

CHEM 541 01W: Advanced Analytical Chemistry (online course) 3 Course Credits

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Course Book: Exploring Chemical Analysis, 4th Ed., Daniel C. Harris, W.H. Freeman and Co.
ISBN-13: 978-1-4292-0147-6

Or **Quantitative Chemical Analysis**, 8th Ed., Daniel C. Harris, W.H. Freeman and Co.
ISBN-13: 978-1-4292-5436-6

Student Learning Outcomes: To familiarize the student with the methods and techniques of quantitative chemical analysis for accurately determining the quantities of a chemical species in a sample. The student will understand the theory and application of these analytical techniques and be able to explain the concepts to their peers. The student will be expected to understand the concepts and applications of the following.

- 1) Significant figures, systematic and random error, propagation of uncertainty, real rule for significant figures, excel and spreadsheets.
- 2) Statistics, Gaussian distribution, Student's t, Grubbs test for outliers, method of least squares, calibration curves.
- 3) Quality assurance, validation of analytical procedure, standard addition, internal standards.
- 4) Volumetric analysis, titration calculations, solubility product, titration of a mixture, titration involving silver ion.
- 5) Gravimetric analysis, precipitation, gravimetric calculations, combustion analysis.
- 6) Acids and bases, pH, strength of acids and bases, pH of strong acids and bases, weak acids and bases, weak acid equilibrium, weak base equilibrium.
- 7) Buffers, Henderson-Hasselbalch equation, preparing buffers, buffer capacity, acid-base indicators.
- 8) Acid-base titrations, determining the end point, Kjeldahl nitrogen analysis, charge balance.
- 9) Polyprotic acids and bases, amino acids, pH of diprotic systems, principal species, titrations of polyprotic systems, proteins, isoelectric focusing.
- 10) Ionic strength and solubility, activity coefficients, charge and mass balance, systematic treatment of equilibrium.
- 11) Metal-chelate complexes, EDTA, metal ion indicators, EDTA titrations, pH-dependent EDTA equilibrium, EDTA titration curves.
- 12) Electrode potentials, redox chemistry and electricity, galvanic cells, standard potentials, Nernst equations, reference electrodes.
- 13) Electrode measurements, silver indicator electrode, junction potential, ion-selective electrodes, glass electrode.
- 14) Redox titrations, redox indicators, titrations involving iodine.

By the end of the course, the student will be able to select and apply an analytical technique suitable for solving a given quantitative analytical problem. Knowledge of quantitative chemical analysis techniques is essential for a wide range of potential employment positions in industry, government and academia.

Student Conduct Policy: All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment (see Student's Guidebook, Policies and Procedures, Conduct).

Cheating and other Breaches of Academic Conduct: Academic cheating, plagiarism, and other forms of academic misconduct may result in removal of the student from the course with a failing grade or may in extreme cases result in suspension or expulsion from the University as described in the Code of Student Conduct section of the Student's Guidebook.

Students with Disabilities: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact: **Office of Student Disability Resources and Services, Texas A&M University-Commerce, Halladay Student Services Building, Room 303 A/D. Phone (903) 886-5150 or (903) 886-5835. Fax (903) 468-8148. StudentDisabilityServices@tamuc.edu**

Summer 2015 Schedules will be dropped for students who have not paid the balance due on their accounts. Check the drop date and the status of your account on MyLeo. It is available 24/7 at <https://leo.tamuc.edu/login.aspx>. If you need assistance to pay the balance, please contact the Bursar's Office (903-886-5051).

Evaluation: All tests and exams are open books/notes and must be completed within the scheduled time frame. Each test and exam is made available at the end of the week Friday-Sunday and once entered students have the allotted time to complete the test or exam.

Weekly tests: (8) 1-hour tests 6.25% each (50% total)

Comprehensive Midterm and Final exams: 2-hour exams held in the Science Building of Texas A&M University – Commerce 25% each (50% total)

Grading: A: > 85%, B: 75-84.9%, C: 65-74.9%, D: 50-64.9%, F: <50%

Class Schedule and Reading Assignments from "Exploring Chemical Analysis"

| Week | Chapter and Topics | |
|------|---|-----------------------------------|
| 1 | Chapters 3 and 4: Math Toolkit and Statistics | Test 1 |
| 2 | Chapters 5 and 6: Quality Assurance and Titrations | Test 2 |
| 3 | Chapter 7: Gravimetric and Combustion Analysis | Test 3 |
| 4 | Chapters 8 and 9: Acids and Bases, Buffers | Test 4 |
| 5 | Chapter 10: Acid-Base Titrations | Comprehensive midterm exam |
| 6 | Chapter 11: Polyprotic Acids and Bases | Test 5 |
| 7 | Chapters 12 and 13: Equilibrium and EDTA Titrations | Test 6 |
| 8 | Chapters 14 and 15: Electrode Potentials and Measurements | Test 7 |
| 9 | Chapter 16: Redox Titrations | Test 8 |
| 10 | Review and Final exam: | Comprehensive final exam |