

Tarleton State University
Department of Chemistry, Geosciences, and Physics
Course Syllabus

Fall Semester, 2018

Course:

CHEM 3407 Quantitative Analysis

M 3:00 - 5:00 PM
Class Room 109 Science
Lab - 6 hours/week
Lab Room 436 Science

Instructor:

Dr. Linda Schultz schultz@tarleton.edu

Phone: (254)968-9143 or 968-9146 or (325)643-1384 (home) or (325)642-0490 (mobile)

Office: 407 SCIEN

Office Hours: by appointment

Course Prerequisites:

A grade of C or better in 8 hours of freshman CHEM; junior classification, or approval of department head

Course Description:

A study of the experimental and theoretical principles concerning gravimetric and volumetric analysis. Topics include data treatment, equilibrium, precipitation, neutralization, oxidation-reduction, potentiometry, and introduction to spectroscopy.

This course consists of 2 lecture hours and two three (3) hour lab periods per week for 4 hours of college credit and is offered each fall semester.

Required Texts and Materials:

ANALYTICAL CHEMISTRY by Gary D. Christian, Purnendu K. Dasgupta, and Kevin A. Schug, 7th ed., Wiley, 2014.

Calculator - scientific type, **nonprogrammable**.

Protective eyewear for laboratory.

Attendance Policy:

Good attendance is essential to successful mastery of course material. Attendance will be monitored by weekly quizzes. Please notify the instructor of excused absences. These are described in the current University Catalog and in the TSU Student Handbook.

Grades will not be lowered due to poor attendance. However, good attendance may be considered as a bonus point for borderline grades at the end of the semester.

University Policy:

The student is expected to be familiar with student responsibilities as outlined in the current University Catalog and TSU Student Handbook.

Tarleton State University expects students to maintain high standards of personal and

scholarly conduct. Students guilty of academic dishonesty are subject to disciplinary action. Academic dishonesty includes, but is not limited to, cheating on an examination or other academic work, plagiarism, collusion, and the abuse of resource materials. The Departmental Academic Honesty Policy is found in the CHEM 1412 Lab Manual. The faculty member will be responsible for initiating action for each case of academic dishonesty that occurs in this class.

If you are a student with a disability seeking accommodations for this course, please contact the Center for Access and Academic Testing, at 254.968.9400 or caat@tarleton.edu. The office is Math 201. More information is at www.tarleton.edu/CAAT/ or the University Catalog.

Grading Policy:

Please refer to the current University Catalog for additional information regarding grades and course withdrawal policies. For this course, your grade will be determined as follows:

Lecture Grade:		50%
3 exams	45%	
10 quizzes	15%	
Homework	10%	
Final Exam	30%	
Laboratory Grade		50%
Unknown Results	50%	
Lab Reports	30%	
Final Exam	20%	

The final grade will be assigned as follows, although the instructor reserves the right to lower the limits slightly at her discretion considering factors such as student attendance.

A = 90% or above
B = 80% - 89%
C = 70% - 79%
D = 60% - 69%
F = below 60%

Tarleton differentiates between a failed grade in a class because a student never attended (F0 grade), stopped attending at some point in the semester (FX grade), or because the student did not pass the course (F) but attended the entire semester. Stopping or never attending class is considered an unofficial withdrawal and can result in the student having to return aid monies received. For more information see the Tarleton Financial Aid website.

Make-up exams will be by permission of the instructor. Please contact the instructor immediately after the missed exam to make arrangements. **There is no make-up for quizzes.**

Course Objectives:

Upon completion of this course, the student will be able to demonstrate a satisfactory understanding of:

1. Accuracy, precision, and data handling techniques..

2. Stoichiometric calculations.
3. Basic principles of chemical equilibrium and be able to write equilibrium constant expressions for chemical reactions.
4. The chemical natures of acids and bases and be able to calculate pH of solutions of strong and weak acids and bases, salts, and buffer solutions.
5. Factors affecting solubility equilibria and be able to calculate solubilities.
6. Electron exchange in chemical reactions, the basic principles of electrochemistry, and be able to balance oxidation / reduction equations.
7. Gravimetric Analysis.
8. Acid-base, complexiometric, precipitation, and redox titrations.
9. Potentiometric measurements.
10. Basic spectroscopy.

Sources of Assistance:

1. The textbook. It cost a lot of money. Read it and work the homework problems. Solutions to many of these problems are in the back of the book.
2. Your instructor. If you are having difficulty working the problems, call or come by to see me. However, it is not recommended that you do this the hour before class.
3. Your classmates. I do not mind if students work together on homework problems, as long as this is not abused. However, do not get into a situation of "the blind leading the blind." If in doubt, refer to #2 above.
4. Other Chemistry texts available in Room 434 and the library.
5. Tutors. Many upper level Chemistry majors tutor (for money). A list will be available in the CHGP departmental office in Room 117.

Course Schedule:

see attached.

note: The course schedule is tentative. The instructor reserves the right to change this syllabus at any time. Any changes will be announced in class in advance.

Homework Problems*

Chapter 3: 1, 3, 5, 9, 11, 13 (a and c), 15, 24, 40.

Chapter 5: 3, 5, 7, 11, 13, 17, 21, 32, 58, 59.

Chapter 6: 3, 5, 15 (a, c, e), 17.

Chapter 7: 7, 9, 17, 29, 33, 46, 48.

Chapter 8: 15, 17, 18, 19, (and turn in graphs of curves).

Chapter 9: 15, 17.

Chapter 10: 10, 11, 15, 23, 25, 27, 29, 35.

Chapter 11: 11.

Chapter 12: 15 (a, c), 16, 21 (a, c)

Chapter 13: 11.

Chapter 14: 7 (b, d, f), 11, 15.

Chapter 16: 12, 13, 20, 30, 34, 36, 42.

*From ANALYTICAL CHEMISTRY by Christian, Dasgupta, and Schug, 7th ed..

Note: Answers to problems are in back of book. However, you must show all work and/or explain your answer. (also, the book is not always correct...)

Quantitative Analysis - Laboratory Policies

Lab Manual:

There is not a separate laboratory manual for this course; copies of the experimental procedures will be furnished prior to the starting date of the experiment.

Lab Notebook:

Each student will be responsible for purchasing a **Lab Notebook** with numbered, duplicate pages, and a handwritten outline, or summary, of the steps to be taken during each experiment will be recorded in the notebook. These procedures will normally be reviewed in class prior to the date that the analysis is performed. **No unknowns will be issued to a student until this outline has been reviewed by the instructor.** A copy of this outline will be handed in with the lab report. All data obtained will also be recorded in the lab notebook, and the instructor may examine the notebook at any time. A well-kept notebook may be the basis for bonus points on the lab grade.

Lab Reports:

A formal, written lab report is required for each laboratory exercise (10/semester). Lab reports will be scored based upon the following rubric.

Grading Rubric for Lab Reports

Component / %	Basis of Evaluation
Organization / 10%	The report should be in the standard format of Introduction, Theory, Experimental, Results/Conclusions, References.
Mechanics of Writing / 10%	The report should be written using correct sentence structure and free of errors in grammar, spelling, and punctuation. Please double space.
Content / 60%	The report must clearly describe the theory of the determination, including all relevant chemical reactions, equations, and any other major factors which would affect the analysis.
References / 20%	The report must include at least 5 <i>relevant</i> references from legitimate sources and references must be listed in a recognized scientific format. <i>All references must be cited in the body of the report at the point where the referenced material is presented.</i>
Other factors	Points will be deducted for lateness at a rate of 10 points/week. Reports will not be accepted after 2 weeks. <i>Plagiarism will result in a grade of 0 on the report and may result in other sanctions appropriate to the severity of the offence.</i>

Chemistry 3407 lab reports are due on the dates indicated on the course schedule. Late reports will be penalized at the rate of 1 letter grade per week. For example: If a report is due on Monday and would have received a grade of B, on Wednesday it would receive a grade of B-, on Friday it would receive a grade of C+, on the next Monday it would receive a grade of C, etc. No reports will be accepted after a two week period has elapsed. (This policy does not apply to numerical results).

Reports should be handed in (in duplicate) in an 8 x 10 manila folder. The reports should consist of the following components.

1. Introduction:

This is a brief summary of the purpose of the experiment and the basic analytical principles involved.

2. Theoretical Discussion:

This is the bulk of the report. The theoretical discussion should cover the specific theory of the determination, including all relevant chemical reactions and equations, and include such factors as function of particular reagents, method errors and means of offsetting them, impurities, formation of precipitates, detection of endpoints, blanks, indicators, pH requirements, temperature, and any other factors which would affect the analysis. The student is expected to use various reference books, the textbook for the course and other textbooks, and original research articles to obtain this information, and these sources must be acknowledged in the report. **Each report must contain at least five different references** and at least three original references should be utilized during the course of the semester. The original references may not be from online sources, and must be accompanied by a short summary of the article on a separate sheet of paper.

3. Experimental:

This will be the duplicate experimental procedure outline from your lab notebook.

4. Numerical Results:

These results should include the results for three individual samples, the mean result of the three samples, and the average deviation. If one result can be discarded on the basis of a Q-test, this fact should be reported on the result sheet and this result may be omitted from the calculation of the mean. The actual calculation for at least one sample should be shown, and the duplicate data sheet from the lab notebook should accompany the report.

The numerical results will be graded separately from the theoretical discussion report. The numerical grade will be based upon the following:

<u>Difference between reported and true value</u>	<u>Grade</u>
0.00 - 0.1 %	10
0.11 - 0.2 %	9
0.21 - 0.35 %	8
0.36 - 0.5 %	7
0.51 - 1.0 %	6
more than 1.0 %	5

Each of the three individual sample results is worth 10 points, and the mean is also worth 10 points. The precision grade will be based on 10 points also, with one point deducted for each one per cent of relative average deviation. Therefore, each analysis has a total value of 50 points.

5. Conclusions:

This is a brief summary of your final results and a discussion of any relevant observations about factors which might have influenced them.

6. References:

References should be in the following format:

See handout.

List of Experiments:

1. Introduction to Lab – Measurements of Mass and Volume (no report required)
2. Gravimetric Determination of Chloride
3. Gravimetric Determination of Sulfate
4. Acid-Base Titration of Potassium Hydrogen Phthalate
5. Acid-Base Titration of Soda Ash
6. Determination of Chloride by Precipitation Titration
7. Determination of Calcium by EDTA Titration
8. Determination of Sulfate by Conductometric Titration.
9. Spectrophotometric Determination of K_{sp}
10. Potentiometric Titration of Soda Ash
11. Determination of Oxalate by Redox Titration

Note: Some of these experiments are unique to Tarleton State University. Details of these procedures may be submitted for publication in a scientific journal at a future date. Although no student names or identities will be revealed, some student results may be included in the article.

Tarleton State University Core Value Statements:

Academic Integrity Statement

Tarleton State University's core values are integrity, leadership, tradition, civility, excellence, and service. Central to these values is integrity, which is maintaining a high standard of personal and scholarly conduct. Academic integrity represents the choice to uphold ethical responsibility for one's learning within the academic community, regardless of audience or situation.

Academic Civility Statement

Students are expected to interact with professors and peers in a respectful manner that enhances the learning environment. Professors may require a student who deviates from this expectation to leave the face-to-face (or virtual) classroom learning environment for that particular class session (and potentially subsequent class sessions) for a specific amount of time. In addition, the professor might consider the university disciplinary process (for Academic Affairs/Student Life) for egregious or continued disruptive behavior.

Academic Excellence Statement

Tarleton holds high expectations for students to assume responsibility for their own individual learning. Students are also expected to achieve academic excellence by:

- honoring Tarleton's core values.
- upholding high standards of habit and behavior.
- maintaining excellence through class attendance and punctuality.
- preparing for active participation in all learning experiences.
- putting forth their best individual effort.
- continually improving as independent learners.
- engaging in extracurricular opportunities that encourage personal and academic growth.
- reflecting critically upon feedback and applying these lessons to meet future challenges.

Academic Service Statement

In support of Tarleton's core value of service, each student is expected to participate in a service learning experience as a part of the Spring term week of service. This experience will challenge students to be engaged in the local community, address a community need, connect course objectives to the world around you, and involve structured student reflection. In this service learning experience you will not only enhance your knowledge and skills, but actively use those skills as you serve your community.