glassware	30 Points
16-Sep	Lab 2: Penny Statistics	30 Points
23-Sep	Lab 3A: Gravimetric Analysis	30 Points
30-Sep	Lab 3B: Continues	30 Points
7-Oct	Lab 4: Spectrophotometry	30 Points
14-Oct	Lab 5: Standardization of NaOH	30 Points
21-Oct	Lab 6: Analysis of KHP unknowns	30 Points
28-Oct	Lab 7: Standardization of KMnO ₄	30 Points
4-Nov	Lab 8: Analysis of oxalate	30 Points
11-Nov	Lab 9: TBA	30 Points
18-Nov	Lab 10: TBA	30 Points

¹ <https://www.angelo.edu/current-students/student-handbook/>

² <https://www.angelo.edu/academics/catalog/>

³ <https://www.angelo.edu/live/files/27603-student-handbook-2020-21#page=96>

⁴ <https://www.angelo.edu/current-students/disability-services/>

⁵ <https://www.angelo.edu/content/files/14197-op-1011-grading-procedures>

⁶ <https://www.angelo.edu/live/files/27603-student-handbook-2020-21#page=96>

⁷ https://www.angelo.edu/current-students/writing-center/academic_honesty.php

⁸ <https://www.angelo.edu/content/files/14206-op-1019-student-absence-for-observance-of>

⁹ <https://www.angelo.edu/incident-form>

¹⁰ <https://www.angelo.edu/title-ix>

¹¹ <https://www.angelo.edu/covid-19/>