St. Bonaventure University
CHEMISTRY 201
ANALYTICAL CHEMISTRY
Fall 2020

Instructor: **Dr. Carolyn Hutchinson**
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Office Hours: MW 1:00 – 2:30 pm; T 11:30 am – 12:30 pm; 2:00 – 3:00 pm
Also available by appointment
Sign up using calendly.com/chemhutchinson
Class Schedule: TR 10:00 – 11:15 am
Classroom: 305 Plassman Hall

Tentative Lecture Schedule*

Week	Day	Date	Sections	Topic	Assignment
1	T R	Aug 25 Aug 27	0, 1.1-1.4 3.1-3.4	Analytical Process Treatment of Data	 **SR #1**
2	T R	Sept 1 Sept 3	4.1-4.5 7.1-7.3	Treatment of Data Gravimetric Analysis	 **Start CS #1**
3	T R	Sept 8 Sept 10	8 9	Acids & Bases Buffers	**HW #1**
4	T R	Sept 15 Sept 17	12.1-12.2 12.1-12.2	Activity Activity / **CS presentations**	 **Present CS #1**
5	T **R**	Sept 22 **Sept 24**	6.1-6.3 --	Volumetric Analysis **EXAM #1**	**HW #2**
6	T R	Sept 29 Oct 1	1.5, 6.4-6.6, 12.3-12.5	Equilibrium & Solubility Equilibrium & Solubility	 **SR #2**
7	T R	Oct 6 Oct 8	10.1-10.6, 11	Acid-Base Titrations Acid-Base Titrations	**HW #3**
8	T R	Oct 13 Oct 15	13 13	EDTA Titrations EDTA Titrations	 **Start CS #2**
9	T **R**	Oct 20 **Oct 22**	14, 16 --	Redox Titrations **EXAM #2**	**HW #4** **Exam #2**
10	T R	Oct 27 Oct 29	14, 16 18, 19.1-19.3	Redox Titrations Spectrophotometry & Calibration Curves	
11	T R	Nov 3 Nov 5	4.6-4.8 20	Spectrophotometry & Calibration Curves Atomic Spectroscopy	**HW #5** **SR #3**
12	T R	Nov 10 Nov 12	21.1-21.3, 22 21.1-21.3, 22	Chromatography Chromatography / **CS presentations**	 **Present CS #2**
13	T **R**	Nov 17 **Nov 19**	21.1-21.3, 22 --	Chromatography **EXAM #3**	**HW #6**
14	T R	Nov 24 Nov 26	5 --	Quality Assurance **NO CLASS** – Thanksgiving Break	
15	T R	Dec 1 Dec 3	0 --	Revisiting the Analytical Process **NO CLASS** – Reading Day	**HW #7**
	W	**Dec 9**	--	**Final Exam (1:10 – 3:40 pm)**	**SR #4**

* Schedule is subject to change at the discretion of the instructor.
Up-to-date schedule and due dates are available on Moodle.

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Interactive Syllabus

An interactive version of this syllabus can be accessed at https://www.cphutchinson.com/chem201-f2020. This is another way to access the information contained in the course syllabus. It does not replace the official course syllabus.

Course Description

Three hours of lecture a week. A study of the theory and techniques of quantitative analysis, including gravimetric, volumetric, potentiometric, spectrophotometric and chromatographic methods.

Course pre-requisite

Take CHEM-102

Required Textbook/Materials

- Textbook: *Exploring Chemical Analysis*; Daniel C. Harris; 5th edition, 2012, ISBN 1429275030
- Scientific Calculator (not graphing). Suggestions are available on Moodle.
- Course Moodle Website Access – https://moodle.sbu.edu/
- Sapling – https://www.saplinglearning.com/ibiscms/login/
    - Sign-up instructions: search for "St. Bonaventure University" and select the course (we're the only course option ☺)
    - For help https://support.pearson.com/getsupport/s/

Course Objectives

In this course, students will:

- Understand the goals and roles of analytical chemistry in the broader context of chemistry and the sciences
- Learn the types of questions analytical chemists seek to answer as well as the methods and steps required to perform these quantitative analyses
- Understand and explain how chemical reactions are used to provide a quantitative measurement of one or more analytes in a sample
- Develop critical reasoning skills to quantify the amount of unknown in a sample and report the measurement with appropriate errors/uncertainty for a given set of data
- Develop a greater understanding of relevant chemical equilibria (solubility, acid-base, complexation, redox) and apply it to different types of equilibrium-based problems (pH, principal series, fractional composition, etc.)
- Understand the difference between accuracy and precision as well as the figures of merit used to quantify them
- Perform appropriate statistical tests (Grubbs-test, t-test, F-test, Q-test, etc.) on one or more sets of data
- Begin to understand how certain forms of instrumental analysis and the underlying methods of calibration (external standards, internal standards, standard addition) may be used for quantification with these methods.

Student Learning Outcomes (SLOs)

At the end of the course students will be able to:

- Be able to apply the analytical process to answer scientific questions.
- Understand the nature of accuracy and precision and be able to quantitatively describe each for a dataset.
- Know how and when to use gravimetric, volumetric, potentiometric, spectrophotometric and chromatographic analysis methods.

- Be able to report percent analyte in a sample, regardless of method used.
- Understand the nature of the precipitation process used in gravimetric analysis.
- Understand the nature of dissolution and be able to calculate solubilities from K_{sp}.
- Understand the difference between molar concentration and activity.
- Relate equilibrium constants to concentrations of reactants and products.
- Understand acid-base, complexometric, redox, and precipitation titrations.
- Understand how light absorption is measured and be able to use Beer's Law in spectrophotometric methods.
- Understand the basic terms and concepts used in atomic spectroscopy.
- Understand the basic terms and concepts use in chromatography.

Departmental Learning Outcomes

The Chemistry Departmental Learning Outcomes can be found here: http://www.sbu.edu/academics/schools/arts-and-sciences/departments-majors-minors/chemistry/learning-outcomes

Class Notes

Keys to Success:

1. Attend all lectures. No make-ups of exams will be allowed outside of excused absences as defined by St. Bonaventure University.
2. Plan ahead for your writing assignments and case studies. Late assignments will be penalized.
3. Keep up with reading and Sapling homework.
4. Participate! Ask questions both in and out of class. Remember that I am a resource for you to use and that I want you to succeed in my class.
5. Moodle is a class resource. Lectures, readings, lab assignments will be posted on Blackboard. We will be using TurnItIn for all of the writing assignments. Course announcements will be through Email, so make sure that you have an SBU Email account and that you check it regularly. It is the responsibility of every student to VERIFY that the instructor can open any assignment submitted electronically.

Contacting Your Instructor

The best way to reach your instructor outside of office hours is via the email on the top of this syllabus. You can expect a response within 24 hours. Outside of emergencies, emails will only be answered between 7am and 9pm M-F. Messages sent through Moodle may take up to 1 week to receive a response. Students are strongly encouraged to attend office hours and tutoring sessions if they have any questions.

Attendance & Absences

There is not a grade given for attendance in this class. Attendance information will still be collected. It is the responsibility of each student to notify the instructor if there is a university excused absence for the exams at least **72 hours (3 days) prior**. If the student is "excused" from an examination, performance on the final examination will be used to replace the exam grade. **MAKEUP EXAMINATIONS REQUIRE A VALID REASON** with documentation! All unexcused assignments and examinations will be given a grade of ZERO!

Calculators & Other Technology

Calculators must be scientific. Programmable and graphing calculators are not allowed. Please see the Moodle page or interactive syllabus for suggestions. Phones **cannot** be used as calculators. You are encouraged to use the same calculator for all parts of chemistry (during class, homework, exams, lab, etc.) Cell phones are not to be used during class outside of collaborative activities, such as Socrative.

Laptops and tablets are permitted for notetaking but taking notes by hand is strongly recommended.

Grade Distribution

Grades on all assignments will be given in points. Points in all categories will be approximately equivalent.

Each category will be weighted as stated below:

Hourly Exams (3):	300 points (30%)
Final Exam:	200 points (20%)
Homework (Sapling):	200 points (20%)
Case Studies (2):	150 points (15%)
Self-reflections (4):	100 points (10%)
In-class assignments:	50 points (5%)
Total:	**1000 points**

Letter grade assignment:

Grade	Points	Percentage
A	930-1000	93-100%
A-	900-929	90-92%
B+	870-899	87-89%
B	830-869	83-86%
B-	800-829	80-82%
C+	770-799	77-79%
C	730-769	73-76%
C-	700-729	70-72%
D+	670-699	67-69%
D	630-669	63-66%
D-	600-629	60-62%
F	0-599	0-59%

To be graded on the grading scale defined above, you must pass the final exam (> 130 points). Failing to meet this requirement will result in a student not to be graded by the grading scale described in the previous section. Grades in these cases are determined on an individual basis and are at the instructor's discretion. Thus, failing the final, skipping an excessive number of homework assignments or class assignments may result in a grade lower than the number of points you have accumulated would otherwise indicate.

If you feel that an error was made in the grading of homework or exams, you may request a re-grade by notifying the instructor within one week of receiving it.

Exams

There will be **three 75-minute exams**. The tests will be a combination of short answer, calculation-based problems, multiple choice, and true/false questions. The hourly exams only cover the material covered between the previous exam and the current exam. There will be a **2-hour comprehensive Final Exam**. The Final Exam will be cumulative. You must show all work at receive partial credit; if no work is shown, the question will be given a **zero** on that problem. You will be given a periodic table and a sheet with formulas and constants for every exam. You do not need to memorize these, but you are expected to know how and when to use them.

All exams must be taken during the regularly scheduled times. Exams cannot be taken outside the scheduled time. There will be **NO makeup exams** without valid documentation. A missed exam will count as a ZERO (excluding a well-documented serious illness, requiring hospitalization). If classes are cancelled by the University on the day of a scheduled exam, then the test is automatically scheduled for the next class lecture period. For university excused absences it is the students' responsibility to notify the instructor and make arrangements within 48 hours.

Assignments

Case Studies (CS)

Case studies will be completed in groups of 4. You will have the option of several case studies to choose from. These are intended to provide you with real-world context for the content of this course including forensics, environmental chemistry, petrochemistry, and pharmaceutical chemistry. These case studies will also give you experience in collaboration, as science is often done with other people. Each group will create a written summary and give a short (10 minute) oral presentation on their case study; additionally, each group member will be evaluated by their fellow group members. Each case study is worth 75 points broken down as:

Written summary – 30 points
Oral presentation (10 min) – 30 points
Group evaluation – 15 points

Homework Assignments (HW)

There will be Chapter Homework (HW) assignments due at **11:59 pm** every other Sunday based on the material we cover in class. The tentative schedule is noted above which may change due to class progress. **Updated due dates and times can be found on Sapling.** Homework problems should be answered while we are covering the chapter in class. You are encouraged to work on these daily as they are quite long to do in one sitting. You are strongly encouraged to ensure you understand how to work all homework problems as problems and questions on the exams will be based upon homework and examples worked in class.

Self-reflections (SR)

Scientists often have to write documents that explain and reflect on topics that are decidedly unscientific—our philosophy on teaching, a personal statement, an account of a meaningful experience. These documents often create a lot of unease and discomfort because we have moved away from the usual scientific communication that is full of concrete, "real" ideas and results. However, this type of writing is crucial for scientific success. As such, we will be writing self-reflections at four times during the semester. The requirements will be the same for each assignment. This assignment should be short (1-2 pages; no more than 750 words). These are not intended to be strenuous writing assignments and will not be read by anyone other than your instructor.

In-Class Assignments

These will be short, problem-solving worksheets that will be worked together during class. They are due at the beginning of the next class period. These are intended to provide you with guided practice in the concepts of this course.

Attendance

There is not a grade given for attendance in this class. Attendance information will still be collected.

Class courtesy is also an important aspect of the course. The use of cellular phones, unrelated discussions, and interruption of the questions of fellow students is discouraged. If you are disruptive to

the class, you will be asked to leave in order to maintain a productive learning environment. Every student is welcome in this class. Therefore, sexism, racism, homophobia, transphobia, and other forms of discrimination are not permitted. Inappropriate remarks will not be tolerated and may result in grade penalties.

Late Work Policy

Late work will receive a penalty of 25% per day and will not be accepted after 4 days. This DOES include weekends for anything submitted via Moodle

Inclusion Policy

As a student at St. Bonaventure University, you have the right to an evaluation of academic performance free from discrimination on the basis of race, religion, color, gender, age, national or ethnic origin, marital status, sexual orientation, veteran status, political affiliation, or disability status. (www.sbu.edu/codeofconduct)

Students with Disabilities

St. Bonaventure is firmly committed to providing an equal opportunity for a college education to all qualified students. The philosophy of the Office of Student Disability Services reflects the interpretation of Section 504 of the Rehabilitation Act of 1973 in terms of providing reasonable and individualized accommodations. We welcome students with disabilities into our campus community and our programs. In this spirit, we are committed to providing reasonable opportunities to qualified students to participate in campus programs and activities. We recognize that the needs for each person with a disability are unique; therefore, services and/or accommodations are provided on an individualized basis. Students with disabilities are encouraged to participate in all aspects of campus life. Self-identification is essential and self-advocacy is encouraged.

Students with disabilities who feel they need academic accommodations should contact Adriane Spencer (aspencer@sbu.edu), Director of Disability Support Services Office, 100D Plassmann Hall (Student Success Center), 716-375-2065. Please reach out early in the semester so that we can assist you as soon as possible. Documentation from the Disability Support Services Office is required before the instructor can make accommodations.

For further information, please visit the Office for Disability Services Web site: http://www.sbu.edu/life-at-sbu/services-for-students/disability-support-services

Online Help & Academic Honesty

Online websites for homework should be a **last resort**. The "Experts" on these sites do not have the experience and expertise you can find at St. Bonaventure University. In my experience, the answers are nearly always incorrect. Uploading exam and homework problems is a violation of the Academic Honesty Policy. If any of my course materials are uploaded without my permission, any student **who uploads or uses** the answers from these websites will receive a **ZERO** for the assignment.

Online resources are not permitted for use for any exam. Any student suspected of cheating will receive a zero on the exam and a violation will be submitted to the Academic Honesty Committee.

Academic Honesty Policy

Enrollment at St. Bonaventure University requires adherence to the University's standards of academic integrity. These standards may be intuitively understood and cannot, in any case, be listed exhaustively. The following examples, detailed in full in Appendix A of the Code of Conduct (http://www.sbu.edu/codeofconduct), represent some basic types of unacceptable behavior: cheating, plagiarism, fabrications, obtaining an unfair advantage, aiding and abetting academic dishonesty, falsification of records and official documents, and unauthorized access to records. Academic dishonesty is a serious matter and will be dealt with accordingly, with University sanctions ranging from grade alteration to the possibility of expulsion. Students should familiarize themselves with these very important provisions of the Academic Honesty Policy, which is outlined in the Code of Conduct for

reference only. Acts of academic dishonesty are not processed through the University Judicial process; the process for handling alleged violations is outlined within the policy.

Face Coverings & Other COVID-19 Considerations

According to the St. Bonaventure policy, you are required to wear a face covering that completely covers your nose and mouth at all times during class. If you come to class without a face covering, you will not be allowed to attend the class that day. If you fail to wear your face covering correctly for the entire class period, you will be required to leave immediately. If this occurs during an exam day, you will receive a **ZERO** for the exam.

The face covering cannot be made of mesh, an open knit, or another material that does not decrease the spread of droplets. Masks with vents are allowed but you are encouraged to use a second mask with them to minimize the spread of droplets. Any exemptions to this policy must come from the Office of Student Disability Services.

You must remain 6 feet from other people at all times during class. Group work will be facilitated using technology listed on the Course Materials page. This class will be paperless as much as possible. Office hours will be held exclusively online via Zoom. You may be asked to sanitize your desk in order to begin and/or end class.

If you travel to a restricted state that requires quarantine according to Governor Cuomo's Executive Order 205, issued June 25, 2020, contact your instructor ASAP to make arrangements. Similarly, if you are quarantined due to COVID-19, contact your instructor ASAP to make arrangements.

I sincerely thank you for all your cooperation during these unprecedented times.