

Class meetings: Chem 104 is a 4 credit class. Lectures meet MWF 10:20-11:20 am in HS 260. 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.

Instructor contact information:

office: HS 432 *research lab:* HS 437 *phone:* (920) 424-7095 *email:* mihalick@uwosh.edu
office hours MWF 8:30-9:30 am, T 10:20-11:20 am, or by appointment

Required course manuals (available only at University Books and More):

Introduction to the Chemistry of Materials and *Laboratory Manual for Chemistry 104*

Required supplies:

safety goggles with indirect vents (available from the Chem Club); calculator (not cell phone).

Course Overview: The stuff that surrounds us – in our clothing, desks, and coffee cups – is made out of materials. In this course we will discuss the chemistry behind the materials that society depends on, metals, polymers and ceramics. Materials chemistry is an active area of scientific research and one with many practical applications.

Chem 104 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. 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 is a way of living without compromising opportunities for future generations.

This 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. Group activities and quizzes will contribute to your grade.

Homework: Outside of class you will read the textbook, review lecture notes, look at websites, and do homework problems. Answers to homework problems will not be collected, but quizzes will check your understanding of the assignments. Although assignments will be distributed weekly (via D2L), it is best to devote time each day to studying for the course. 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. You will submit pdfs of your papers to the D2L drop box. During the last lab of the semester you will give a brief presentation on your advanced material.

Laboratory: Teamwork will be practiced in the laboratory. All students must participate in the weekly laboratory. The experiments in *Laboratory Manual for Chemistry 104* are closely connected to the lecture material. Read the experiment before the 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 the lab notes from that day to be graded. 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. There are no make-ups for a missed laboratory. 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 the office! If the listed hours are not convenient for you, call or email to make an appointment. I will also answer questions via email.

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

date	event	learn about
T 2/6	Volunteer Fair	nonprofit organizations in our community
W 2/7	Taste of Oshkosh	student organizations
2/12 - 2/16	Academic Open Houses	majors, minors, and certificate programs
W 2/21	Study/Intern Abroad Fair	international opportunities
Th 3/1	Sustainability Career Networking	networking, internships, and careers
W 3/7	Career Fair on the Fox	networking, internships, and careers
4/23 - 4/27	Earth Week	issues related to sustainability
Th 4/26	Celebration of Scholarship	student research and creative activities
W 5/2	Career & Internship Fair	networking, internships, and careers

You will be **required** to attend

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

Attendance at other events will be optional, for extra credit.

Grading: There will be quizzes most Fridays. Three 100 point exams will also be given in lecture. They will have questions on material covered in lecture, laboratory, and homework.

Laboratory work	120
in-class Activities	26
Campus Events	20
Quizzes (best 10)	80
Papers & presentation	54
Exams	<u>300</u>
TOTAL	600

Final grades will be based on the total points accumulated. Expected grade ranges are

100 - 87% A 86 - 75 B 74 - 63 C 62 - 50 D < 50 F

The instructor reserves the right to lower the cutoffs.

All grades will be posted in D2L so you can keep track of your performance. **Early Alert** will occur in week 6. Each of you will receive an email indicating how well you are doing in this class. The alert will indicate if everything is ok; if poor attendance is causing problems; or if your grade is below a C. If you do not see "ok" for Chem 104, please stop by your instructor's office to discuss possible ways to improve the situation.

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Lab 2 meets T 8:00-10:10 am in HS 401.

week of	Monday	lab (M or T)	Wednesday	Friday
1/29	1. Classification of Matter	Physical Properties of Materials	1. Classification of Matter	1. Classification of Matter Q
2/5	2. Structure of Solids	Properties of Crystals	2. Structure of Solids	2. Structure of Solids Q
2/12	3. Metals	Modification of Metal Properties	3. Metals	3. Metals Q
2/19	4. Alloys Paper 1 due	Heat Capacities of Materials	4. Alloys	4. Alloys Q
2/26	review	Fiber Identification by Physical & Chemical Properties	Exam 1	5. Structure of Polymers
3/5	5. Structure of Polymers	Polymers from Monomers I	5. Structure of Polymers	5. Structure of Polymers Q
3/12	6. Polymerization Reactions	Polymers from Monomers II	6. Polymerization Reactions	6. Polymerization Reactions Q
3/26	7. Applications of Polymers	Separation of Dyes by Paper Chromatography	7. Applications of Polymers	7. Applications of Polymers Q Paper 2 due
4/2	8. Dyes & Paints	Preparation of Pigment and Paints	8. Dyes & Paints	review Q
4/9	Exam 2	Identification of Metal Ions in Ceramics	9. Pottery	9. Pottery
4/16	10. Glass	Preparation and Modification of Glass	10. Glass	10. Glass Q
4/23	11. Construction Materials	Preparation of Concrete	11. Construction Materials	12. Semiconductors Q
4/30	12. Semiconductors	Concrete, check out	12. Semiconductors Paper 3 due	13. Advanced Materials Q
5/7	13. Advanced Materials	Presentations on Advanced Materials	review	Exam 3

Q = quiz