

# FUNDAMENTALS OF CHEMISTRY

## UNIVERSITY OF NEBRASKA - LINCOLN

CHEM113A

FALL 2021

<b>CLASS MEETS:</b>	MWF 11:30 AM – 12:20 PM	HAH 112
<b>RECITATION MEETS:</b>	M 4:30 – 5:20 PM	zoom
	W 1:30 – 2:20 PM	zoom
	TH 8:30 – 9:20 AM	zoom

### INSTRUCTOR

Dr. Catherine Eichhorn  
Assistant Professor of Chemistry

### HOW TO REACH DR. EICHHORN

*Email:* ceichhor@unl.edu (include Chem113 in title)  
*Office Hours:* Th 12:30 – 2 pm in person (HAH 723)  
Sun 7 – 8 pm by zoom (ID 989 0067 5009)

### TA

Katie Patterson  
Graduate Student

### HOW TO REACH KATIE

*Email:* through Canvas Inbox (include Chem113 in title)  
*Office Hours:* Tu 4 – 6 pm or by appointment by zoom

## COURSE DESCRIPTION

At its most fundamental, Chemistry is the study of matter. In this course you will begin to explore and develop an understanding of matter at the atomic and molecular level. This molecular-level understanding will help you make sense of the world and engage with pressing scientific issues.

## LEARNING OBJECTIVES

Your study will focus on four main ideas:

- 01 All matter is made up of atoms
- 02 Properties of matter can be explained by atomic and molecular structure and behavior
- 03 Changes in matter involve the rearrangement of particles of matter and/or the transfer of electrons
- 04 Changes in matter are driven by electrostatic forces and accompanied by energy changes

and two main practices:

- 01 Chemists use models to understand atoms, molecules, and their behavior
- 02 Chemists gather data and use theory to make arguments about atoms, molecules, and their behavior

DETAILED COURSE INFORMATION IN CANVAS UNDER CLASS ESSENTIALS

## TEXTBOOK

Pettruci, Herring, Madura, and Bissonnette.  
General Chemistry: Principles and Modern  
Applications. (10th or 11th edition).



*E-book and access code for Mastering  
Chemistry on Canvas*

Course ID: eichhorn54968

All other **required** materials will be posted  
to the course Canvas page.

## REQUIRED TECH



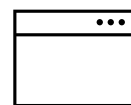
Computer  
/Tablet

iClicker  
Account



Internet  
Access

Mastering  
Chemistry



Browser

PDF Reader



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## COURSE FORMAT

The course will be in person and you are encouraged to attend in person for optimal engagement with the material, peers, and instructor. The course will also be live-streamed on zoom and recorded for students unable to attend class in person.

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## COURSE POLICIES

### ACCESSIBILITY

If you need any accessibility-based accommodations, please let the instructor know so appropriate arrangements can be made. See the University Policy page on Canvas under Class Essentials for more information. If you have trouble acquiring the resources needed for the class, especially textbook and computer, please let the instructor know immediately so accommodations can be made. The UNL Library has laptop to check out (<https://libraries.unl.edu/laptops>).

### ACADEMIC INTEGRITY

Your intellectual growth depends on responsibility, honesty, and doing your own work. Presenting the work of others as your own by taking ideas from others (plagiarism) or copying other's work is dishonest, hurts your reputation and credibility, and will result in a failing grade on the assignment and potentially disciplinary action. See the University Policy page on Canvas under Class Essentials for more information.

### HEALTH AND WELL-BEING

These are not normal times. Please be kind to yourself, and to others. If you are struggling, please reach out to the instructor. Please see the University Policy on Counseling and psychological services for more information.

### FACE COVERINGS

Given current CDC and county health guidance and the current transmission level of COVID-19 in our community, I respectfully request that you join me in wearing a face covering during our classes. If you have a documented medical need for face coverings in class, please notify the instructor immediately so accommodations can be made.

### ATTENDANCE

The course has been designed to give you many opportunities to meaningfully engage with the TA and instructor, peers, and the material beyond in-person attendance. Attendance will be taken for record-keeping and safety reasons but your attendance in person will not count toward your grade. In person attendance is encouraged but not mandatory.

If you do not feel well **DO NOT** come to class in person. Students who are sick or who are engaging in self-quarantine in accordance with guidance from the Lincoln-Lancaster County Health Department or their health care professional should not physically attend in-person classes.

### FLEXIBILITY

Life happens. Especially right now. Extra credit assignments will be available throughout the course. The lowest 3 homework grades, and lowest 10 Knowledge Checks, will be dropped. At the end of the semester, your lowest unit exam grade will be replaced with the average of your highest and lowest unit exam grades.

### DUE DATES

Assignment due dates are designed to help you progress through the course while engaging in deep learning. Deadline extensions may be permitted on a case-by-case basis. Please contact the instructor as soon as possible if you anticipate missing critical deadlines.

*Late policy:* Assignments turned in one week late will have a 10% penalty, two weeks late will have a 20% penalty. Exceptions to this policy may be granted on a case by case basis.

## ASSIGNMENTS & GRADING

### KNOWLEDGE CHECKS

BEFORE CLASS

150 POINTS

Knowledge checks help make sure you have a good understanding of the material before class. To prepare, work through the material on Canvas and in the textbook that will be covered in class the next day. KCs should take approximately 10-20 minutes to complete and are submitted through Mastering Chemistry. KCs are due by midnight the night before each class and are worth 5 points each.

### EXAMS

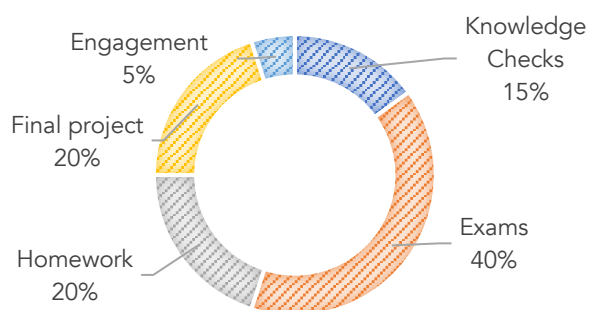
4 UNIT, 1 FINAL

400 POINTS

Exams assess your summative understanding of concepts covered in the unit. You will have 90 minutes to complete each exam. Unit exams are 75 points each and the final exam is 100 points. Exams will take place on the following dates:

- Exam 1: Sept 16 (Ch. 1, 2, 8.1-8.5)
- Exam 2: Oct 7 (Ch. 8.6-8.11, 9, 10)
- Exam 3: Nov 4 (Ch. 11, 7, 3)
- Exam 4: Dec 2 (Ch. 4, 5, 6, 12)
- Final exam: Dec 16 (Ch. 1-12)

If you have a conflict or anticipate missing an exam, you **must** notify the Professor before the exam start. Class and exam policies and procedures are subject to change depending on national, state, or University issued guidance.



POINTS	PERCENT	GRADE
970-1000	97.0+	A+
930-969	93.0+	A
900-929	90.0+	A-
870-899	87.0+	B+
830-869	83.0+	B
800-829	80.0+	B-
770-799	77.0+	C+
730-769	73.0+	C
700-729	70.0+	C-
670-699	67.0+	D+
630-669	63.0+	D
600-629	60.0+	D-
<600	<60.0+	F

### HOMEWORK

WEEKLY

200 POINTS

Homework gives you the opportunity to practice your problem-solving skills and evaluate your understanding of the material covered during the week. Each homework assignment should take about one hour to complete and is submitted through Mastering Chemistry. Each homework assignment is worth 20 points and is due by midnight on Sundays.

### ENGAGEMENT

IN CLASS

50 POINTS

Engagement includes in-class work comprising both individual and group components. You will have the opportunity to practice problems in class to assess your understanding in real time. Your responses will be recorded using the iClicker polling. In addition, you will engage with one another to solve complex conceptual problems, and to think about how the Chemistry you learn in class connects with the world around you.

### FINAL PROJECT

BIWEEKLY

200 POINTS

You will select a journal article from the list below. Four assignments, focused on different aspects of the paper, will guide you through the process of critical evaluation of scientific literature, culminating in a final report.

**Materials/Physical/Inorganic:** Yoo JJ, Seo G, Chua MR, Park TG, Lu Y, Rotermund F, Kim Y, Moon CS, Jeon NJ, Correa-Baena J, Bulović, V, Shin SS, Bawendi MG, Seo J. Efficient perovskite solar cells via improved carrier management. *Nature* **2021** 590, 587–593.

**Synthesis/Organic:** Knapp RR, Tona V, Okada T, Sarpong R, Garg NK. Cyanoamidine cyclization approach to remdesivir's nucleobase. *Org. Lett.* **2020** 22 (21), 8430-8435.

**Chemical Biology/Biochemistry:** Branon TC, Bosch JA, Sanchez AD, Udeshi ND, Svinkina T, Carr SA, Feldman JL, Perrimon N, Ting AY. Efficient proximity labeling in living cells and organisms with TurboID. *Nat Biotechnol.* **2018** 36(9), 880-887.

**Chemical Education:** Hensen, C & Barbera, J. Assessing affective differences between a virtual general chemistry experiment and a similar hands-on experiment. *J. Chem. Educ.* **2019** 96, 2097–2108.

**Environmental:** Schartup AT, Thackray CP, Qureshi A, Dassuncao C, Gillespie K, Hanke A, Sunderland, EM. Climate change and overfishing increase neurotoxicant in marine predators. *Nature* 2019.

**Analytical/Forensic:** Azaldegui C, Aguilar G, Enriquez S, Madonna C, Parish Fisher C, Burks R. Benzoic acid derivatives as luminescent sublimation dyes in cyanoacrylate fuming of latent fingerprints. *J Forensic Sci.* **2021** 66,1085– 1093.

LET US KNOW IF YOU HAVE ANY QUESTIONS!

## IMPORTANT DATES

### FINAL PROJECT ASSIGNMENT 1

#### ANATOMY OF THE PAPER

In this assignment, you will learn how to evaluate sources, break down a piece of scientific writing into composite parts, and connect recent scientific findings with course material.

### FINAL PROJECT ASSIGNMENT 2

#### RESEARCH PROBLEM

In this assignment, you will learn how a single paper, and its findings, fits into a larger body of scientific knowledge. You will identify the key knowledge gap that the paper is addressing, why it is an important problem to be solved, and the research strategy the authors used to solve this problem.

### FINAL PROJECT ASSIGNMENT 3

#### MATERIALS AND METHODS

In this assignment, you will dive into the methods to understand what experiments and instruments were used to perform the research study.

### FINAL PROJECT ASSIGNMENT 4

#### RESULTS AND DISCUSSION

In this assignment, you will learn how the methods were used to collect data, and how this data was analyzed and interpreted to make new scientific findings.

### FINAL PROJECT REPORT

In the final report, you will connect all previous assignments, and feedback from instructors, to create a cohesive piece of writing that critically evaluates the paper and generate new experimental strategies to make further progress on the research topic in the paper.

## STRATEGIES FOR SUCCESS

### MANAGE YOUR TIME

At the beginning of the semester, map out exams, project due dates, etc to keep track of important deadlines. Break larger projects into smaller tasks. Each week, make a list of assignments (and due dates) for all your classes. Plan your week with these due dates in mind to make sure you don't miss any deadlines.

### ASK FOR HELP

Your TA and instructor want you to succeed! Go to recitation and office hours to get help. Study groups are also a great way to study and work through problem sets as a group to make sure you understand the material. Take advantage of tutoring through CAST – ask your advisor and/or instructor for more information.

### STUDY SMARTER

Set aside specific time for class related work. Treat that time like you are actually in class! Follow these steps for more effective studying (this is also known as the Pomodoro Technique):

- 1) Spend 1-2 minutes setting a goal. Decide what you want to accomplish in that study session. This goal should be specific and reasonable.
- 2) Study for 30-45 minutes with focus. Use a timer or apps like Forest to motivate you to focus.
- 3) Times up! Look back at your goal to see if you achieved it. If not, was it a reasonable goal? Reflect to see if you can refine your goal next time to be more achievable.

### SELF CARE

College is stressful, especially these days! Make sure you are getting enough rest, getting proper nutrition, and taking care of your health both mental and physical. If you are struggling, please reach out for help. CAPS is a great resource.

### TAKE GREAT NOTES

Before class, review the textbook and course materials and take notes as you read. During class, write down key concepts covered and work through problems. After class, re-write your class notes, using the textbook and other resources to fill in gaps.

PROJECT SECTIONS	DUE DATE	POINTS
PAPER SELECTION	AUG 27	10
FP 1	SEPT 10	25
FP 2	OCT 1	25
FP 3	OCT 29	25
FP 4	NOV 19	25
REPORT	DEC 10	100

# COURSE SCHEDULE

**AUG 23**

## **INTRODUCTION**

**CHAPTER 1**

Before class: Complete survey & intro to Mastering Chemistry

After class: Review syllabus and Canvas Module 0

**AUG 25**

## **MEASUREMENT & UNCERTAINTY**

Before class: KC 1

After class: look through FP papers

**AUG 27**

## **SIGNIFICANT FIGURES & DENSITY**

Before class: KC 2

After class: HW 1 (Ch. 1) due 8/29

FP selection due

**AUG 30**

## **ATOMIC THEORY & ELECTRONS**

**CHAPTER 2**

Before class: KC 3

**SEPT 1**

## **THE PERIODIC TABLE: ELEMENTS & MASS**

Before class: KC 4

**SEPT 3**

## **MOLES**

Before class: KC 5

After class: HW 2 (Ch. 2) due 9/5

**SEPT 6**

## **LABOR DAY, NO CLASS**

**SEPT 8**

## **LIGHT & ENERGY**

**CHAPTER 8**

Before class: KC 6

**SEPT 10**

## **QUANTUM THEORY & WAVE MECHANICS**

Before class: KC 7

After class: HW 3 (Ch. 8.1-8.5) due 9/12 FP 1 due at midnight

**SEPT 13**

## **THE HYDROGEN ATOM**

Before class: KC 8

**SEPT 15**

## **ELECTRON SPIN & CONFIGURATION**

Before class: KC 9

After class: Exam prep

----- Exam 1 Sept 16 -----

**SEPT 17**

## **ELECTRON SPIN & CONFIGURATION**

Before class: KC 10

After class: HW 4 (Ch. 8.6-8.11)

**SEPT 20**

## **THE PERIODIC TABLE**

**CHAPTER 9**

Before class: KC 11

**SEPT 22**

## **PERIODIC TRENDS & IONIZATION**

Before class: KC 12

**SEPT 24**

## **MAGNETISM & POLARIZATION**

Before class: KC 13

After class: HW 5 (Ch. 9) due 9/26

**SEPT 27**

## **COVALENT BONDING**

**CHAPTER 10**

Before class: KC 14

**SEPT 29**

## **LEWIS STRUCTURES**

Before class: KC 15

**OCT 1**

## **RESONANCE**

Before class: KC 16

After class: HW 6 (Ch. 10) due 9/26 FP 2 due at midnight

**OCT 4**

## **SHAPES OF MOLECULES**

Before class: KC 17

**OCT 6**

## **EXAM REVIEW**

Before class: KC 18

After class: Exam prep

----- Exam 2 Oct 7 -----

**OCT 8**

## **VALENCE BONDING**

**CHAPTER 11**

Before class: KC 19

After class: practice self-care

**OCT 11**

## **HYBRIDIZATION PART 1**

Before class: KC 20

**OCT 13**

## **HYBRIDIZATION PART 2**

Before class: KC 21

**OCT 15**

## **MOLECULAR ORBITAL THEORY**

Before class: KC 22

After class: HW 7 (Ch. 11) due 10/17

## COURSE SCHEDULE, CONTINUED

OCT 18-19

FALL BREAK, NO CLASS

OCT 20

INTRO TO THERMODYNAMICS CHAPTER 7

Before class: KC 23

OCT 22

HESS'S LAW

Before class: KC 24

After class: HW 8 (Ch. 7) due 10/24

OCT 25

CHEMICAL COMPOUNDS CHAPTER 3

Before class: KC 25

OCT 27

OXIDATION STATES

Before class: KC 26

OCT 29

NAMING COMPOUNDS

Before class: KC 27

After class: HW 9 (Ch. 3) due 10/31 FP 3 due at midnight

NOV 1

CHEMICAL REACTIONS CHAPTER 4

Before class: KC 28

NOV 3

CHEMICAL REACTIONS

Before class: KC 29

After class: Exam prep

----- Exam 3 Nov 4 -----

NOV 5

CHEMICAL REACTIONS

Before class: KC 30

After class: HW 10 (Ch. 4) due 11/7

NOV 8

AQUEOUS SOLUTIONS CHAPTER 5

Before class: KC 31

NOV 10

REDOX REACTIONS PART 1

Before class: KC 32

NOV 12

REDOX REACTIONS PART 2

Before class: KC 33

After class: HW 11 (Ch. 5) due 11/14

NOV 15

GAS LAWS: PRESSURE

CHAPTER 6

Before class: KC 34

NOV 17

IDEAL GAS LAW

Before class: KC 35

NOV 19

KINETICS & PROPERTIES OF GASES

Before class: KC 36

After class: HW 12 (Ch. 6) due 11/21 FP 4 due at midnight

NOV 22

INTERMOLECULAR FORCES CHAPTER 12

Before class: KC 37

NOV 24-26

THANKSGIVING BREAK, NO CLASS

NOV 29

PHASES OF MATTER

Before class: KC 38

DEC 1

CRYSTALS

Before class: KC 39

After class: Exam prep

----- Exam 4 Dec 2 -----

DEC 3

IONIC CRYSTALS

Before class: KC 40

After class: HW 13 (Ch. 12) due 12/5

DEC 6

REVIEW

DEC 8

REVIEW

DEC 10

LAST DAY OF CLASS

REVIEW

After class: Final project report due at midnight

----- Final Exam Dec 16 -----