

**Survey of Organic Chemistry**  
**Chemistry 101 Lecture and Lab**  
**Fall 2022**  
**Dr. Badger**

**Web Site: <https://crbadger.uwsp.edu/rbadger/101/>**

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**The Instructor** (contents)

- Name: Dr. Robert Badger (students usually call me Dr. Badger or Dr. B; colleagues or fellow basketball players call me Bob)
- Office: 449 Chemistry Biology Building
- Phone: 715-346-3700
- email: [rbadger@uwsp.edu](mailto:rbadger@uwsp.edu)

My schedule:

You should view the white space as 'office hours'. While I do not sit in my office during these hours waiting for students (I do spend some of these hours in CBB220, CBB422 or CBB429 - glass blowing among other things) I will definitely be available for scheduled appointments (just send me an email with your preferred date and time and we will get together). I invite you to stop by and knock on my door.

Robert Badger	Fall Semester 2022				
	Monday	Tuesday	Wednesday	Thursday	Friday
08:00	101 Lab 01L1 220		101 Lab 01L2 220		
09:00	101 Lab 01L1 220		101 Lab 01L2 220		
10:00	101 Lab 01L1 220	Class Prep. Please avoid	101 Lab 01L2 220	Class Prep. Please avoid	
11:00	Lab Grading	101 Lab 01L3 220	Lab Grading	101 Lab 01L4 220	
12:00		101 Lab 01L3 220		101 Lab 01L4 220	
13:00		101 Lab 01L3 220		101 Lab 01L4 220	
14:00	Class Prep. Please avoid	Class Prep. Please avoid	Class Prep. Please avoid	Class Prep. Please avoid	
15:00	101 Lec 01 CBB101	101 Lec 01 CBB101	101 Discussion CBB101	101 Lec 01 CBB101	
16:00		Lab Grading		Lab Grading	

White boxes in the schedule above indicate times when I can/will make myself available to help you with anything that is giving you trouble in chemistry 101.

### Philosophy (contents)

Chemistry 101 is a one semester general chemistry for non-science majors. In lecture and lab we shall discuss - demonstrate - elucidate - illuminate material from chapters 1-17 of Suchocki, "Conceptual Chemistry", 5th Ed. This necessarily means we will move at a fairly rapid pace and in some cases will not be able to discuss in sufficient detail material that may be of interest or confusing to you. I urge you to ask questions in lecture/discussion/lab or stop by my office. You can even stop me in the street, if necessary, to obtain satisfactory solutions to problems you may have. I can not guarantee to have all the answers, but I will try to find them, if possible. There is also a menu item to the left labeled 'Anonymous Questions/Comments' that will allow you to send an anonymous email to me. I will post responses under the 'Dr. Badger Responds' menu item for those queries that I feel the whole class should know about.

### Format:

The course consists of three hours of lecture per week, one hour of discussion, three hours of lab per week and, probably, five hours per week outside of class for problem sets (10 - 20 questions each), pre-lab quizzes and preparing for exams.

### Audience:

Primarily freshman and sophomores majoring in everything from biology to philosophy who need only one or two natural science courses. In some cases this may be the only science course you will take at the college level. This means I should/can bring all of the natural sciences (biology, chemistry, physics, geology, geography among others) into the course to help you make sense of our increasingly science based technological

society.

### Living and Learning During COVID-19.

#### Face Coverings:

- As I write this syllabus face coverings are not required although I will probably wear one much of the time as my advanced age makes me more susceptible to severe complications from Covid-19 or the flu. If we are faced with a significant surge of Covid-19 cases this rule may change.

#### Other Guidance:

- Please monitor your own health each day. Give some consideration to taking advantage of Covid testing that may be available on campus. If you are not feeling well or believe you have been exposed to COVID-19 or the flu, do not come to class; email me (rbadger@uwsp.edu) 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.
- Avoid congregating in groups before or after class and stagger your arrival and departure from the classroom, lab, or meeting room.
- Remove disposable gloves and wash your hands when leaving the lab, since you may have been exposed to hazardous chemicals in addition to biological hazards.

#### Goals:

- To understand how microscopic molecular and electronic structure correlate with macroscopic physical properties and chemical reactivity.
- To understand how electron movement during chemical reactions cause atoms to move and change their bonding character.
- To understand how laboratory observations, measurements and experiments have led to the fundamental chemical concepts that describe the molecular structure and reactions of substances.

### Text and Supplementary Materials (contents)

#### REQUIRED:

1. Course Text: John Suchocki, "Conceptual Chemistry," 5th Edition, Pearson Education, 2014. Available at text rental. Dr. Suchocki also maintains a web site for his text at <https://conceptualscience.com/chemistry/>
2. Purchase a 'Sharpie' from the bookstore or your favorite office supply store (K-Mart, Walmart, etc.). This will be used in the lab to label beakers, flasks and samples to keep track of materials you work with.

#### LabFlow (contents)

3. LabFlow: University of Wisconsin-Stevens Point - Fall 22 - CHEM 101. Please click this link and create an account before classes start, if possible. Access will cost \$30.00 if you pay via the LabFlow web site and ~\$40.00 if you purchase access at the bookstore.

You will need the Enrollment Code listed below for your lab section when you create your account.

LabFlow Section Enrollment Codes			
Section 01L1	Mon 8:00 AM - 10:50 AM	Room 220	Enrollment Code: 81191
Section 01L2	Wed 8:00 AM - 10:50 AM	Room 220	Enrollment Code: 81192
Section 01L3	Tue 11:00 AM - 1:50 PM	Room 220	Enrollment Code: 81193
Section 01L4	Thu 11:00 AM - 1:50 PM	Room 220	Enrollment Code: 81194

**Recommended:**

1. A calculator capable of addition, subtraction, multiplication, division and common logs for use on exams, labs and problem sets.
2. An internet capable phone, tablet or computer to enter class and lab data. iPads/keyboards will be available in the laboratory only for those of you who need one during lab.

**Attendance** (contents)**Lecture:**

Attendance records will be maintained and extended absences will be reported to the Dean of Students. Attendance, in itself, will have no direct effect on your grade, but your performance on exams, labs, and problem sets will undoubtedly suffer.

**Lab:**

**Laboratory attendance is mandatory**, since you will not be able to perform experimental work anywhere else.

**Absences:**

The student is responsible for all missed material.

**Grading (contents)**

Generally, final grades will be based on total points accumulated where the lowest Prelab, lab, and problem set score will be dropped. All problem sets and exams will be multiple choice. Grades will be assigned on the following curve:

grade	Percent points possible	Course Exercise	Course point allocations
A	93	Three Hour exams	300 pts.
A-	90-93	Final exam	100 pts.
B+	87-90	Ten Problem Sets	90 pts.
B	83-87	Laboratory Experiments (13)	180 pts (10 pts/report; 5 pts/prelab)
B-	80-83	Total	670 pts.
C+	77-80		
C	73-77		
C-	70-73		
D+	67-70		
D	60-67		
F			

I reserve the right to alter this curve depending on the overall performance of the class. I will under no circumstances raise this curve.

**Exams (contents)**

Exams are closed book and will be given during the Thursday class hour indicated on the attached schedule. Questions will be taken mainly from the lecture and assigned text, suggested problems and problem sets. It has become my policy to include one or more problems from each chapter on exams. Thus, by diligently working the problems, you are assured of being able to successfully answer at least two or three questions correctly on exams. The more problems you solve the better your exam results will be. Materials you may bring: pencils, pens, erasers, calculators and **one side of one 3 x 5 inch index card containing any information you feel may help you on the exam.** You will not be allowed to share any of the above items nor use cell phones, tablets or computers during the exam.

Materials I will provide: the exam, and a periodic chart.

Please note the excerpt from UWSP 14 below. I am concerned about academic misconduct. **It is my policy that anyone guilty of academic misconduct will receive an F for the course grade.** I intend to initiate some or all of the following measures to protect your intellectual property:

- **Assigned exam seats** On exam day I may project a list of assigned seats and you will be required to sit in your assigned seat or, if and as space allows, a seat that is completely isolated from others.
- **Unique exam** I may create two or more different exams on different colored paper. You must have a different colored exam than your neighbor to the left and right.
- **Video tape** I may video tape the exam to assist in preventing academic misconduct.
- **Your assistance** During the exam please take every precaution to protect your intellectual property - the answers you have placed on your exam. Keep your eyes on your paper or your notecard.

**UWSP 14.03 ACADEMIC MISCONDUCT SUBJECT TO DISCIPLINARY ACTION.** (contents)

**Academic misconduct is an act in which a student:**

1. Seeks to claim credit for the work or efforts of another without authorization or citation;
2. Uses unauthorized materials or fabricated data in any academic exercise;
3. Forges or falsifies academic documents or records;
4. Intentionally impedes or damages the academic work of others;
5. Engages in conduct aimed at making false representation of a student's academic performance; or
6. Assists other students in any of these acts.
7. Examples of academic misconduct include, but are not limited to:
  - cheating on an examination
  - collaborating with others in work to be presented, contrary to the stated rules of the course
  - submitting a paper or assignment as one's own work when a part or all of the paper or assignment is the work of another
  - submitting a paper or assignment that contains ideas or research of others without appropriately identifying the sources of those ideas
  - stealing examinations or course materials
  - submitting, if contrary to the rules of a course, work previously presented in another course
  - tampering with the laboratory experiment or computer program of another student
  - knowingly and intentionally assisting another student in any of the above, including assistance in an arrangement whereby any work, classroom performance, examination or other activity is submitted or performed by a person other than the student under whose name the work is submitted or performed.

### Lab (contents)

Please click this link and create an account before classes start, if possible.

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Section 01L4	Thu 11:00 AM - 1:50 PM	Room 220	Enrollment Code: 81194

### Laboratory Maintenance:

I will inspect(unannounced) all workstations occasionally during the semester to see that your benchtop, sink, lab drawer and common equipment areas (balances) are in good working order. White solids and unidentifiable liquids on benchtops will result in loss of lab points. Paper towels, broken glass and other water insoluble solids found in the sink will result in loss of points. Hot plate (when used) must be turned off as you leave. I will evaluate on a day when you have been present in lab. Everyone will lose one maintenance point every time I am required to clean up the balances or chemical hoods. Please speak with me if you are unsure how to clean up a particular spill.

### Prelabs (13)(60 pts.)

The multiple choice prelabs will consist of 10 or more questions that you will be able to answer by reading the lab procedure (also links and videos therein on the web site), and material in your lecture text that pertain to reactions being performed. There will undoubtedly be some questions you can not answer without help from me. Please do not hesitate to ask and I will point you in the correct direction to answer the questions.

### Homework (contents)

The most efficient way to learn new material is to practice applying it. To this end, I will have 10 problem sets available on the Chem 101 web site worth 10 points each (0.5 pts

per question). You can actually visit a particular problem set multiple times before the due date and change your answers. While you are encouraged to discuss these problems with the instructor and classmates you must ultimately provide your own answers. Due dates are listed in the schedule and there will be no exceptions or extensions.

## Schedules (contents)

## Chemistry 101 - Tentative Lecture Schedule - Fall 2022

Modified on Monday, June 20, 2022 at 1:03 PM.					
<u>Exams will be held on the Exam days during the lecture hour.</u>					
<b><i>Problems sets will be due on problem days by 23:59.</i></b>					
Reading assignments in Smith.					
<b>September</b>					
<b>Mon</b>	<b>Tue</b>	<b>Wed</b>	<b>Thu</b>	<b>Fri</b>	<b>Reading Assign.</b>
5 NO CLASS	6 NO LAB	7 NO LAB	8 NO LAB	9 Prob 1	Chap 1
12	13	14	15	16 Prob 2	Chap 2 & 3
19	20	21	22	23 Prob 3	Chap 4 & 5
26	27	28	29 Exam 1	30	Chap 6
<b>October</b>					
<b>Mon</b>	<b>Tue</b>	<b>Wed</b>	<b>Thu</b>	<b>Fri</b>	<b>Reading Assign.</b>
3	4	5	6	7 Prob 4	Chap 6
10	11	12	13	14 Prob 5	Chap 7
17	18	19	20	21 Prob 6	Chap 8 & 9
24	25	26	27 Exam 2	28	Chap 10
31					
<b>November</b>					
<b>Mon</b>	<b>Tue</b>	<b>Wed</b>	<b>Thu</b>	<b>Fri</b>	<b>Reading Assign.</b>
	1	2	3	4 Prob 7	Chap 11
7	8	9	10	11 Prob 8	Chap 12
14	15	16	17	18 Prob 9	Chap 13
21 NO LABS	22 NO LAB	23 NO LAB	24	25	Chap 14
28	29	30			Chap 14
<b>December</b>					
<b>Mon</b>	<b>Tue</b>	<b>Wed</b>	<b>Thu</b>	<b>Fri</b>	<b>Reading Assign.</b>
			1 Exam 3	2	Chap 15
5	6	7	8	9 Prob 10	Chap 16
12	13	14	15	16	Chap 17
19 Final Exam 8:00 - 10:00 AM	20	21	22	23	



## Chemistry 101 - Tentative Lab Schedule - Fall 2022

<i>Prelabs must be submitted at the time and date specified on the LabFlow web site.</i>		
<u>In general, reports will be due by the end of the lab period.</u>		
<b>September</b>		
Mon	Experiment	Thur
5	NO LABS	8
12	Check-in, safety, Conversion Factors and Problem Solving, Check-in	15
19	Density and Specific Gravity	22
26	Separating the Components of a Mixture	29
<b>October</b>		
Mon	Experiment	Thur
3	Introduction to Light and Matter	6
10	Water Content of a Hydrate Salt	13
17	Molecular Modeling of C, N, and O Compounds	20
24	Preparation and Properties of Soap	27
31	Density and Specific Gravity	Nov. 3
<b>November</b>		
Mon	Experiment	Thur
7	Chemistry of Copper and Percent Recovery	10
14	Chemical Reactions and Equations	17
21	NO LABS	24
28	LeChatelier's Principle	Dec. 1
<b>December</b>		
5	Aspirin and Other Analgesics	8
12	Oxidation-Reduction of Christmas Ornaments, Check-out	15

**Learning Goals (contents)****Chapter 1 About Science**

1. Describe the nature of science and the scientific method.
2. Provide an example of the scientific method in action.
3. Relate technology to the furthering of science and vice versa.
4. Distinguish between scientific facts, hypotheses, laws, and theories.
5. Describe chemistry as a central science with an emphasis in applied research.
6. Convert the units of a known physical quantity.

Suggested problems: Pages 19-21  
Odd numbered questions.

**Chapter 2 Particles of Matter**

1. Describe the particulate nature of matter.
2. Describe the evidence for the particulate nature of matter.
3. Distinguish between mass, weight, and volume.
4. Calculate the density of a material.
5. Differentiate between potential and kinetic energy.
6. Distinguish between heat and temperature.
7. Describe the particulate nature of three phases of matter.
8. Describe how the volume of a gas is affected by pressure, temperature, and number of particles.

Suggested problems: Pages 50-54  
Odd numbered questions.

**Chapter 3 Elements of Chemistry**

1. Describe how materials can be identified by their physical and chemical properties.
2. Recognize the elements of the periodic table as the fundamental building blocks of matter.
3. Identify how elements are organized in the periodic table.
4. Contrast compounds with the elements from which they are created.
5. List three guidelines used to name compounds.
6. Recognize mixtures and show how they can be separated by physical means.
7. Classify the states of matter under the categories of pure and impure.
8. Show how nanotechnology is a novel and promising application of chemistry.

Suggested problems: Pages 85-88  
Odd numbered questions.

**Chapter 4 Subatomic Particles**

1. Distinguish between models that describe physical attributes and those that describe the behavior of a system.
2. Identify experiments leading to the discovery of the electron.
3. Defend Rutherford's conclusion that each atom contains a densely packed positively charged center.
4. Describe the structure of the atomic nucleus and how the atomic mass of an element is
5. Describe the nature and range of electromagnetic waves.

6. Recount how the quantum nature of energy led to Bohr's planetary model of the atom.
7. Summarize how electrons, when confined to an atom, behave as self-reinforcing wave-like entities.

Suggested problems: Pages 124-128

Odd numbered questions.

## Chapter 5 The Atomic Nucleus

1. Identify three forms of radioactivity and their effects on living tissue.
2. Identify the natural sources, the units, and the applications of radioactivity.
3. Describe how the strong nuclear force acts to hold nucleons together in the atomic nucleus.
4. Name the isotope that results from a series of alpha and beta decays.
5. Recognize how a radioactive element can be identified by the rate at which it decays.
6. Review how the age of ancient artifacts can be determined by measuring the amounts of remaining radioactivity they contain.
7. Describe the process by which large atomic nuclei can split in half leading to the production of energy.
8. Show how the mass of a nucleon depends upon the identity of the nucleus within which it is contained.
9. Describe the process by which small nuclei can join together leading to the production of energy, such as occurs in the Sun.

Suggested problems: Pages 155-158

Odd numbered questions.

## Chapter 6 How Atoms Bond

1. Identify paired and unpaired electrons within an electron-dot structure.
2. Use the periodic table to predict the type of ion an atom tends to form.
3. Describe how ions combine to form ionic compounds.
4. Relate the properties of a metal to how the atoms of that metal are chemically bonded.
5. Describe how atoms combine to form covalent compounds.
6. Predict the shape of a small molecule using the valence-shell electron-pair repulsion model.
7. Differentiate between ionic, polar covalent, and nonpolar covalent chemical bonds.
8. Recognize the important role that molecular interactions play in determining the physical properties of a material.

Suggested problems: Pages 188-190

Odd numbered questions.

## Chapter 7 How Molecules Mix

1. Identify four different types of dipole attractions and their role in determining the physical properties of a material.
2. Describe the formation of saturated and unsaturated solutions from a molecular point of view.
3. Describe the components of a solution and calculate a solution's concentration.
4. Discuss how solutes dissolve in solvents and how solubility changes with

temperature.

5. Describe the mechanism by which soaps and detergents clean and how this mechanism is foiled by hard water.
6. Describe how dissolved ions can be removed from hard water.
7. Identify the industrial means by which water is purified.

Suggested problems: Pages 220-224  
Odd numbered questions.

## Chapter 8 How Water Behaves

1. Relate the physical properties of ice to its crystalline structure.
2. Identify the molecular processes involved in the freezing and melting of water, the impact of a solute on these processes, and why water is most dense at 4°C.
3. Describe how cohesive and adhesive forces within water give rise to surface tension and capillary action.
4. Show, on a molecular level, how evaporation and condensation lead to cooling and warming effects, respectively, and how they relate to the process of boiling.
5. Describe how the formation and breaking of hydrogen bonds are responsible for water's high specific heat and relate this to global climate.
6. Identify the molecular processes that occur as a substance, such as water, changes phase and how this necessarily involves the input or output of energy.

Suggested problems: Pages 252-256  
Odd numbered questions.

## Chapter 9 How Chemicals React

1. Identify whether a chemical equation is balanced or not balanced.
2. Correlate the formula mass of a substance with the number of molecules or atoms that substance contains.
3. Use the concept of moles to calculate the mass of reactants needed to produce a given mass of products.
4. Calculate the amount of energy released or absorbed by a chemical reaction using the bond energies of reactants and products.
5. Recognize that all chemical reactions are driven by the tendency of energy to disperse.
6. Describe the requirements that must be met in order for a chemical reaction to occur.
7. Discuss how a catalyst can speed up a chemical reaction using the destruction of stratospheric ozone as an example.

Suggested problems: Pages 287-290  
Odd numbered questions.

## Chapter 10 Acids and Bases in Our Environment

1. Identify when a chemical behaves as an acid or a base.
2. Describe how the strength of an acid or base affects the number of ions in solution.
3. Calculate the pH of a solution given the hydronium ion concentration.
4. Describe the chemical nature of a buffer solution and how it resists changes in pH.
5. Identify sources of acidity in rainwater and how this acidity can impact the environment.
6. Describe the impact atmospheric carbon dioxide has on the ocean's pH and

mineral composition.

Suggested problems: Pages 314-318  
Odd numbered questions.

## Chapter 11 Oxidations and Reductions Charge the World

1. Identify when a chemical undergoes oxidation or reduction.
2. Show how electricity can be generated using materials that tend to lose or gain electrons.
3. Describe how oxidation and reduction occur within a device that generates electricity.
4. Identify how a fuel cell generates electricity.
5. Describe the nature of n-type and p-type silicon and how they can be used to create a photovoltaic cell.
6. Describe examples of electrolysis as an application of oxidation/reduction reactions.
7. Review the oxidation-reduction chemistry involved in the creation of common metals.
8. Compare and contrast the processes of corrosion and combustion.

Suggested problems: Pages 346-350  
Odd numbered questions.

## Chapter 12 Organic Compounds

1. Identify the structures of hydrocarbons.
2. Identify the structures of unsaturated hydrocarbons.
3. Discuss the significance of heteratoms in organic compounds.
4. Review the general properties of alcohols, phenols, and ethers.
5. Review the general properties of amines and alkaloids.
6. Review the general properties of carbonyl compounds.
7. Summarize the retro-synthetic strategy used to plan the synthesis of a complex organic molecule.
8. Describe how polymers are synthesized from monomers.
9. Recount the history of the development of plastics starting from the early 1900s.

Suggested problems: Pages 388-393  
Odd numbered questions.

## Chapter 13 Nutrients of Life

1. Identify the basic components of a cell and the four major classes of biomolecules.
2. Recognize the molecular structures of simple and complex carbohydrates.
3. Compare and contrast the properties of fats and steroids.
4. Classify the structure of a protein based on the organization of its amino acids and describe how enzymes work.
5. Identify nucleic acids as polymers of nucleotides and describe how they code for the building of proteins.
6. Distinguish vitamins from minerals and the roles they play in our nutrition.
7. Classify metabolic reactions as either catabolic or anabolic.
8. Describe how the body utilizes carbohydrates, fats, and proteins.

Suggested problems: Pages 432-434  
Odd numbered questions.

## Chapter 14 Medicinal Chemistry

1. Classify drugs by their origin and describe the synergistic effect.
2. Describe the lock and key model and how it is used in the development of new medicines.
3. Describe how chemotherapy protects us from bacterial and viral infections as well as cancer.
4. Summarize how a nerve impulse travels along a neuron and across the synapse to an adjacent neuron using neurotransmitters.
5. Describe how stimulants, hallucinogens, and depressants work and the problems that occur with the abuse of these chemicals.
6. Compare and contrast how anesthetics, analgesics, and endorphins act to alleviate pain.
7. Describe how statins, vasodilators, beta-blockers, and calcium channel blockers help to protect the heart.

Suggested problems: Pages 472-475  
Odd numbered questions.

## Chapter 15 Optimizing Food Production

1. Describe the flow of energy and nutrients between trophic levels.
2. Distinguish between the macro- and micronutrients needed by plants.
3. Identify what makes for healthy soil.
4. Describe the origins of straight and mixed fertilizers.
5. Describe the benefits and risks of insecticides, herbicides, and fungicides.
6. Provide examples of poor agricultural practices.
7. Provide examples of sustainable agricultural practices.

Suggested problems: Pages 502-504  
Odd numbered questions.

## Chapter 16 Protecting Water and Air Resources

1. Describe how water circulates through the hydrologic cycle.
2. Review water consumption trends in the United States.
3. Identify sources of water pollution and explain the significance of biochemical oxygen demand.
4. Identify the four stages of wastewater treatment
5. Describe the formation and composition of Earth's atmosphere.
6. Differentiate aerosols from particulates and industrial smog from photochemical smog.
7. Describe the greenhouse effect and potential environmental impacts of increased levels of atmospheric carbon dioxide.

Suggested problems: Pages 534-537  
Odd numbered questions.

## Chapter 17 Capturing Energy

1. Provide a brief overview of how electricity is generated and distributed and how its consumption is measured.
2. Describe the chemical nature of fossil fuels and their advantages and disadvantages.
3. Describe the benefits and hazards of nuclear energy as generated by nuclear

fission.

4. Describe the ideal sustainable energy source.
5. Identify three energy sources that allow water to be used to generate electricity.
6. Review how biomass can be used to create fuel or electricity.
7. Provide examples of how direct sunlight can be used as a source of useful energy.
8. Describe the prospects of hydrogen as a carrier of energy.

Suggested problems: Pages 570-572

Odd numbered questions.

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Last update: Monday, 29-Aug-2022 11:14:25 CDT

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