Course: CHEM 101 General Chemistry I  
(GenEd/Natural Sciences – IAI P1 902 L)

Credit Hours: 4 credit hours

Method of Delivery: Two 75-minute classroom lectures and 2 hours of laboratory weekly.

Lecture Time: TTh, 3:00 pm - 4:15 pm, Currens 203

Laboratory Location: 021-029 sections (Currens 327)

Course Description: (IAI P1 902 L)
A survey for students who do not plan to take chemistry beyond the 100 level. Application of the general principles of inorganic and organic chemistry to biological, environmental, and applied sciences. Prerequisites: one year of high school algebra or MATH 099N, and either one year high school chemistry or CHEM 100. 3 hrs. lect.; 2 hrs. lab.

Instructor: Dr. Shaozhong Zhang, Office: Currens 430-B  
Phone: 298-1685;  
Email: s-zhang@wiu.edu

Office Hours: TTh, 11:00 am-12:00 pm, and MW, 11:00 am – 12:00 pm or by appointment

Required Textbooks:
Lecture: Introduction to General, Organic, and Biochemistry, 10th Ed.,  
2013 by Bettelheim, Brown, Campbell, Farrell and Torres;  
Student Copy ISBN: 978-1-133-10508-4

Laboratory: Chem 101 Laboratory Manual, Western Illinois University  

Students enrolled in this course are levied a non-refundable laboratory usage fee of $35 to cover the cost of consumable supplies utilized during the semester.

Prerequisites: One year of high school algebra or MATH 099N, and either one year high school chemistry or CHEM 100.

Goals of the Course: This course is designed to give the student a basic grounding in all of the basic areas of general chemistry. The laboratory sessions are coordinated with the lecture topics
so students can benefit from their hands-on experience reflecting what they learn from the lectures. The lecture will cover the following chapters:

**Chapter 1. Matter, Energy and Measurement**

**Learning Objectives:** After students complete this chapter, they will be able to:

1. use exponential notation to represent very large or very small numbers as powers of 10
2. use metric system
3. determine the number of significant figures
4. do unit conversions by the factor-labeled method
5. describe states of matter
6. calculate density and specific gravity
7. classify potential and kinetic energy
8. describe how heat is transferred and use heat equation

**Assignments:**
1. Reading chapter 1 (p. 1-26)
2. Chapter 1 homework
3. Chapter 1 Quiz

**Lab 1: Density and Specific Gravity** (Lab manual p. 9-23)

**Chapter 2. Atoms**

**Learning Objectives:** After students complete this chapter, they will be able to:

1. classify matter
2. describe Dalton’s atomic theory
3. describe atomic structure
4. use the Periodic Table
5. write electron configurations
6. describe the trends of the Periodic Table (Periodic properties)

**Assignments:**
1. Reading chapter 2 (p. 31-61)
2. Chapter 2 homework
3. Chapter 2 Quiz

**Lab 2: Separation of the components of a Mixture** (Lab manual p. 25-33)

**Chapter 3. Chemical Bonds**

**Learning Objectives:** After students complete this chapter, they will be able to:

1. describe the octet rule
2. name anions and cations
3. describe the two major types of chemical bonds, ionic and covalent
4. name ionic and covalent compounds
5. draw Lewis structures
6. describe resonance and draw curved arrows and push electrons
7. predict bond angles in covalent molecules
8. determine the polarity and the molecular shape of molecules

**Assignments:**
1. Reading chapter 3 (p. 68-99)
2. Chapter 3 homework
3. Chapter 3 Quiz

**Lab 3: Empirical Formulas of Compounds** (p. 35-45)

**Chapter 4 Chemical Reactions**

**Learning Objectives:** After students complete this chapter, they will be able to:
1. classify physical and chemical reactions
2. balance chemical equations
3. predict the reactivity of ions in aqueous solutions
4. describe oxidation and reduction
5. describe formula and molecular weights
6. use the mole to calculate mass relationship
7. calculate mass relationships in chemical reactions
8. identify endothermic and exothermic reactions

**Assignments:**
1. Reading chapter 4 (p.108-133)
2. Chapter 4 homework
3. Chapter 4 Quiz

**Lab 4: Chemical Reactions and Equations** (Lab manual 47-60)

**Lab 5: Chemicals in Everyday Life** (Lab manual p. 61-71)

**Chapter 5 Gases, Liquids, and Solids**

**Learning Objectives:** After students complete this chapter, they will be able to:
1. define three states of matter
2. describe gas pressure and its measurement
3. describe the kinetic molecular theory of gases
4. use the laws that govern the behavior of gases
5. use Avogadro’s Law, the Ideal Gas Law, and Dalton’s Law.
6. identify the types of attractive forces exist between molecules
7. describe the behavior of liquids at the molecular level
8. describe the properties of various types of solids
9. use a phase diagram to interpret phase changes and the energy involved

**Assignments:**
1. Reading chapter 5 (p. 140-169)
2. Chapter 5 homework
3. Chapter 5 Quiz

**Lab 6: Behavior of Gases: Molar Mass of a Vapor** (Lab manual p. 73-86)

**Chapter 6 Solutions and Colloids**
Learning Objectives: After students complete this chapter, they will be able to:
  1. classify most common types of solutions
  2. describe the properties of solutions.
  3. identify factors that affect solubility
  4. describe the most common units for concentration
  5. explain why water is a good solvent
  6. describe colloids and their properties
  7. describe colligative properties: freezing point depression, boiling point elevation, and osmolarity

Assignments:
  1. Reading chapter 6 (p.177-204)
  2. Chapter 6 homework
  3. Chapter 6 Quiz

Lab 7: Soluble and Insoluble Salts (Lab manual p. 87-98)
Lab 8: Analysis of Alum (Lab manual p. 99-109)

Chapter 7 Reaction Rates and Chemical Equilibrium

Learning Objectives: After students complete this chapter, they will be able to:
  1. measure reaction rates
  2. describe molecular collisions
  3. explain the relationship between activation energy and reaction rate
  4. describe how to change a chemical reaction rate
  5. identify whether a reaction has reached equilibrium
  6. calculate and interpret an equilibrium constant
  7. use Le Chatelier’s Principle to predict the direction of a chemical reaction

Assignments:
  1. Reading chapter 7 (p. 210-234)
  2. Chapter 7 homework
  3. Chapter 7 Quiz

Lab 9: Reaction Rates and Equilibrium (Lab manual p. 111-125)

Chapter 8 Acids and Bases

Learning Objectives: After students complete this chapter, they will be able to:
  1. define acids and bases (Arrhenius, Lowry-Brønstad theory)
  2. define the strength of acids and bases
  3. identify conjugate acid-base pairs
  4. name common acids and bases
  5. predict the position of equilibrium in an acid-base reaction
  6. use acid ionization constants
  7. describe the properties of acids and bases
  8. describe the acidic and basic properties of pure water
  9. define and calculate pH and pOH
  10. calculate concentration by using titration methods
11. describe buffers and calculate the pH of a buffer using the Henderson-Hasselbalch equation

Assignments:
1. Reading chapter 8 (p.139-270)
2. Chapter 8 homework
3. Chapter 8 Quiz

Lab 10: Acid-Base Titration (Lab manual p. 127-139)

Chapter 9 Nuclear Chemistry

Learning Objectives: After students complete this chapter, they will be able to:
1. describe radioactivity
2. describe nuclear radioactive decay (alpha-, beta-, gamma - decay)
3. balance a nuclear equation
4. calculate nuclear half-life
5. explain how radiation dosimetry is related to human health
6. define nuclear fission and nuclear fusion

Assignments:
1. Reading chapter 9 (p.275-300)
2. Chapter 9 homework
3. Chapter 9 Quiz

Attendance Policy: Attendance will be taken each class period. Students need to sign in on the lecture signup sheet during the lecture. If students have three or fewer excused or non-excused absences, they will earn 30 bonus points which will be added to their gradebook at the end of semester. After three absences, 5 points will be deducted from the 30 bonus points for each absence. If a student misses 9 lectures, the student will lose all 30 bonus points.

Students are prohibited to sign in for other students. If the student signs for another student, both students will lose their 30 bonus points at once.

If a student signs on the attendance sheet and then leaves for no reason, the student will lose 5 bonus points for that day’s attendance. If a student needs to leave the lecture earlier for a special reason, please let me know in advance so you won’t lose the 5 points.

Definition of Excused Absences: Excused absences include documented illnesses, documented family medical emergencies, military commitments, WIU required athletic trips, and other absences excused by the course instructor.

Classroom Seating Policy: Currens Hall 203 is a big classroom. The classroom TA will sit in row 8 and all students are requested to seat in the central area between rows 1-7.

50 minutes Examination Dates:
Exam 1: September 29, Tuesday - Chapters 1 - 3
Exam 2: October 19, Tuesday - Chapters 4 -5
Exam 3: November 09, Tuesday - Chapters 6 - 7
Exam 4: December 07, Tuesday - Chapters 8 - 9

Final Examination: A final examination will be given on Tuesday, December 17, 2015, 3:00 pm - 4:50 pm.

Exam Policy
* You only need a pencil and a simple scientific calculator for your exam. All electronic devices such as cell phone, iPod, iPad, Labtop, smart watch et al, are not allowed during the exam.
* If a student takes the exam paper out of the classroom during or after the exam, he or she will get a zero for that exam.
* All hats, caps, and hoods that cover your ears are not allowed to be worn during exams.
  The instructor reserves the right to assign seating for the students during exams and/or any other time deemed necessary.

Exam grades are based on the total number of correct answers, and all grades are final. No curve will be applied to exam grades, and no “retakes” will be allowed. No “extra point” assignments will be made or applied to grades. Students can view their individual quiz and exam scores on WesternOnline (WIU ECom is required for login).

Makeup exams will only be given if the absence is due to an official university trip with advance notice, an important personal event cleared with me in advance, or a personal or family emergency with documentation. Oversleeping or forgetting the date of an exam will not be accepted as an excuse. If you know about a conflict in advance, I may allow you to take a "makeup" exam earlier than the scheduled time. EXCUSES MUST BE SUPPORTED WITH DOCUMENTATION, and it is your responsibility to obtain this documentation. If you do not provide documentation, there will be no makeup.

MAKE-UP EXAMS WILL BE SHORT ANSWER FORMAT. Make-up exams must be taken within one week of the scheduled time, except in exceptional circumstances such as an extended illness.

No incomplete will be given to a student with a failing grade in the course. No incomplete will be given in this course unless the student experiences a documented emergency that takes him/her away from the university for at least two consecutive weeks and/or causes him/her to miss the final exam. The student must notify the instructor of this emergency before the final exam.

Homework: Since critical thinking and problem solving are important components of chemistry, homework and answers keys will be posted on WesternOnline in order to help students grasp principles and concepts discussed in class. Regular practice will help your overall exam scores.
Chapter Quizzes: Quizzes will be posted in WesternOnline under “Assessment”. You have two attempts for each chapter quiz. The highest grade will be counted. There are 9 chapter quizzes and your best 8 quizzes will be counted as your grade.

Outside work requirements for the course: Students are expected to study, review and learn all material discussed in lecture, as well as read assigned chapters in the textbook, and to work assigned practice problems/questions/terms on Western Online. Generally a minimum of 2 to 3 hours of outside study time is required for each hour of class time for this course.

There is no quiz makeup if students miss the deadlines for submitting their quizzes online.

Classroom Policies:
Other than a simple scientific calculator or laptop (for taking notes except during exams), electronic devices such as graphing calculators, cell phones, IPODs and MP3 players are not allowed to be used in the classroom at any time!

Keep in mind that you are still responsible for material covered while you are absent, so be sure to copy notes from that day. If you need help to study, please come to me during office hours. As your instructor, I feel honored to have a chance to work with you. I’m here to help you to learn well so do not hesitate to contact me. Even if it is not in my office hours, you’re always welcome to email me to make an appointment for us to meet. I sincerely hope you all will enjoy the course and most importantly, you learn fundamental knowledge in general chemistry from this course, and build a solid foundation for your future courses and careers.

Requirements for passing this course:
Lecture part: You must earn at least 45% (270 points) of the maximum points attainable (600) in the lecture part or you automatically fail the course.

Laboratory part: You must earn at least 60% (120 points) of the maximum points attainable (200) in the lab part or you automatically fail the course.

Grading System
4 Lecture exams (100 points each) = 400 points
1 Final exam = 120 points
8 Best Quizzes (10 points for each) = 80 points
Lab = 200 points
Total: 800 points

Grading System: Letter grades for the course will be assigned based on the following point system out of a maximum of 800 points:

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<thead>
<tr>
<th>Grade</th>
<th>Points</th>
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<tbody>
<tr>
<td>A</td>
<td>≥ 704 (88%)</td>
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<tr>
<td>A-</td>
<td>≤ 703 (84%-87.9%)</td>
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<td>B+</td>
<td>≤ 671 (80%-83.9%)</td>
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<td>D+</td>
<td>≤ 479 (57%-59.9%)</td>
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<td>≤ 456 (54%-56.9%)</td>
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<tr>
<td>D-</td>
<td>≤ 431 (50%-53.9%)</td>
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≤ 608 < 639 (76%-79.9%) = B
≤ 576 < 607 (72%-75.9%) = B-
≤ 544 < 575 (68%-71.9%) = C+
≤ 512 < 543 (64%-67.9%) = C
≤ 480 < 511  (60%-63.9%) = C-

Chemistry Resource Center: Currens 107. Free tutoring and/or help is provided by the department through the Chemistry Resource Center.

WIU Policies for Students with disabilities: In accordance with University values and disability law, students with disabilities may request academic accommodations where there are aspects of a course that result in barriers to inclusion or accurate assessment of achievement. To file an official request for disability-related accommodations, please contact the Disability Resource Center at 309-298-2512, disability@wiu.edu or in 143 Memorial Hall. Please notify the instructor as soon as possible to ensure that this course is accessible to you in a timely manner.

Emergency Preparedness: The WIU Office of Risk Management and Emergency Preparedness provides resources on how to respond to emergency situations. Please view the video resources at www.wiu.edu/rmep/ (Click “Resources” on the right side of the page). If the fire alarms sound and/or students are asked to evacuate the building all students should proceed immediately to the nearest exit and gather at the southwest corner of the Higgins parking lot near the fence until the “all clear” is given.

The following action is prohibited under the Student Conduct Code: Disorderly Conduct: Any behavior which disrupts the regular or normal functions of the University community, including behavior which breaches the peace or violates the rights of others. Any student convicted of academic dishonesty, can receive a failing grade and may be subject to further academic penalties.

Web address for Academic Integrity Policy: (http://www.wiu.edu/policies/acintegrity.php)

Web address for Student Rights and Responsibilities: (http://www.wiu.edu/policies/acintegrity.php)
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Chapter</th>
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<tbody>
<tr>
<td>1</td>
<td>08-25</td>
<td>Syllabus</td>
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<td>L1: Matter, Energy, and Measurements</td>
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<td>08-27</td>
<td>L2: Atoms</td>
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<td>2</td>
<td>09-01</td>
<td>L3: Atoms</td>
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<td>09-03</td>
<td>L4: Atoms</td>
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<td>*09-06, Sunday at 8:00 pm, Chapter 1 Quiz Due</td>
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<td>3</td>
<td>09-08</td>
<td>L5: Atoms</td>
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<td>09-10</td>
<td>L6: Atoms</td>
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<td>Chemical Bonds</td>
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<td>*09-13, Sunday at 8:00 pm, Chapter 2 Quiz Due</td>
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<td>4</td>
<td>09-15</td>
<td>L7: Chemical Bonds</td>
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<td>09-17</td>
<td>L8: Chemical Bonds</td>
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<td>09-22</td>
<td>L9: Chemical Bonds</td>
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<td>09-24</td>
<td>L10: Chemical Bonds</td>
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<td>*09-27, Sunday at 8:00 pm, Chapter 3 Quiz Due</td>
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<td>6</td>
<td>09-29</td>
<td>Exam 1 (L1 – L10)</td>
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<td>10-01</td>
<td>L11: Chemical Reactions</td>
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<td>7</td>
<td>10-06</td>
<td>L12: Chemical Reactions</td>
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<td>10-08</td>
<td>L13: Chemical Reactions</td>
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<td>Gases, Liquids, and solids</td>
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<td>* 10-11, Sunday at 8:00 pm, Chapter 4 Quiz Due</td>
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<td>8</td>
<td>10-13</td>
<td>L14: Gases, Liquids, and solids</td>
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<td>10-15</td>
<td>L15: Gases, Liquids, and solids</td>
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<td>Solutions and Colloids</td>
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<td>* 10-18, Sunday at 8:00 pm, Chapter 5 Quiz Due</td>
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<td>9</td>
<td>10-20</td>
<td>Exam 2 (L11 – L15)</td>
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<td>10-22</td>
<td>L16: Solutions and Colloids</td>
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<td>10-27</td>
<td>L17: Solutions and Colloids</td>
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<td>10-29</td>
<td>L18: Solutions and Colloids</td>
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<td>* 11-01, Sunday at 8:00 pm, Chapter 6 Quiz Due</td>
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<td>11</td>
<td>11-03</td>
<td>L19: Reaction Rates and Chemical Equilibrium</td>
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<td>11-05</td>
<td>L20: Reaction Rates and Chemical Equilibrium</td>
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* 11-08, Sunday at 8:00 pm, Chapter 7 Quiz Due

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<tr>
<th>Date</th>
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<tbody>
<tr>
<td>11-10</td>
<td>Exam 3 (L16 – 20)</td>
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<tr>
<td>11-12</td>
<td>L21: Acids and Bases</td>
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<td>11-17</td>
<td>L22: Acids and Bases</td>
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<td>11-19</td>
<td>L23: Acids and Bases</td>
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<td>11-24</td>
<td>Thanksgiving Holiday (No class)</td>
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<td>11-26</td>
<td>Thanksgiving Holiday (No class)</td>
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<td>11-29</td>
<td>Sunday at 8:00 pm, Chapter 8 Quiz Due</td>
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<td>12-01</td>
<td>L24: Nuclear Chemistry</td>
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<td>12-03</td>
<td>L25: Nuclear Chemistry</td>
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<td>12-08</td>
<td>Exam 4 (L21 – L25)</td>
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<td>12-10</td>
<td>Final Exam Review</td>
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<tr>
<td>12-17</td>
<td>Final Exam (comprehensive exam, L1 – L25)</td>
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THIS COURSE SCHEDULE IS SUBJECT TO CHANGE UPON NOTIFICATION BY INSTRUCTOR.