



University of Wisconsin-Stevens Point

# Welcome to Quantitative Analysis Lab

CHEM 247, Fall 2020

Tuesday and Thursday 5:00 AM – 7:50 PM (CBB 466)



**Instructor:** Dr. Dave Snyder  
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**Office Location:** CBB 445

**Virtual Zoom Office:** <https://uwsp.zoom.us/j/7424698010>

**Office Hours:** M, Tu, W, F 12:00 – 12:50 PM and by appointment

715-346-2155

**Please contact me with your questions or concerns!**

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## About the Instructor



My name is Dr. Dave Snyder, and I'm excited about working with you this fall. Quantitative Analysis was one of my favorite classes when I was a student and is one of my favorite courses to teach here at UWSP. During this semester, you will gain key laboratory skills along with the confidence to apply these skills to fundamental problems in analytical chemistry. Whether you plan on working in a laboratory or will be utilizing data derived from an analytical laboratory, a fundamental understanding of the practical and theoretical basis of chemical analysis will be critically important to you. This course will be challenging, but please be assured that I will be there to support you and guide you along the way. I think (and hope) you will be amazed at the transformation you will undergo during this term!

## What is this course all about?

This course will provide you with the opportunity to learn the fundamental theories and methods of quantitative chemical analysis. The methods that you will learn in this course are currently employed by scientists and laboratory technicians around the world to analyze a wide variety of samples including environmental samples, food and pharmaceutical samples, and tissue samples critical in diagnosing diseases in humans, plants, and animals.

## COVID-19 Health and Safety

### 1. Face Coverings:

At all UW-Stevens Point campus locations, the wearing of face coverings is mandatory in all buildings, including classrooms, laboratories, studios, and other instructional spaces. Any student with a condition that impacts their use of a face covering should contact the [Disability and Assistive Technology Center](#) to discuss accommodations in classes. Please note that unless everyone is wearing a face covering, in-person classes cannot take place. This is university policy and not up to the discretion of individual instructors. Failure to adhere to this requirement could result in formal withdrawal from the course.

### 2. Other Guidance:

Please monitor your own health each day using [this screening tool](#). If you are not feeling well or believe you have been exposed to COVID-19, do not come to class; email your instructor and contact Student Health Service (715-346-4646).

- As with any type of absence, students are expected to communicate their need to be absent and complete the course requirements as outlined in the syllabus.
- Maintain a minimum of 6 feet of physical distance from others whenever possible.
- Do not congregate in groups before or after class; stagger your arrival and departure from the classroom, lab, or meeting room.
- Wash your hands or use appropriate hand sanitizer regularly and avoid touching your face.
- Please maintain these same healthy practices outside the classroom.

## Learning Outcomes

Upon successful completion of this course, you should be able to:

1. Properly document and report the results of chemical analyses and report the relative error associated with these results
2. Identify errors associated with chemical analyses and describe and demonstrate methods of minimizing or eliminating these errors
3. Demonstrate the ability to accurately determine the amount of an analyte in a given sample using a variety of analytical techniques

## Inclusive Excellence

**I recognize** that students in my classroom may have diverse racial, ethnic, cultural, and religious backgrounds, sexual orientations and gender identities. I further recognized that students in my classroom may face unique challenges due to health conditions, family obligations, current or past military service, and other situations that may result in significant obstacles to learning.

**I am committed** to providing a civil, respectful, and equitable classroom where all my students have the opportunity to succeed and feel safe and valued. I believe diversity should be celebrated and embraced because it helps to create an optimal environment for shared inquiry and the development of sophisticated graduates who recognize the value of diversity and human dignity.

**I welcome** your suggestions and ideas on how we can create and maintain an inclusive and equitable learning environment during the semester.

## Course Format

### Laboratory

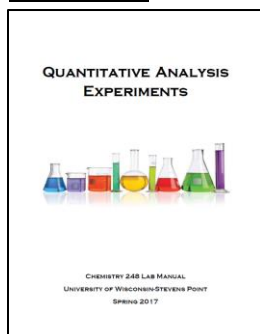
During labs, you will analyze unknown samples and quantify the amount of specific substances, known as analytes, using a variety of analytical techniques. You will work individually and at your own pace with the expectation that all experiments must be completed prior to the last day of lab. Your lab grade will depend on how closely your results match the actual amount of analyte in your unknown (known as the *true value*). *Success in lab depends on being organized and thoroughly prepared for each lab period.*

Here are some suggestions that will help you to succeed:

1. **Know which experiment you will be working on at least two (2) lab periods in advance.** This will help you to gather, prepare, and organize necessary reagents and unknowns.
2. **Read the experimental procedure thoroughly before coming to lab** and be sure to speak with the instructor regarding any questions you have about the procedure.
3. **Prepare your laboratory notebook before coming to lab.** Write the purpose and procedure, write and annotate important chemical reactions, list reagents and their purpose, and create data tables before coming to lab. Leave plenty of space for additional data and calculations.
4. **Use lab time for experimental work only.** Do calculations and write-ups outside of lab so that you can stay on, or ahead of, the lab schedule. *Lab time is best used for experimental work.*

## Required Materials and Learning Resources

### Lab Manual



Quantitative Analysis Experiments, Fall 2020, by UWSP Dept. of Chemistry  
*Available for purchase at the University Store.*

### Lab Notebook



You will need (2) permanently-bound notebooks, preferably quadrille ruled. The notebook shown at the left ("the original marble cover 80 sheets") is *available for purchase at the University Store* and is preferred.

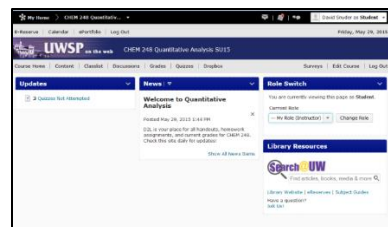
Spiral notebooks, notebooks with detachable pages, and previously-used permanently-bound notebooks are not acceptable

### Scientific Calculator



You will need a scientific calculator with log functions. It does not have to be a fancy, expensive one. My trusty Casio fx-300 ES solar (shown at left) costs \$11.49 at Staples®, got me through college and graduate school, and never needs new batteries!

### Canvas Course Site



All course documents including rubrics, this syllabus, and other supporting material, can be found on the course Canvas site (login at <https://www.uwsp.edu/canvas>). Your grades, along with your overall course grade, can be found on this site as well.

### E-Mail

Please feel free to e-mail me at [dave.snyder@uwsp.edu](mailto:dave.snyder@uwsp.edu) if you have any questions or concerns during the semester. While I may not be able to reply to your messages instantly, I will do my best to reply as quickly as possible. E-mail messages should be professionally formatted, should include an appropriate salutation (e.g., “Dear Dr. Snyder”), an appropriate closing (“Sincerely, Steve E. Pointer”), and should be written in Standard English. Sending me e-mails is a good opportunity to develop or improve your professional communication skills.

## **Support and Help is Available!**

### Instructor Support

- **Instructor Office Hours:** During office hours, I am available to assist you in all aspects of this course. I will be available via Zoom during posted office hours. If these times don’t work for you, please schedule an appointment with me.

### Disability Services

The University of Wisconsin Stevens Point is committed to providing students with disabilities the academic accommodations and auxiliary aids necessary to ensure access to all university services, programs, and activities. In addition to the university's campus-wide efforts to promote access and inclusion, students with disabilities are further accommodated based on specific individual needs. The Disability and Assistive Technology Center (DATC) is responsible for determining these accommodations. They provide services and assistance to enrolled students who are either permanently or temporarily disabled.

- The registration process can take up to 3 weeks to complete, so if you believe you will require accommodations, begin the process as soon as possible. To start the process, contact The Disability and Assistive Technology Center (DATC) at 715-346-3365 or emailing [datctr@uwsp.edu](mailto:datctr@uwsp.edu)
- UWSP has many services for students offered by various offices. Although decisions regarding disability specific accommodations are made on a case by case basis.
- Visit the Disability and Assistive Technology Center (DATC) website at: <http://www.uwsp.edu/disability/Pages/default.aspx> for information on services offered to students with specific disabilities

### Advocacy

In the case of extended illness, family emergencies, or other unforeseen personal situations that present a significant challenge to successfully completing a course, students should contact the Dean of Students (call 715-346-2611, email [DOS@uwsp.edu](mailto:DOS@uwsp.edu), or visit their office at 212 Old Main). The dean and his staff will provide discreet advocacy and advice for students having academic, personal, or other non-academic concerns. When times are tough, don’t go it alone!

## Course Policies

### Academic Integrity Policy

The Board of Regents, administrators, faculty, academic staff, and students of the University of Wisconsin system believe that academic honesty and integrity are fundamental to the mission of higher education and of the University of Wisconsin system. Students are responsible for the honest completion and representation of their work, for the appropriate citation of sources, and for respect of others' academic endeavors. Students who violate these standards will be confronted and must accept the consequences of their actions. **Please be aware that the penalties for academic misconduct can include suspension or expulsion from the university.** More information on UWSP academic standards and disciplinary procedures pertaining to academic misconduct can be found at:

<http://www.uwsp.edu/admin/stuaffairs/rights/rightsChap14.pdf>

### Participation and Attendance Policy

While no formal attendance policy will be enforced, attendance will be taken during each lab period for the purposes of contact tracing. Students are expected to complete all assigned experiments within the time provided, so missing lab periods may result in the inability to complete these experiments and a loss of points.

### Late Work Policy

Meeting deadlines, completing work in a timely manner, and working efficiently are important life and career skills. Additionally, staying on-track with your work reduces stress. The procedure for requesting an extension for lab reports can be found in the laboratory section of this syllabus.

### Electronics use Policy

The use of cell phones and tablets is prohibited in the lab without the express consent of the instructor.

## Laboratory

### Laboratory Results (Accuracy Scores)

You will be graded on the accuracy of your results for each experiment, i.e., how close your experimentally determined value is to the “true” value for the unknown you analyzed. The details of laboratory grading can be found later in this syllabus and on page 149 of the lab manual. It is possible to *redo* one lab with a new unknown, if time permits, and it is also possible to *recalculate* the results of your experiment if you have made a calculation error.

1. *Redo*: A student may repeat one (1) experiment with a new unknown, if time permits. The grade for the experiment will be the average of the two scores, and a new lab report must be submitted.

2. *Recalculation*: In the case of a calculation error, a new report must be submitted along with an indication in your lab notebook of where the error occurred and a new set of calculations. Errors in judgment may not be used to recalculate a result. For example, you may not change your result to a median value from a mean or vice versa. You should discuss recalculations with your lab instructor. Your new score will be determined by subtracting five points from your “recalculated” accuracy score. *Recalculations must be submitted within two lab days after the lab has been graded and returned to you.*
3. *Due Date Extensions/ Late Reports*: If you are not able to meet the deadline for a laboratory report, speak with your lab instructor about an extension. Together, you and your instructor will set a new due date. You must also send an e-mail to the lab instructor confirming the new due date. Lab reports submitted after the due date will incur a five (5) point penalty for each lab period that it is late.

### Laboratory Notebook

Your lab notebook is an important record of the work that you have performed. Your lab notebook will be collected and evaluated after each experiment is completed, and *laboratory results will not be accepted unless they are accompanied by a complete notebook entry*. We will be discussing how to properly prepare and keep a lab notebook during the first week of class. The rubric I will be using to evaluate your notebook appears at the end of this syllabus.

## Grading Information

The final course grade will be determined as a weighted percent by category as shown below. The approximate percent per item is based on the number of items in each category (shown in parentheses). Note that grading is evenly split between lecture activities and lab activities.

Category (Items)	Approx. % per Item	% of Final Grade
Lab Results (6)	13	80
Lab Notebook (6)	2	10
Formal Lab Report (1)	10	10
<b>Total</b>		<b>100</b>

### Grading Scale

The following scale will be used to assign letter grades:

Grade	Percent Range	Grade	Percent Range
A	100 – 93	C+	79 – 76
A-	92 – 90	C	75 – 73
B+	89 – 86	C-	72 – 70
B	85 – 83	D+	69 – 66
B-	82 – 80	D	65 – 64
		F	63 – 0



## Scoring of Laboratory Experiments

Your lab accuracy score is based on how close you come to the “true” or accepted value for your unknown. This is calculated using the following formula:

$$\text{Accuracy Score} = \left| \frac{\Delta x}{\Delta x_{100}} \right|$$

$\Delta X$  is the difference between your reported answer and the “true” or accepted value and represents the accuracy of your experimental results. In other words,  $\Delta X = (\text{your value} - \text{“true” value})$

$\Delta X_{100}$  is the maximum  $\Delta X$  allowed for a grade of 100% or 50 points (see page 149 in your lab manual).

Your grade depends on the number of  $\Delta X_{100}$ 's you are from the correct answer. For example, suppose you determine that the percent sodium carbonate in your soda ash unknown is 35.65% and the “true” value for your unknown is 35.40%.

$$\Delta x = (\text{your value} - \text{“true” value}) = (35.65\% - 35.40\%) = +0.25\%$$

The  $\Delta X_{100}$  value for soda ash is 0.20% (this value can be found on page 149 of your lab manual), so the accuracy score is calculated as follows:

$$\text{Accuracy Score} = \left| \frac{\Delta x}{\Delta x_{100}} \right| = \left| \frac{0.25}{0.20} \right| = 1.25$$

The accuracy score is then converted to a percent and point score using the following scale:

	<b>Accuracy Score</b>	<b>Grade (%)</b>	<b>Grade (Points)</b>
Your score	1 or less	100	50
falls in this	→ 1 to 1.5	90	45
range	1.5 to 2	80	40
	2 to 3	70	35
	3 to 5	60	30
	5 to 8	50	25
	8 to 12	40	20
	12 to 20	30	15
	20 or more	20	10

Accordingly, your accuracy score would earn you a grade of 90% or 45 points.

## Laboratory Schedule

Session	Date	Experiments	Pages in Lab Manual	Due Dates
1	9/3	Check-In		
2	9/8	Calibration of Pipets	41 – 42	
3	9/10	Calibration of Pipets	41 – 42	
4	9/15 <sup>1</sup>	Sodium Carbonate in Soda Ash	43 – 53	
5	9/17	Sodium Carbonate in Soda Ash	43 – 53	
6	9/22	Manganese in Steel	63 – 82	
7	9/24	Manganese in Steel	63 – 82	Soda Ash Due
8	9/29	Manganese in Steel	63 – 82	
9	10/1	Vanillin in Vanilla Extract <sup>2</sup>	83 – 88	
10	10/6	Vanillin in Vanilla Extract	83 – 88	Mn in Steel Due
11	10/8	Vanillin in Vanilla Extract	83 – 88	
12	10/13	Ethanol by Titration	101 – 106	
13	10/15	Ethanol by Titration	101 – 106	Vanillin Rough Draft Due
14	10/20	Ethanol by GC	115 – 122	
15	10/22	Ethanol by GC	115 – 122	Ethanol by Titration Due
16	10/27	Cu-Zn by Atomic Absorption	123 – 128	
17	10/29	Cu-Zn by Atomic Absorption	123 – 128	Ethanol by GC Due
18	11/3	Bleach by Coulometry	129 – 136	
19	11/5 <sup>3</sup>	Bleach by Coulometry	129 – 136	AA Due
20	11/10	Make-Up		
21	11/12	Make-Up		Coulometry Due
22	11/17	Make-Up		
23	11/19	Make-Up		
24	11/24	Check-Out		

**Notes:** <sup>1</sup>The last day to “clear” drop is 9/14

<sup>2</sup>Small group experiment with formal report

<sup>3</sup>The last day to “W” drop is 11/6

## Lab Notebook Grading Checklist

Item	√	Point Deduction	Page(s)
All entries made in ink			
All entries legible			
Updated table of contents			
Updated page numbers (right hand pages only)			
Date and signature present at the top of each page where data is collected			
Experiment <i>title</i>			
Experiment <i>purpose</i>			
Experiment <i>procedure</i>			
Experiment <i>procedure</i> contains appropriate amount of information			
<u>Annotated</u> chemical equations			
Reagents listed along with their purpose			
Safety/disposal information present for hazardous substances			
All data presented in tables with titles, headings, and units			
Data errors appropriately labeled and footnoted			
Pertinent calibration curves/chromatograms pasted in notebook			
Graph axes labeled and with appropriate units and precision			
Sample calculations present and labeled			
Printed results sheet			
Conclusions			
No pages removed from notebook			
Complete, typed-written report submitted			
<b>Points Possible</b>		<b>5.00</b>	
<b>Total Deduction</b>			
<b>Points Earned</b>			

### NOTES:

1. A 0.25 pt. deduction will be taken for each missing/incorrect item for lab reports submitted for Soda ash and Mn in steel. A 0.50 pt. deduction will be taken for each missing/incorrect item for the remaining experiments.
2. Points may be deducted if subsequent lab entries are not noted in the table of contents and page numbers in subsequent lab entries are missing/incorrect.
3. If data is not recorded in the notebook when it is collected or if it is recorded in pencil or on right-hand pages, 5.00 points will be deducted from the notebook score.
4. If a notebook scores less than 0 points, points will be deducted from the accuracy score for the experiment.