Introduction: Chemistry 112 is the second semester of a two-semester course that is intended to provide you with a strong foundation for upper-level courses in the Chemistry Department. As a part of this learning community you will better understand the connections between the study of chemistry and other scientific areas. The course requires that the students and the professor invest time and energy but this investment should be rewarding for whatever career you select.

Overall Learning Objectives:

- Intermolecular Forces and how they affect solutions
- Liquids and their characteristics
- Phase Changes and phase diagrams
- Solutions
  - Various Methods for defining solution concentrations
  - Factors that affect solubility
  - Colligative properties and calculation using these properties
  - Colloids.
- Entropy and Free Energy
- Entropy
  - Definition
  - Predicting the sign of entropy
  - Second Law of Thermodynamics
  - Third Law of Thermodynamics
- Gibbs Free Energy
  - Definition
  - Predicting Spontaneity
  - Relationship between equilibrium constant and Gibbs Free Energy
- Chemical Equilibrium
  - Reaction Quotient vs. Equilibrium Constant
  - Homogeneous vs. Heterogeneous Equilibrium
  - Calculating Equilibrium Expressions
Co-requisite: Chemistry 112 Lab, which is a separate one-hour course is a co-requisite and Math 111 course work or proven competency is a co-requisite.

**Texts:**

2) ALEKS is a module which must be purchased separately from the textbook, either at the bookstore or on line (see instructions on the web at Aleks.com). For more information on ALEKS see below.

The Class Code for Aleks is AU49L-MHYNJ

Calculator: You will need a non-programmable calculator for exams.

Course Expectations:

A. Attendance

Zoom class attendance is to your benefit and mandatory. Missing more than 6 classes (with or without excuse) is grounds for a student being dropped from the class. Performance in the course is directly proportional to attendance. Students are responsible for all information presented in class whether they are present or not. Students should obtain notes from a classmate, read the associated material in the text and on OAKS or Zoom, and then ask questions during class or office hours.

Class sessions will be recorded (if technologically possible) via both voice and video recording. By attending and remaining in this class, the student consents to being recorded. Recorded class sessions are for instructional use only and may not be shared with anyone who is not enrolled in the class.

B. Responsibilities
You are accountable for all material covered or assigned in class. You are expected to spend whatever time it takes to learn the material and to do both ALEKS and the homework. I am here to explain the material and help you to the best of my time and ability but we all must invest the effort to make this a success. I expect all students to participate in class.

C. Academic Integrity

Lying, cheating, attempted cheating, and plagiarism are violations of our Honor Code that, when suspected, are investigated. Each incident will be examined to determine the degree of deception involved.
Incidents where the instructor determines the student’s actions are related more to misunderstanding and confusion will be handled by the instructor. The instructor designs an intervention or assigns a grade reduction to help prevent the student from repeating the error. The response is recorded on a form and signed both by the instructor and the student. It is forwarded to the Office of the Dean of Students and placed in the student’s file.

Cases of suspected academic dishonesty will be reported directly by the instructor and/or others having knowledge of the incident to the Dean of Students. A student found responsible by the Honor Board for academic dishonesty will receive a XXF in the course, indicating failure of the course due to academic dishonesty. This status indicator will appear on the student’s transcript for two years after which the student may petition for the XX to be expunged. The F is permanent.

Students can find the complete Honor Code and all related processes in the Student Handbook at: [http://deanofstudents.cofc.edu/honor-system/studenthandbook/](http://deanofstudents.cofc.edu/honor-system/studenthandbook/).

D. Accommodations for Students with Disabilities

The College will make reasonable accommodations for persons with documented disabilities. Students should apply for services at the Center for Disability Services/SNAP located on the first floor of the Lightsey Center, Suite 104. Students approved for accommodations are responsible for notifying me as soon as possible and for contacting me one week before accommodation is needed.

E. Course Materials:

All lecture materials, homework and tests will be available to students on OAKS. Although all lectures will be recorded (if allowed by Zoom), you will still need to take careful lecture notes. The best use of our time is when you are following the lecture and we are working problems together. OAKS, including Gradebook, will be used for this course throughout the semester to provide the syllabus and class materials and grades for each assignment, which will be regularly posted.

F. Inclement Weather, Pandemic or Substantial Interruption of Instruction
If our classes are suspended, I will announce to students a detailed plan for a change in modality to ensure the continuity of learning. All students must have access to a computer equipped with a web camera, microphone, and Internet access. Resources are available to provide students with these essential tools.

G. Email

Email is considered an official method for communication at the College of Charleston. College of Charleston email accounts are automatically assigned to all students upon acceptance at the College. If a student wishes to have email redirected from their official College issued account to another email address (e.g. @aol.com, @hotmail.com, @yahoo.com, or any other server other than the official @g.cofc.edu), they may do so, but at their own risk.

Students are expected to check their College of Charleston official email on a frequent and consistent basis in order to remain informed of College related communications. Checking email on a daily basis is recommended.

H. Homework

A major key to success (both mine and yours) in this class is doing chemistry problems again and again. Homework is worth 10% of your final grade and the 8 assignments will be posted on OAKS on the Thursday prior to the due date (noted in this syllabus). Grading of the homework is based on legibility and correctness. If the homework is not legible, it will get a zero so I suggest typing your answers or printing very neatly. You should then scan it and save it to the OAKS drop box. The drop box in OAKS does not handle iphone images well so you will need to make other arrangements. Finally, you can send your homework as an attachment to an e-mail but please let me know that you are doing so.

I. ALEKS

ALEKS = Assessment and LEarning in Knowledge Spaces is a Web-based, artificially intelligent assessment and learning system.
ALEKS uses adaptive questioning to quickly and accurately determine exactly what a student knows and doesn't know in a course. ALEKS then instructs the student on the topics she is most ready to learn. As a student works through the course, ALEKS periodically reassesses the student to ensure that topics learned are also retained and these are called Knowledge Checks. During a Knowledge Check, the student will lose access to the on-line text until the student finishes the Knowledge Check. There are 4 Knowledge Checks in our course, the first is to do a preassessment of your skills entering the class and the last three to analyze how well you are retaining the material. ALEKS due dates are noted on-line at the ALEKS site and you must finish each modules (11 in total) before **10:30 PM of the Due Date.**

The class code is **AU49L-MHYNJ**

Aleks is worth **10%** of your grade and is graded on how much of each module you complete. The final date for completing ALEKS is **4/29/21.** **Once the due date is past you cannot go back and complete a module. So do ALEKS early.**

For any problems with ALEKS let me know promptly and we will solve it together.

**J. Hourly Exams**

The following are *tentative* dates for the exams. **These dates are subject to change.** All exams are on-line (OAKS) and will require use of the respondus lockdown browser / webcam monitor

Tuesday, February 16
Thursday, March 25
Tuesday, April 20

**Final Exam:** The Final Exam will be given on line on Thursday, 4/29 at 8:00 – 10:00 AM. It is scheduled to last **2.0 hours.**

**Makeups:** There are **NO** makeup tests. If you miss an exam and have an excellent reason then your grade will be based on your remaining tests and other class work. You may not miss more than one exam. In cases of major
illnesses or other reasonable issues we will work together to develop a solution which is fair to you, your fellow students and me.

K. Supplemental Instruction and Tutoring:

The learning community will have an SI for the course that is responsible for providing additional instruction of the chemistry content. Our SI is to be determined. The SI will be arranging a variety of times and methods when they will be available to work through problems with you. Your attendance is not required, but data has shown that students who use SI do better in the course. Also, tutoring at the Center for Student Learning in chemistry is available to students at no cost. The times and methods for use of this resource are being determined but further information is available online at (http://csl.cofc.edu/labs/).

L. Grading:
Your final grade will be calculated by the following formula:

3 Exams: top 2 (20% each and 15% for lowest) 55%
Final Exam 25%
Homework 10%
ALEKS 10%
Total 100%

Letter % GP
A 93-100 4.0
A- 90-92 3.7
B+ 87-89 3.3
B 83-86 3.0
B- 80-82 2.7
C+ 77-79 2.3
C 73-76 2.0
C- 70-72 1.7
D+ 67-69 1.3
D 63-66 1.0
D- 60-62 0.7
F Below 0

M. The Course:

On-line Course Methodology:
A. All lectures will be held on Zoom. I will send out an e-mail to all authorized students prior to the first day of class with the link to the zoom lecture. Students will be asked to participate so at the appropriate time they should turn on both their video and audio. I will have my video on so you can see me and the zoom screen.

B. We will spend time introducing ourselves to each other and I would like both the video and audio to be active then for the students introducing themselves.

C. For students asking or answering questions, please turn on both your video and audio.

D. All Office Hours are on Zoom, I have set aside specific hours for Office Hours, but it is my intention to be flexible in my availability to you. I only ask that you reserve a time by e-mail and gather as many of your colleagues to share in the session as you can.

E. If you have any other suggestions or comments please feel free to let me know.

Basic Structure of the Course:

Module 1- Solutions and Spontaneity and Equilibrium – Chapters 13, 15, 16 and 7.2, 7.5 and 12.2 and 12.5
Module 2- Acids and Bases (weak and strong) and Buffers and $K_{sp}$ – Chapters 17 and 18.
Module 3 – Electrochemistry and Kinetics– Chapters 19 and 14
Module 4- Nuclear Chemistry – Chapter 20

These topics are covered in Chapters 13-20 with parts of 7.2, 7.5 and 12.2, 12.5 in your textbook.

PROPOSED CLASS SCHEDULE (SUBJECT TO CHANGE)

1/12/21: First Day of Class
- Discuss Syllabus
- Chapter 7.2, Polarity (review)
- Chapter 7.5 Intermolecular Forces (review)
• Chapter 12.2 Properties of Liquids
• Chapter 12.5 Phase Changes

1/14/21
• Chapter 13.1 and 13.2 – Solution formation energetics
• Chapter 13.3-Concentration units
• Chapter 13.4-Factors that affect solubility (review chapter 9.2)

1/19/21
• Chapter 13.4-Factors that affect solubility (review chapter 9.2)
• Chapter 13.5-Colligative Properties
• Chapter 13.6-Calculations using colligative properties

1/21/21
**Homework Assignment 1 on OAKs -Due on 1/21/21 by 6:00 PM**
• Chapter 13.6-Calculations using colligative properties – Cont’d
• Chapter 13.7-Colloids

1/26/21
• Chapter 15.1- Spontaneous Processes
• Chapter 15.2 - Entropy
• Chapter 15.3 – Entropy changes in a system
  o Qualitatively predicting the sign of $\Delta S_{sys}$

1/28/21
• Chapter 15.3 – Cont’d
• Chapter 15.4 – Energy changes in the universe
  o Second and Third Law of Thermodynamics

2/2/21
**Homework Assignment 2 on OAKs -Due on 2/2/21 by 6:00 PM**
• Chapter 15.5 – Predicting Spontaneity
  o Free Energy - $\Delta G$
    • Calculations
• Chapter 15.6 – Thermodynamics in living systems

2/4/21
• Chapter 16.1 – Equilibrium
• Chapter 16.2 – Calculating Equilibrium constants
• Chapter 16.3 – Equilibrium expressions
  o Manipulation
  o Gaseous

2/9/21
• Chapter 16.3 - Cont’d
• Chapter 16.4 – Free Energy and Equilibrium
• Chapter 16.5 – Calculating Equilibrium quantities
ICE Tables

2/11/21
Homework Assignment 3 on OAKs – Due 2/11/21 by 6:00 PM
  • Chapter 16.5 – Cont’d
  • Chapter 16.6 – Le Chatelier’s Principle

2/16/21 Test #1 on Chapters 7.2, 7.5, 12.2, 12.3, 13, 15, 16 (Module 1)

2/18/21
  • Chapter 17.1 – Bronsted Acids and Bases
  • Chapter 17.2 – Molecular Strength and Acid Strength
  • Chapter 17.3 – Acid-Base Properties of Water
  • Chapter 17.4 – pH and pOH

2/23/21
  • Chapter 17.4 - Cont’d
  • Chapter 17.5 – Strong Acids and Bases
  • Chapter 17.6 – Weak Acids and Acid Ionization Constants

2/25/21
Homework Assignment 4 on OAKs – Due 2/25/21 by 6:00 PM
  • Chapter 17.6 – Cont’d
  • Chapter 17.7 – Weak Bases and Base Ionization Constants
  • Chapter 17.8 - Conjugate Acid-Base Pairs

3/2/21 No Class

3/4/21 No Class

3/09/21
  • Chapter 17.9 – Diprotic and Polyprotic Acids
  • Chapter 17.10 – Acid-Base Properties of Salt Solutions
  • Chapter 17.11 – Acid-Base Properties of Oxides and Hydroxides

3/11/21
Homework Assignment 5 on OAKs – Due 3/11/21 by 6:00 PM
  • Chapter 18.1- Common Ion Effect
  • Chapter 18.2 – Buffer Solutions

3/16/21
- Chapter 18.3 – Acid – Base Titrations

3/18/21
- Chapter 18.4 – Solubility Equilibria
- Chapter 18-5 – Separation of Ions based on Solubility

3/23/21
Homework Assignment 6 on OAKs – Due 3/23/21 by 6:00 PM
- Chapter 19.1 – Balancing Redox Reactions
- Chapter 19.2 - Galvanic Cells

3/25/21 Test #2 on Chapters 17 and 18 (Module 2)

3/30/21
- Chapter 19.3 – Standard Reduction Potentials
- Chapter 19.4 - Spontaneity of Redox Reactions under standard conditions

4/01/21
Homework Assignment 7 on OAKs -Due on 4/01/21 by 6:00 PM
- Chapter 19.5 – Spontaneity of Redox Reactions under non-standard conditions
- Chapter 19.6 – Batteries
- Chapter 19.7 - Electrolysis

4/06/21
- Chapter 19.7 Cont’d
- Chapter 19.8 - Corrosion

4/08/21
- Chapter 14.2 - Collision Theory
- Chapter 14.3 – Reaction Rates

4/13/21
- Chapter 14.4 – Dependence of Reaction Rate on Concentration
- Chapter 14.5 – Dependence of Reactant Concentration on Time

4/15/21
Homework Assignment 8 on OAKs -Due on 4/15/21 by 6:00 PM
- Chapter 14.6 – Dependence of Reaction Rate on Temperature
- Chapter 14.7 – Reaction Mechanism
- Chapter 14.8 – Catalysis

4/20/21 Test #3 – Chapters 14 and 19 (Module 3)

4/21/21
- Chapter 20.1 – Nuclei and Nuclear Reactions
• Chapter 20.3 – Natural Radioactivity
• Chapter 20.4 – Nuclear Transmutation
• Chapter 20.5 and 20.6 - Nuclear Fission and Fusion