

Class meetings lecture MWF 9:10-10:10 am, HS 175
lab 1 M 1:50-4:00, HS 401 lab 2 T 8:00-10:20, HS 401 4 credits

Instructor Dr. Jennifer E. Mihalick *phone* (920) 424-7095 *email* mihalick@uwosh.edu
office HS 439 *office hours for students* MTW 10:20-11:20, F 8:00-9:00, or by appointment

Required course materials (available at University Books and More):

The Chemistry of Materials and their Role in a Sustainable Society by J. E. Mihalick

Laboratory Manual for Chemistry 104 by J. Mihalick

Garbology by E. Humes

safety goggles with indirect vents (discounted, used goggles will be available from Chem Club)

basic calculator (cell phones are not allowed for quizzes or exams)

Course Description: This laboratory course will teach the chemistry behind materials that society depends on: metals, ceramics, and polymers. Historic and economic impacts of their manufacture and use will be considered. Applications of advanced materials in fields such as electronics, aviation or art will be discussed. This course may be combined with Chemistry 103 to form a two-semester sequence for the Bachelor of Science degree. Note: Chemistry 104 is not a prerequisite for higher level chemistry courses.

Course Overview: The stuff that surrounds us – in our clothing, desks, and coffee cups – is made out of materials. Materials chemistry is an active area of scientific research and one with many practical applications.

Chem 104Q2 is a "Quest II" course for the University Studies Program "USP", UW Oshkosh's plan to provide you with a Liberal Education. This approach to learning develops skills and knowledge in a variety of disciplines to prepare you to deal with a complex, diverse and changing society. Each USP course addresses several of the UW Oshkosh Essential Learning Outcomes. Quest II courses include opportunities for **planning your future** in college, work, and life, and also introduce **ethical reasoning** as a way to analyze and evaluate complex situations. Ethical reasoning, based on beliefs about values, answers the question "what is the right thing to do?" You will be prepared to define and explain ethical reasoning; recognize ethical issues and questions; recognize and understand the reasons for personal beliefs; identify and understand arguments that challenge those beliefs; and engage in difficult conversations with those who may or may not share your beliefs.

In this course we will consider the signature question "**how do people understand and create a more sustainable world?**" Sustainability may be defined as a way of living without compromising opportunities for future generations.

In this course you will gain **knowledge of sustainability and its applications**, demonstrating the ability to understand local and global earth systems; the qualities of ecological integrity and the means to restore and preserve it; and the interconnection of ecological integrity, social justice, and economic well-being.

This lab science course also fills a "Nature" requirement for the USP. You will gain **knowledge of human cultures and of the physical and natural world**.

More specifically, you will be able to:

- recognize the three major classes of materials;
- explain how the history of civilizations is tied to the development of materials and the sustainability of their practices;
- describe interrelationships among structure & composition, physical & chemical properties, processing, and performance for each class of materials;
- analyze the sustainability of materials processing and applications;
- compare ethical perspectives on access to natural resources and processed materials, processing methods, and fates of materials;
- use appropriate laboratory techniques to process materials, determine their properties, and minimize the creation of waste.

List of Topics

Classification of Matter: historic eras, metric system, physical & chemical properties, three pillars of sustainability, atomic structure, periodic table

Structure of Solids: crystalline, amorphous

Metals: metallic and ionic bonds, oxidation-reduction reactions, alloys, magnets
ethical issue: access to minerals

Polymers: covalent bonds, natural & synthetic fibers, paper, polymerization reactions

Dyes: light & color, interactions with fibers

ethical framework for sustainability: 12 Principles of Green Chemistry and Engineering

Ceramics: pottery, heat and reactions, glass, concrete

Semiconductors: electronic structure of solids, transistors, light emitting diodes
ethical/sustainability issue: disposal of electronic devices

Advanced Materials

Planning your future in college, work, and life: academic opportunities (majors & minors, study abroad, research & creative activity), student organizations, career & alumni connections

Course Components

Lecture: Major concepts will be introduced and discussed in lecture. We will observe samples of materials, view videos of materials processing, analyze laboratory results, and discuss news articles during the lecture periods. In-class activities will contribute to your grade. Quizzes and exams will also be given in lecture (see schedule on page 5). The exams will have questions about material covered in lecture, laboratory, and homework. If you are absent for a quiz or exam, contact me as soon as possible with your excuse and availability for a makeup.

Homework: Outside of class you will read the textbook, review lecture notes, look at websites, and do homework problems. Homework assignments will be distributed weekly, in Canvas. Homework will not be collected, but frequent quizzes will check your understanding of the assignments. Studying with classmates may be helpful.

You will also write three short papers during the semester, based on references recommended by the instructor. Paper 1, on a metal, will focus on structure and properties; sources, abundance and extraction methods; and applications. Paper 2 will focus on economic and environmental impacts of polymers. Paper 3, on an advanced material, will analyze the sustainability of its synthesis, processing, or performance. During the last lab of the semester you will give a brief class presentation on your advanced material.

Laboratory: All students must participate in the weekly laboratory. It is an opportunity to practice teamwork with lab partners. The experiments in *Laboratory Manual for Chemistry 104* are closely connected to the lecture material. Read the experiment before your lab period begins. The pre-lab assignment for each experiment will be checked at the beginning of the period. At the conclusion of each lab period you will leave your notes for grading. Most students will earn 10 points for each experiment. Points will be deducted if the pre-lab assignment is not done; an experiment is not finished; notes are not complete; or safety rules are not followed. Graded lab notes will be returned in lecture.

Doing laboratory experiments is an important part of the course. If you miss a laboratory, or leave before the experiment is complete, you must submit a written excuse to the instructor (email is acceptable). According to Department policy, a student who misses more than one lab without an excuse will fail the course.

Office Hours: If you have questions about a lecture, lab, or homework assignment; if you want to learn more about materials or chemistry; or if you just have some time to kill between classes, stop by my office! If the scheduled hours are not convenient for you, call or email to make an appointment. I will also answer questions via email.

It is the policy and practice of UW Oshkosh to create an inclusive learning environment. If there are aspects of the instruction or design of this course that result in barriers to your inclusion, please notify me as soon as possible. For more information on accommodations, visit the Accessibility Center <<https://uwosh.edu/deanofstudents/accessibility-center/>>.

Campus Events: During the semester there will be campus events to help you **plan your future** in college, work, and life. There will also be events related to sustainability. Here is an initial list:

date	event	learn about
W 2/8	TitanFest/Taste of Oshkosh	student organization opportunities
M 2/13 – Th 2/17	Academic Open Houses	majors, minors, certificate programs
W 2/22	Study Abroad/Away Fair	international opportunities
W 3/1	Career Fair on the Fox	networking, internships, careers
April	Earth Month	issues related to sustainability
Th 4/27	Celebration of Scholarship & Creative Activity	student accomplishments

You will be **required** to attend five campus events:

- Academic Open Houses of 3 departments;
- 1 current opportunities event (Taste of Oshkosh, Study Abroad);
- 1 career-related event;
- 1 sustainability-related event;
- Celebration of Scholarship & Creative Activity.

Events that can be used for these purposes will be listed in Canvas modules.

Attendance at some additional events for extra credit will be possible.

Grading: Scores will be posted in Canvas so you can keep track of your performance.

Laboratory work	120
Campus Events, In-class Activities	44
Quizzes	81
Papers & presentation	55
Exams	<u>300</u>
TOTAL	600

Final grades will be based on the total points accumulated in the course.

Expected grade ranges are 100 - 87% A; 86 - 75 B; 74 - 63 C; 62 - 50 D; < 50 F

Early Alert email messages will be sent after Exam 1 if poor attendance is causing problems, and/or if your grade is below a C. If you have any concerns about your performance in the course, please stop by my office to discuss possible ways to improve the situation.

One Stop for Student Success: Find information about all the resources available to UW Oshkosh students at <<https://uwosh.edu/one-stop/>>.

Students are advised to see the following URL for disclosures about essential consumer protection items required by the Students Right to Know Act of 1990:

<https://uwosh.edu/financialaid/resources/consumer-information/>

Class meetings:

Lectures meet MWF 9:10-10:10 am in HS 175.

Lab section 1 meets M 1:50-4:00 pm; lab section 2 meets T 8:00-10:10 am. Both are in HS 401.

week of	Monday	lab (M or T)	Wednesday	Friday
1/30	1. Classification of Materials	Safety; Physical Properties of Materials	1. Classification of Materials	1. Classification of Materials Q1
2/6	2. Structure of Solids	Properties of Crystals	2. Structure of Solids	2. Structure of Solids Q2
2/13	3. Metals	Modification of Metal Properties	3. Metals	Career Planning
2/20	4. Alloys	Heat Capacities of Metals	4. Alloys Paper 1 due	4. Alloys Q3
2/27	review	Fiber Identification by Physical & Chemical Properties	Exam 1	5. Structure of Polymers
3/6	5. Structure of Polymers	Polymers from Monomers I	5. Structure of Polymers	5. Structure of Polymers Q4
3/13	6. Polymerization Reactions	Polymers from Monomers II	6. Polymerization Reactions	6. Polymerization Reactions Q5
3/20	<i>spring break, no classes</i>			
3/27	7. Processing and Performance of Polymers	Separation of Dyes	7. Processing and Performance of Polymers Paper 2 due	7. Processing and Performance of Polymers Q6
4/3	8. Dyes and Paints	Preparation of Pigment and Paint	8. Dyes and Paints	review
4/10	Exam 2	Identification of Metal Ions in Ceramics	9. Pottery	9. Pottery
4/17	9. Pottery	Preparation and Modification of Glass	10. Glass	10. Glass Q7
4/24	11. Construction Materials	Preparation of Concrete	11. Construction Materials	12. Semiconductors Q8
5/1	12. Semiconductors	Concrete, check out	12. Semiconductors Paper 3 due	13. Advanced Materials Q9
5/8	13. Advanced Materials	presentations on advanced materials	review	Exam 3

Q = quiz