# University Chemistry II CHEM1123 (Lecture)

Spring 2021

**Class Time and Location: MW** 12:30 - 1:50, **Room**: S235
**Instructor**: Gaumani Gyanwali – Ph. D.: OSU-Stillwater; MS, BS: Tribhuvan University
**Office Location: S244**
**Office Hours:** Posted on the office door
**Contact Information: Office**: (479)-394-7622, Ext. 1339
**Cell**: (479)-234-8727 **Email**: gyanwali@uarichmountain.edu

**Prerequisite**: Successful completion of 1and a half units of high school algebra, OR a co-requisite MTH203 or Permission of Instructor

**Resources**:

Textbook: Chemistry Zumdahl.and Zumdahl: Brooks Cole Cengage, 2010. *ISBN 978-0-547-12532-9*

Required Materials:

1. Calculator capable of roots, exponents, and logarithms.
2. Miscellaneous pens, paper, and pencils.

**Face Mask Policy:** As per the Executive Order from the governor of Arkansas, all students are required to wear a proper face covering that completely covers the nose and mouth while on campus and in class. Masks with holes or masks that do not completely cover nose and mouth are not acceptable. Any student that does not have a proper mask will leave class and be referred to the Vice-Chancellor for Student Affairs for possible disciplinary action.

**Food and Drink:** Food and drinks, including water are not allowed in the classroom at any time.

**Course Description**: This course is a 3 credit hours course and is designed to provide the basic chemistry background necessary for science majors such as Physics, Chemistry, Biology, Biochemistry, Pharmacy, Forestry, Medicines, Engineering, etc. The theories of chemistry based on fundamental principles include colligative properties, chemical kinetics, chemical equilibrium, acid-base theory and equilibrium, solubility and complex ion equilibria, thermodynamics, and redox reactions and electrochemistry. Must take the laboratory course CHEM1121 concurrently with this course to have full 4 credit hours.

**Program Outcomes:** Students will increase their

-writing, reading, speaking, and listening skills,
-competency in mathematics, utilizing their analytical and occupational skills to solve real life problems,
-understanding of different cultures and societies across the globe and how both have changed over time,
-understanding of basic principles and their application in the field of physical sciences and biological sciences, and
-technological and research skills.

**Rationale:** Through the study of chemistry, problem solving experiences, and laboratory activity, the student develops an understanding of matter and the laws that explain the interactions between matters, including the energy changes involved. The gained knowledge is applicable in upper level chemistry courses.

**Course Objectives:** Upon completion of University Chemistry II, the students should be able to:

1. Understand the solubility and solution composition using various controlling factors affecting them. (Components: analyze, compare, correlate, illustrate)
2. Know the different colligative properties and their dependence on the solute present. (Components: analyze, differentiate, comprehend, apply)
3. Understand the concept of kinetics of a reaction by applying rate laws. Perform related calculations based on the information from the rate laws. (Components: calculate, correlate, compare, solve problems)
4. Understand equilibrium constant and the equilibrium expression and apply them to solve problems quantitatively and qualitatively. (Components: calculate, correlate, distinguish, solve problems)
5. Compare pH of strong and weak acids and bases and compare acidic and basic properties of salts and oxides. (Components: compare, solve problems, identify and apply)
6. Understand and perform titrations between acids and base involving pH measurements applying common ion effect.
7. Establish relation between solubility and solubility product constant. (Components: analyze, compare, correlate, illustrate)
8. Understand and develop a relationship among three fundamental quantities of thermodynamics. (Components: analyze, compare, correlate, illustrate)
9. Understand the concept of electrochemical reactions as redox reactions. Develop a working formula of a fuel cell through half reactions. (Components: differentiate, comprehend, classify, logical arguments)
10. Perform experiments designed to reinforce the concepts, derive conclusions, and prepare a lab report. In lieu of some laboratory works, research work may be implemented based on the availability of research projects and funding. (Components: collaboration, data collection, calculation and formulation, proper grammar and format, documentation, logical argument, research, interpret, hands-on skills)

**Topical/Unit Outline:**

I. <u>Properties of Solutions:</u>
   a. Solution composition
   b. Energies of solution formation
   c. Factors affecting solubility
   d. Vapor pressure of solutions
   e. Boiling point elevation and freezing point depression
   f. Osmotic pressure
   g. Colligative properties of electrolyte solutions
   h. Colloids

II. <u>Chemical Kinetics</u>
   a. Reaction rates
   b. Rate laws
   c. Integrated rate laws

d. Reaction mechanisms
e. Activation energy and transition state
f. Catalysis

III. Chemical Equilibrium
a. Equilibrium condition
b. Equilibrium constant
c. Equilibrium expression involving pressure
d. Heterogeneous equilibrium
e. Application of equilibrium constant
f. Solving equilibrium problems
g. Le Chatelier's Principle

IV. Acid-Base Theory
a. Nature of acids and bases
b. Strong and weak acids
c. The pH scale
d. Calculation of pH of strong and weak acids
e. Calculation of pH of strong and weak bases
f. Polyprotic acids
g. Acidic and basic properties of salts
h. Acidic and basic oxides
i. Lewis acid-base model

V. Acid-Base Equilibrium
a. Common ion effect
b. Buffer solutions
c. Buffering capacity
d. Titrations and pH curves
e. Acid base indicators

VI. Solubility and complex ion equilibria
a. Solubility product and solubility product constant
b. Calculation of solubility from $K_{sp}$

VII. Thermodynamics
a. Spontaneous process and entropy
b. Entropy and 2nd Law of Thermodynamics
c. Effect of temperature
d. Free energy
e. Entropy change in a chemical reaction
f. Free energy and chemical reaction
g. Free energy and pressure
h. Free energy and equilibrium
i. Free energy and work

VIII. Oxidation Reduction and Electrochemistry
a. Balancing oxidation reduction equations
b. Galvanic cells
c. Standard reduction potential
d. Cell potential, electrical work, and free energy
e. Batteries
f. Fuel cells
g. Electrolysis and electroplating

**Tentative Schedule for Lecture: University Chemistry II**

| Week | Topics/Activities by Book Chapter | Date/Day |
|---|---|---|
| 1 | Syllabus/Properties of solution | 1/11 M, 1/13 W |
| 2 | Properties of solution<br>Chemical Kinetics | 1/18 M<br>1/20 W |
| 3 | Chemical Kinetics | 1/25 M, 1/27 W |
| 4 | Review<br>**Test 1** | 2/1 M<br>**2/3 W** |
| 5 | Chemical Equilibrium | 2/8 M, 2/10 W |
| 6 | Chemical Equilibrium<br>Acid Base Theory | 2/15 M<br>2/17 W |
| 7 | Acid-Base Theory<br>Review | 2/22 M<br>2/24 W |
| 8 | **Test**<br>**2**<br>Acid Base Equilibrium | **3/1 M**<br>3/3 W |
| 9 | Acid Base Equilibrium<br>Solubility and Complex Ion Equilibria | 3/8 M<br>3/10 W |
| 10 | Solubility and Complex Ion Equilibria | 3/15 M, 3/17 W |
| 11 | *Spring*<br>*Break!* | *3/22 - 3/26* |
| 12 | Review<br>**Test 3** | 3/29 M<br>**3/31 W** |
| 13 | Thermodynamics | 4/5 M, 4/7 W |
| 14 | Thermodynamics /Electrochemistry | 4/12 M, 4/14 W |
| 15 | Electrochemistry<br>Review | 4/19 M,<br>4/21 W |
| 16 | **Test 4**<br>Review for final exam | **4/26 M**<br>4/28 W |
| 17 | **Final Exam** | **5/5 W** |

**Course Conduct:** The class will be taught using a combination of lecture using *Powerpoint* presentation, solving in-class questions, demonstrations, group interaction and discussions. Students are strongly encouraged to discuss concepts and examples as opportunities are presented during instructor presentation. It is the student's responsibility to inform the instructor when a concept is confusing or otherwise unclear. Students must answer all the in-class questions before leaving the classroom and discuss with the instructor about any confusing concept right away.

You are encouraged to solve problems forming a study group and actively taking part in discussion. You may seek assistance from Student Support Services (SSS) check the concepts in homework assignments, quizzes, and exam reviews but the instructor is the primary source of right information. You must inform me no later than 1 week after the classes started if you feel that the difficulty level is too high. You cannot pass the course without completing the homeworks. Expect a minimum of 12 hours of work on this class

**UA Rich Mountain Credit Hour Calculator:** For every course credit hour, you should expect to spend at least three clock hours per week of concentrated attention on course-related work, including but not limited to time attending class, as well as out-of-class time spent

completing homework, seeking help from instructor or tutors, preparing for upcoming quizzes/tests/exam, reviewing material, problem solving, and organizing your notebook. For a four hour course, a typical student should expect to spend at least twelve hours per week dedicated to this course. This includes the time spent in class. Please see credit hour calculator attached to end of syllabus.

**Course Requirements/Evaluation (Grading):**

Your grade for this course comes from 4 tests (100 points each) after completion of two or three chapters, one comprehensive final exam given in the finals week (100 points), ten assignments (10 points each), ten quizzes (10 points each).

| | |
|---|---|
| Four tests @100 each | = 300 (lowest one dropped when taken all four) |
| One Final Exam @ 100 | = 100 |
| 10 Quizzes @ 10 each | = 100 |
| 10 Assignments @ 10 each | = 100 |
| **Total points possible** | **= 600** |

The final grade for the course will be determined by dividing the student's total number of points earned by the number of possible points. Grades are assigned on the basis of the following percentage scale, after rounding the calculated percentage to the nearest whole number:

| | |
|---|---|
| 90-100 | **A** |
| 80- 89 | **B** |
| 70- 79 | **C** |
| 60- 69 | **D** |
| 0- 59 | **F** |

**Class Procedures/Student Requirements**:

On-Campus Resources:

1. Your student portal will be populated with the lecture slides for each upcoming chapter. If you wish, you can print the lecture slides of the chapter.
2. You will have in-class practice worksheets to see how the instructor performs the calculations and chemical formulas. Retain those worksheets for future information and knowledge.
3. Student Support Services will have some basic information available about time management, difficulty of the course etc.

tutor.com provides 5 hours of free tutoring online for each UA Rich Mountain student per semester. Johnson Learning Commons has contract with this online site where personal tutors are available 24/7. Create an account and get help personally from home or anywhere if internet access is available. Follow the link to log in www.tutor.com/uarichmountain

Attendance Policy: Absence in this course most often results into failing grades unless covered by immediate action and make-up work. Absence is strictly prohibited unless any unavoidable circumstances. If notified of the absence, the instructor can send you the work and you can catch up with completed work. It is your full responsibility to complete the missed work and cover the missed chapter.

Assignment Due Dates: Students are expected to submit the assignments and other works on or before the assigned due dates. You will be penalized for the late works depending on the number of days and full point and importance of the works assigned.

Make-up Work Policy**:** Make up work should be competed promptly after the absence. A maximum of one week will be the guideline. Make-up exams are given only in instances of the most unavoidable, serious circumstances. Prior notice of absence from an exam is required. Upon return after an absence the student is expected to be prepared for the days' class activities.

Cell Phone Policy**:** Do not use the cellphone unless allowed by the instructor.

Extra Credit Opportunity: Optimum student involvement in the course as well as course-related activities is highly recommended and rewarded with extra credit. The value of extra credit points varies with the nature of the activity and the application of that activity in the real life as well as relation of the activity with the course. Points that can be received are unlimited. Simple idea is: the more you are involved in real-life science experiences, the more you understand and enjoy it, and you get good grades!!! Some examples of activities (but not limited to) that earn extra credit points include:

a) Complete and submit the end of chapter Exercises for each chapter.
b) Being an active member of the Science Club coordinated by the instructor
c) Organize activities within the Science Club or participate actively in the activities organized by the Club
d) Taking leadership in group study sessions and manage study sessions with peers
e) Organize or be involved in science and technology awareness activities and helping society to improve utilizing science knowledge
f) Actively participating in science-related meetings and conferences on/off campus
g) Any other science related activities and duties beyond the demand of the course deemed worthy of extra credit by the instructor

**Academic Dishonesty**: It is expected that each student shall do his/her own work on class works, quizzes, and exams. Cheating, copying other's answers, writing other's statement without citing their reference are all considered plagiarism and are penalized from allowing no point in that particular unit up to dismissal from the whole course, depending on the severity of the offense.

**Disability Policy:** It is the policy of UA Rich Mountain to accommodate students with disabilities, pursuant to state and federal law. Any student with a disability who needs accommodations should contact the Associate Vice-Chancellor for Student Affairs Office, 394-7622, ext. 1460.

**Arkansas Clean Air Act**: In compliance with the Arkansas Clean Air Act, UA Rich Mountain is a smoke and tobacco free facility. Students and guests are to refrain from the use of all tobacco products while on campus.

**Student Misconduct**: Students committing misconduct are subject to disciplinary sanction(s) and/or restrictions. Misconduct or prohibited behavior includes, but is not limited to endangerment, harassment, disruption, sexual misconduct, illegal drugs and/or alcohol, fire

or safety issues, gambling, property violations, computer violations or other violations as listed in the UA Rich Mountain catalog.

**UA Rich Mountain Mission:** UA Rich Mountain provides transformative education to all learners.* **under review*

| Credit Hour Requirement Calculator | | | | |
|---|---|---|---|---|
| | | | | |
| **Course Information** | | | | |
| Department, Course Number | CHEM1123(Lecture) and CHEM1121(Lab) | | | |
| Course Title | University Chemistry II | | | |
| Credit Hours | 3 + 1 = 4 | | | |
| Mode of Delivery | Traditional | | | |
| Weeks in Part of Term | 15 | | | |
| Level of Reading Material | Advanced/Scientific/Technical (2) | | | 2 |
| Reading Level of Students | Average Student (2) | | | 2 |
| Average Pages per Hour | 10 | | | |
| | | | | |
| | | *Enter either week or term, not both* | | |
| **Contact Hours** | | **Hours/Week** | **Hours/Term** | **Total Hours** |
| Lecture/Recitation | | | 45 | 45 |
| Lab Contact Hours | | | 24 | 24 |
| | **Pages Asg'd** | **Hours/Week** | **Hours/Term** | |
| **Syllabus Items** | | | | |
| Reading | 380 | | | 38 |
| Assignment | | 1 | | 15 |
| Quiz | | 1 | | 15 |
| Researching Lab questions | | 2 | | 30 |
| Reviewing for exams | | | 10 | 10 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | 0 |
| | | | | |
| **Total Hours** | | | | 177 |
| **Required Hours** | | | | 150 |
| **Difference** | | | | Ok + 27 |