CHM 214

GENERAL CHEMISTRY II

Spring 2020

Class Time and Location: Lecture: TR 12:30 -1:45 **Lab:** R 2:00-4:00, Room: S235
Instructor: Gaumani Gyanwali – Ph. D.: OSU-Stillwater; MS, BS: Tribhuvan University
Office Location: S 244
Office Hours: Posted on office door
Contact Information: Office: (479)-394-7622, Ext. 1339
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Prerequisite: Successful completion of Gen Chem I - CHM114

Resources:

Textbook: Chemistry, Eighth Edition, by Steven S. Zumdahl. Lexington: D. C. Heath and Company, 2010. *ISBN 978-0-547-12532-9*
(*Older editions of the text will likely serve you well as they do not change much from one edition to the next)*

Required Materials:

1. Lab Safety Goggles
2. Laboratory Manual: General Chemistry II Lab CHM 214 customized for UA Rich Mountain
3. Calculator capable of roots, exponents, and logarithms.
4. Miscellaneous pens, paper, and pencils.

Course Description: General Chemistry is designed as a two-semester course. CHM 214 is the second semester of that course. It reinforces the concepts learned in CHM114 in topics including chemical kinetics, electrochemistry, chemical and acid base equilibria. Concept building will be stressed and problem solving skills will be applied to a great extent in this area. These main topics will be reinforced with laboratory work.

Program Outcomes: The knowledge and critical thinking skills acquired in the general education component enable students to analyze problems, to arrive at intelligent conclusions, and to make reasoned choices in their professional and personal lives.

- Use analytical and reasoning skills to solve practical problems based on structure-property relationship.
- Develop critical thinking and research skills based on basic laws of nature and chemistry.

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.

Course Objectives: Upon completion of General Chemistry II, the student 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. <u>Chemical Equilibrium</u>
   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: General Chemistry II

Week	Topics/Activities by Book Chapter	Date/Day
1	Syllabus/Properties of solution	1/14 T, 1/16 R
2	Properties of solution Chemical Kinetics	1/21 T 1/23 R
3	Chemical Kinetics	1/28 T, 1/30 R
4	Review **Test 1**	2/4 T **2/6 R**
5	Chemical Equilibrium	2/11 T, 2/13 R
6	Chemical Equilibrium Acid Base Theory	2/18 T 2/20 R
7	Acid-Base Theory Review	2/25 T 2/27 R
8	**Test 2** Acid Base Equilibrium	**3/3 T** 3/5 R
9	Acid Base Equilibrium Solubility and Complex Ion Equilibria	3/10 T 3/12 R
10	Solubility and Complex Ion Equilibria	3/17 T, 3/19 R
11	*Spring Break!*	*3/23 - 3/27*
12	Review **Test 3**	3/31 T **4/2 R**
13	Thermodynamics	4/7 T, 4/9 R
14	Thermodynamics /Electrochemistry	4/14 T, 4/16 R
15	Electrochemistry Review	4/21 T, 4/23 R
16	**Test 4** Review for final exam	**4/28 T** 4/30 R
17	**Final Exam**	**5/7 R**

Tentative Schedule for Lab:

Date	Experiments	Page #/Miscellaneous info
01/16	Syllabus/Safety	Sign the safety agreement
01/23	1. Freezing Point Depression	Page 1
01/30	2. Rate of reaction	Page 29
02/06	3. Iodination of acetone	Page 67
02/13	4. Le Chatelier's Principle	Page 75
02/20	5. Equilibrium constant of a complex	Page 87
02/27	6. Chemistry of the kitchen	Page 113
03/05	Make-up	
03/12	Research Discussion	
03/19	*7.* pH titration curves	Page 125
03/26	*Spring Break (No lab)*	
04/02	8. Properties of buffer	Page 141
04/09	9. Molar solubility product	Page 151
04/16	10. Thermodynamics of borax solution	Page 163
04/23	11. Introduction to voltaic cells	Page 175
04/30	Make-up	

Course Conduct: The class will be taught using a combination of lecture using *Powerpoint* presentation, solving in-class questions, demonstrations, group interaction and discussions, and performing laboratory experiments. 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 right away when a concept is confusing or otherwise unclear. Students must answer all the in-class questions before leaving the classroom.

You are encouraged to solve problems forming a study group and actively take part in group discussion. You may seek assistance from Student Support Services (SSS) but because of the nature of this course, you should have a good strategic plan and visit the instructor often. In case of extreme difficulty, you must inform within the first week after the classes started. Expect a minimum of 12 hours of work on this class

UA Rich Mountain Credit Hour Calculator: For every credit hour, you should expect to spend at least three clock hours per week of concentrated attention on course-related work. This includes 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, and problem solving. 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) and eleven laboratory reports (20 points each).

Four tests @100 each = 300 (lowest one dropped when taken all four)
One Final Exam @ 100 = 100
11 Lab reports @ 20 each = 200 (lowest one dropped after submitting all eleven)
10 Quizzes @ 10 each = 100
10 Assignments @ 10 each = 100
Total points possible = 800

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**
< 60 **F**

Class Procedures/Student Requirements:

On-Campus Resources: Your student portal will be populated with the lecture slides for each upcoming chapter. If you wish to bring the printed lecture slides to class and write notes on them, you will need to print the lecture slides of the chapter. I will not bring the printed copies to class just because it is too much waste of paper. Computer labs with printers are available in several places on campus including the Johnson Learning Commons. UA Rich Mountain offers students assistance with quality tutors available in the Student Support Services and Learning Enrichment and Advising Center in the Johnson Learning Commons.

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: Regular attendance and punctuality are expected. It is the responsibility of the student to initiate arrangements for all missed activities. If an absence is a planned absence the student is expected to make arrangements for making up work prior to the absence. More than three absences will be considered excessive and, along with work not made up, may adversely affect the grade for the course. Under no circumstances will the student receive credit for the course if more than a fourth of the classes are missed (13 classes). In case of extended illness, or other circumstances, the student must contact the instructor if a WP is desired. If the instructor is not notified a failing grade will be assigned for the course. Laboratory work is scheduled for a specific time and day. However, two make-up times are available in the whole semester and labs can be made up in those times only. Each student is expected to participate in the required laboratory time in order to receive credit for the laboratory activity. There will be no designation of excused or unexcused absences in the lab. Make-up labs are allowed for excused absences only and a week's prior notice is required. Also, if the student is present in lab but fails to submit the lab report, it is counted as absent and no point will be awarded for that lab.

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. Lab reports will be due the next week of the lab period.

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. It will be the student's responsibility to obtain the assignment for that day. Missed labs can be made up in designated dates.

Cell Phone Policy**:** Turn off your cell phone prior to class. If you work for an emergency service such as a fire department, put it on vibrate. It is a sign of disrespect as well as a disruption if non-emergency calls are taken during class. If you chose to take a call anyway, leave the room and take your supplies with you. You are expected not to return that session.

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) Being an active member of the Science Club coordinated by the instructor
b) Organize activities within the Science Club or participate actively in the activities organized by the Club
c) Taking leadership in group study sessions and manage study sessions with peers
d) Organize or be involved in science and technology awareness activities and helping society to improve utilizing science knowledge
e) Actively participating in science-related meetings and conferences on/off campus
f) 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, exams, and lab reports. 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 Vice-Chancellor for Student Affairs Office, 394-7622, ext. 1400.

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: University of Arkansas Rich Mountain exists to provide all residents of the Ouachita Mountain Region with exemplary educational and enrichment opportunities to improve the quality of life and standard of living.

Credit Hour Requirement Calculator

Course Information				
Department, Course Number	CHM 214			
Course Title	General Chemistry II			
Credit Hours	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			46	46
Lab Contact Hours			22	22
	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				176
Required Hours				150
Difference				Ok + 26