

CHEM 5460 Analytical Proficiency

Spring 2023

Course Description: CHEM 5460 (Analytical Proficiency) introduces students to the theory and practice of the quantitative aspects of basic analytical chemistry. Topics to be discussed include solution preparation, statistical analysis, equilibrium calculations, titration analysis, electrochemistry, spectrophotometry, and introductory instrumental analysis.

Course Objectives:

- Introduce Quantitative Analysis (QA) as a *measurement science* that bridges a wide range of scientific disciplines.
- Enhance understanding of statistical terminology and its QA applications.
- Provide practices of volumetric and gravimetric analysis.
- Apply equilibrium concepts in chemical analysis
- Introduce modern instrumental analysis.

Instructor: Prof. Guido Verbeck
Hickory Hall, Room 001
E-mail: gverbeck@unt.edu

Required Text: "Quantitative Chemical Analysis", **10E edition**, by Daniel Harris, Charles Lucy.

Class Schedule: Tuesday/Thursday, 4:00-5:20 PM
CHEM 106

Office Hours: (Tuesday & Thursday, 3:00 – 4:00 PM, Hickory Hall 001) or by appointment

Exams: Three-term exams will be held on Tuesdays of **Feb. 14, April 4, May 2** (100 points each). Please plan accordingly.

The final exam (100 points) will be comprehensive (**Finals: Tuesday, May 9 – 1:30 – 3:30 pm**)

Project: A single Instrumental Project, based on the student's own interest and research will be worth 100 points. The project will entail a practical use of one type of instrument (spectroscopy, electrochemistry, chromatography, or mass spectrometry), where the student collects the needed data from a method they created. (**Procedure due March 7, Final Project due May 2**)

Please note: If UNT is closed on the test date, then the test will be moved to the next class date that UNT is open.

Missing Exam: Plan your schedule accordingly. If you must miss an exam due to a university-approved absence, please see the instructor and discuss the needed accommodations. Permission (with proper documentation) must be obtained in advance. Medical absence requires a proper doctor's statement.

Homework: (100 pts) Working on the problems is very important to achieve a better understanding of the materials taught and a good grade in the class. **Homework (handwritten, not photocopied pages, show details of your work) is due as below.** Late submission will not be allowed.

Upload your completed homework as a pdf file to Canvas by class time on due date (8 points each, can earn 112 points/100 points)

Homework problems:

Week 1: (due Jan. 24) Chap. 0: 1, 2, 4 Chap. 1: 5, 7, 8, 10, 19, 24, 30, 31, 35.
Week 2: (due Jan. 31) Chap. 2: 8, 12, 14, 25 Chap. 3: 4, 6, 12, 18.
Week 3: (due Feb. 7) Chap 4: 2, 5, 15, 23, 35 Chap 5: 9, 16, 23, 28, 33.
Week 4: (due Feb. 14) Chap. 6: 5, 8, 19, 24, 32, 36, 40, 46, 50, 53.
Week 5: (due Feb. 21) Chap. 7: 8, 13, 15, 25, 26 Chap. 8: 5, 14, 21, 23, 34.
Week 6: (due Feb. 28) Chap. 9: 4, 7, 11, 25, 37, 40, 43, 44.
Week 7: (due Mar. 7) Chap. 10: 3, 8, 10, 15, 20, 24, 30, 33, 40.
Week 8: (due Mar. 21) Chap. 11: 2, 6, 10, 16, 20, 31, 41, 47, 55.
Week 9: (due Mar. 28) Chap. 12: 3, 6, 10, 16, 23, 32, 36, 37.
Week 10: (due Apr. 4) Chap. 13: 1, 4, 7, 8, 13.
Week 11: (due Apr. 11) Chap. 14: 3, 4, 16, 21, 28, 36 Chap. 15: 4, 11, 18, 36
Week 12: (due Apr. 18) Chap. 16: 4, 14, 19, 29, 37 Chap. 17: 11, 18, 29, 40.
Week 13: (due Apr. 25) Chap. 18: 14, 22, 25 Chap. 19: 24, 32 Chap. 20: 19, 27 Chap 21: 24.
Week 14: (due May 2) Chap. 22: 6, 36 Chap. 23: 31 Chap. 24: 28 Chap. 25: 26.

Attendance Policy: Class attendance is required and will be monitored periodically. Students will be dropped for nonattendance after three absences. Students who miss the class are responsible for all the missed class materials that may not be addressed by the instructor in a subsequent class.

➤ **Phone Policy: No Phone, headphones, or handheld devices usage (texting, web surfing etc.) during class time.**

Grading Scale:

Final percent Average	Letter Grade
90.0 - 100 %	A
80.0 - 89.9 %	B
70.0 - 79.9 %	C
60.0 - 69.9 %	D
Below 60.0 %	F

Chapters to be covered

Chapter

Analytical Process	0
Chemical Measurements	1
Tools of the Trade	2
Experimental Error	3
Statistics	4
Quality Assurance and Calibration Methods	5
Chemical Equilibrium	6
Let the Titrations Begin	7
Activity and the Systematic Treatment of Equilibrium	8
Monoprotic Acid-Base Equilibria	9
Polyprotic Acid-Base Equilibria	10
Acid-Base Titrations	11
EDTA Titrations	12
Advanced Topics in Equilibrium	13
Fundamentals of Electrochemistry	14
Electrodes and Potentiometry	15
Redox Titrations	16
Electroanalytical Techniques	17
Selections in Spectroscopy	18-21
Selections in Separations and Mass Spectrometry	22-26

Distribution of Points :

Tests	300 points
Finals (comprehensive)	100 points
Homework	100 points
Project	100 points
Total	600 points

To access UNT-Canvas:

Visit: <https://unt.instructure.com/login/ldap>

Login using your EUID and Password

Click on Chem 5460 Analytical Proficiency

Copies of syllabi, lecture presentations, and other relevant materials including any announcements will be posted in Canvas to download and study.