Introductory Chemistry
Kenyon College - Chem 121.01
Fall of 2018
Prof. M. Rouhier

Chemistry 121 Syllabus

Fall 2018

OVERVIEW

This course provides a thorough introduction to the fundamental concepts, theories, and methodologies of chemistry. Topics may include stoichiometry, theories of molecular structure and bonding, the periodic table, acid-base chemistry, chemical equilibria, and thermodynamics. This course provides a basis for further study of chemistry.

EXPECTATIONS

From the course – to be amazed, challenged, and learn a lot about chemistry. Students can expect to improve their problem-solving skills, apply and extend their chemical knowledge to other areas of science, and enhance their written and oral communication skills. We will be spending 3-5 class periods on each topic and it is expected that you will have read the associated material before class. In class we will work more challenging problems, analyze demonstrations, and discuss various applications of chemistry.

From the instructor – to treat each person with respect, be enthusiastic and knowledgeable about the subject, arrive to class on time and prepared, return graded and assessed items in a timely manner, reply to emails in a timely manner (within 24-48 hours), and be available outside of class for questions or further discussion.

Of the students – to respect others, be on time (when arriving to class, turning in assignments, etc.), be prepared for class (have read related course material before class, be alert, etc.), and participate during class (participate in small group activities, answer/ask questions, etc.). Outside of class, you are expected to make consistent progress towards completing course objectives on ALEKS.

RESOURCES

Instructor:	Prof. Matthew Rouhier (“Roo-yer”)
email:	rouhierm@kenyon.edu
Office:	208 Tomisch Hall
Office hours:	M (1-2 pm), W (1-2 pm), R (10-11 am), or by appointment
Class location:	Tomsich 101
Class time:	9:10-10:00 AM; M-W-F
Required materials:	Chemistry, 11th Ed. by Raymond Chang (although any general chemistry textbook is acceptable); ALEKS (Assessment and LEarning in Knowledge Spaces) Online course-companion; basic scientific calculator (bring to every class)
Course websites:	moodle.kenyon.edu (CHEM 121.01) and https://www.aleks.com
Lead tutor:	Cole Meier (will be available at MSSC)

POLICIES

Attendance – Your attendance at every lecture is expected. Excessive absences will lead to a lower grade and may lead to expulsion from the course. As stated in the Course of Study 2018-2019 regarding absence:

> “Instructors will receive notification of student absence due to the following reasons: 1) curricular or extracurricular activities sanctioned in advance by the College, 2) infirmity as determined by the College Health and Counseling Center, or 3) compelling and unavoidable personal circumstances as determined by the dean of students or the dean for academic advising. In these cases, students may not be penalized for the absence, but they should be held responsible for all course assignments. The rescheduling of examinations or assigned work must be initiated by the student.”

Athletics and Extracurricular Activities – If your participation in athletics or extracurricular activities conflicts with a class, scheduled exam time or project due date, please let me know as soon as possible, at least two weeks in advance. Typically you will be expected to complete your work before (not after) the deadline for the rest of the class.

Accommodations – Students who anticipate they may need accommodations in this course because of the impact of a learning, physical, or psychological disability are encouraged to meet with me privately early in the semester to discuss your concerns. In addition, students must contact Erin Salva, Director of Student Accessibility and Support Services (740-427-5453 or salvae@kenyon.edu), as soon as possible, to verify their eligibility for reasonable academic accommodations. Early contact will help to avoid unnecessary inconvenience and delays.

Academic Honesty – Kenyon College is, at the core, an intellectual community of scholars – students and faculty – engaged in the free and open exchange of ideas. Critical to this lively exchange and deep engagement with ideas is the academic integrity of our work, both inside and outside the classroom.

> "At Kenyon College we expect all students, at all times, to submit work that represents our highest standards of academic integrity. It is the responsibility of each student to learn and practice the proper ways of documenting and acknowledging those whose ideas and words they have drawn upon (see Academic Honesty and Questions of Plagiarism in the Course Catalog). Ignorance and carelessness are not excuses for academic dishonesty."
> This class encourages collaborative work; however your work must still be your own. If you are uncertain about the expectations for academic honesty in this class, please ask for clarification.

Technology use – Please refrain from using laptops, tablet devices, cell phones, and recording devices in class without the prior approval of the instructor. All phones should be set to silent. Please bring a calculator to every class.

Title IX – As a faculty member, I am deeply invested in the well-being of each student I teach. I am here to assist you with your work in this course. If you come to me with non-course-related concerns, I will do my best to help. It is important for you to know that all faculty members are mandated reporters of any incidents of harassment, discrimination, and intimate partner violence and stalking. Meaning, I cannot keep information involving sexual harassment, sexual misconduct, interpersonal violence, any other form of harassment or discrimination based on a protected characteristic confidential. The Health and Counseling Center, the College chaplains, and the staff at New Directions Domestic Abuse Shelter & Rape Crisis are confidential resources.

Course grade – your overall course grade will be based on your performance in the following areas:

Category	**Percentage**	**Hypothetical Point Scheme**
Quizzes/Snapshots	5.0 %	25 pts
Case Studies (Project) (Weekly)	5.0% 10.0%	25 pts 50 pts
Semester exams (1) (2) (3)	10.0% 15.0% 15.0%	50 pts 75 pts 75 pts
Final exam	20.0%	100 pts
ALEKS	20.0%	100 pts
Total	100 %	500 pts

Letter grades will be assigned no more strictly than the following scale:
A/A-: 90-100%; B(+/-): 80-89%; C(+/-): 70-79%; D(+/-): 60-69%; F: <59%

COURSE DETAILS

Moodle – All course-related information will be posted and available through the course Moodle site. This includes the current schedule, lecture slides, and a gradebook. The Moodle calendar includes due dates for ALEKS and exam dates. This calendar can be exported to your own personal calendar (see course Moodle site for details). Please check this site frequently for important class-related information.

Quizzes and Snapshots – In order to help you assess your understanding and recognize where it may be lacking, there will be weekly Monday quizzes or snapshots. They will start promptly at 9:10 AM and last no more than 5 minutes. Quizzes will be closed-note and will cover material since the last quiz. Snapshots are 2 to 3 sentence responses that provide timely feedback to the understanding of the material covered in the previous lectures. The snapshots points are awarded for satisfactory completion, not correctness. Because of the nature of the quizzes and snapshots, there will be no makeups; however, your lowest quiz/snapshot grade will be replaced by your highest quiz grade at the end of the semester.

Case Studies – Everyday interesting things are happening in our chemical world. Each week, we will dive into these events by discussing the context, impact, and outcomes of these chemical happenings. These case studies are designed to build conceptual understanding of the material covered in your reading, develop your problem-solving skills, and provide a forum to practice scientific communication. You will be asked to complete short assignments based on the problems or discussions generated in class. Case studies are typically undertaken on Fridays with the associated questions collected at the end of class that day. The questions will be graded for completion and a select subset will be graded for correctness and thought-process. Later in the semester you will have the opportunity to develop your own case study.

Semester exams – There will be three fifty-minute exams during the semester. If you have a scheduling conflict, please notify the instructor in writing at least two weeks prior to the scheduled exam to set up an alternate exam time. The exams are scheduled for September 19th, October 10th, and November 7th. There will be no makeup exams.

Final exam – The final exam will be Wednesday, Dec. 19 at 6:30 p.m. It will be cumulative for the semester and you will have two hours to complete the exam. Because of limited time, it is impossible to include every concept or skill covered in this class, therefore the exam will be a sampling of the topics you learned. You should expect that any topic covered during the semester may appear.

ALEKS online companion – As a supplement to the text, you are asked to purchase access to ALEKS (https://www.aleks.com). ALEKS (Assessment and LEarning in Knowledge Spaces) is a Web-based, adaptive questioning, CHEM 121-course specific, program that supports the material taught in the lecture.

For ALEKS, there are two modes in which you will work: Assessment Mode and Learning Mode. In assessment mode, ALEKS determines what you have and have not yet mastered. Each ALEKS assessment takes about 45 minutes, so please plan accordingly. ALEKS uses the assessment data to determine what topics you have not yet mastered. Then ALEKS has you work in Learning Mode where you work on objectives with tutorials and problems to build your understanding. Working in learning mode is best done in frequent, small blocks of time. For example, 7 30-minute periods with ALEKS in a week is much better than one 3.5-hour block. Your ALEKS grade in the course is determined by the percent mastery of objectives at each of the ALEKS due dates and at the end of the course. Due dates are posted on ALEKS and are mostly synchronized with the content addressed in lecture. The purpose of this is to keep you working regularly on learning chemistry. It is human nature to procrastinate, and this part of the course structure rewards those who work regularly toward mastery!

The percent mastery you earn on each objective or set of objectives associated with each due date will be weighted equally and averaged. The "gradebook" section of ALEKS enables you and me to track these scores. In addition, you will earn an ALEKS score based on your overall level of mastery at the end of the class. The purpose is for you to earn credit for mastery achieved before the course ends, whether or not it is achieved by the deadline. It is also in place to motivate you to work on topics that you forgot, so that by the end of the course you can succeed on the final examination and leave the course with a strong command of general chemistry knowledge. The numerator on the fraction above your ALEKS pie tells you your overall mastery score.

Also note, ALEKS instructs you on the topics you are most ready to learn. As you work through the course, ALEKS periodically reassesses you to ensure that topics learned are also retained. The ALEKS course is very complete in its chemistry coverage and ALEKS avoids multiple-choice questions. Historically students who show a high level of mastery of an ALEKS course are successful in the accompanying lecture. Please remember that ALEKS is tailored to assist you therefore it is to be completed individually.

Student Research – The Chemistry department encourages students with interests in the sciences to consider an independent research experience at some point during your undergraduate education. If you are interested in doing research within the Chemistry department, first check the faculty websites (www.kenyon.edu/academics/departments-programs/chemistry/chemistry/) for an introduction to each person's individual research. If you find one (or more) faculty with interests that pique your curiosity, contact those people to set up an appointment to talk further. Some research groups may be full when you initiate contact, but this status may change semester to semester.

Best Practices for Chem 121 – Found on the Moodle page are documents that includes several strategies for how to be successful in this course. It is encouraged that you look at these documents and put into practice these strategies early in the semester to maximize your success.

LEARNING OBJECTIVES

Chapter 2 Key Concepts:

- Can describe atomic structure (protons, neutrons, & electrons) and define atomic number and mass number.
- Understand the nature of isotopes, i.e. calculate atomic weight from isotopic abundances and isotopic masses.
- Interpret, predict, name, and write formulas for ionic and molecular compounds, e.g. recognize molecular formulas and empirical formulas.

Chapter 3 Key Concepts:

- Explain the concept of the mole, and use molar mass in calculations.
- Derive compound formulas from experimental data, i.e. empirical formulas from percent compositions.
- Perform stoichiometric calculations using balanced chemical equations.
- Understanding the meaning of limiting reactants in a chemical reaction.
- Calculating theoretical and percent yields of a chemical reaction.

Chapter 4 Key Concepts:

- Understand the nature of ionic substances dissolved in water.
- Understand the solute-solvent relationship and expressing solutes in molarity.
- Recognize common acids and bases, and understand their behavior in aqueous solutions.
- Recognize common oxidizing and reducing agents and identify oxidation-reduction reactions.

Chapter 5 Key Concepts:

- Understand the physical characteristics of gases.
- Understand the basis of gas laws and how to use those laws.
- Use the Ideal Gas Law.
- Apply the gas laws to stoichiometric calculations.
- Recognize why gases do not behave like ideal gases under some conditions.

Chapter 6 Key Concepts:

- Assess the transfer of energy as heat associated with changes in temperature and changes of state.
- Understand and apply the first law of thermodynamics.
- Define and understand state functions (enthalpy, internal energy).
- Learn how energy changes are measured.
- Calculate energy evolved or required for physical changes and chemical reactions using tables of thermodynamic data.

Chapter 7 Key Concepts:

- Describe the properties of electromagnetic radiation.
- Understand the origin of light from excited atoms and its relationship to atomic structure.
- Describe the experimental evidence for particle-wave duality.
- Describe the basic ideas of quantum mechanics.
- Define the four quantum numbers (n, l, ml & ms), and recognize their relationship to electronic structure.
- Write the electron configurations for atoms.

Chapter 8 Key Concepts:

- Write the electron configurations for monatomic ions.
- Rationalize trends in atom and ion sizes, ionization energies, and electron affinity.

Chapter 9 Key Concepts:

- Recognize when the rules of Lewis dot structures fail and understand the concept of resonance.
- Understand the properties of covalent bonds and their influence on molecular structure.

Chapter 10 Key Concepts:

- Use the VSEPR theory to predict the shapes of simple molecules and ions and to understand the structures of more complex molecules.
- Use electronegativity and formal charge to predict the charge distribution in molecules and ions, to define the polarity of bonds, and to predict the polarity of molecules.
- Identify the hybridization of a molecule or ion.
- Understanding the difference between valence bond theory and molecular orbital theory.

Chapter 14 Key Concepts:

- Understand the nature and characteristics of chemical equilibria.
- Understand the significance of the equilibrium constant (K) and the reaction quotient (Q).
- Understand how to use K in quantitative studies of chemical equilibria.

Chapter 15 Key Concepts:

- Use the Brønsted-Lowry and Lewis theories of acids and bases.
- Apply the principles of chemical equilibrium to acids and bases in aqueous solution.
- Predict the outcome of reactions between acids and bases.
- Understanding the influence of structure and bonding on acid-base properties.

TENTATIVE SCHEDULE

Date	Topics	Case Studies	ALEKS
8/31 – F	Syllabus & ALEKS 2.1-2.3 Atomic Structure & Isotopes	*CS - Neurogenesis*	9/2 Initial Assessment Due **SUN**
9/3 – M	2.5-2.7 Atomic Formulas & Atomic Representations		
9/5 – W	3.1-3.3 Mole Concept		
9/7 – F	3.5-3.7 Molar Mass, & % Composition	*CS - Onions*	9/7 Obj. Prereq Due **FRI**
9/10 – M	3.8 Stoichiometry		9/11 Obj. 1 Due **TUE**
9/12 – W	3.9-3.10 Limiting Reagent, & % Yield		
9/14 – F	4.1-4.2 Ionic Substances In Water	*CS - Ibuprofen*	9/14 Obj. 2 Due **FRI**
9/17 – M	4.3 Common Aqueous Reactions & Acids and Bases		9/18 Obj. 3 Due **TUE**
9/19 – W	**Exam 1**		
9/21 – F	4.4 Redox Reactions	*CS - Biofuel Cells*	
9/24 – M	4.5 Solute Solvent Relationships		9/25 Obj. 4 Due **TUE**
9/26 – W	5.1-5.5 Gas Laws And Ideal Gas Law		
9/28 – F	5.8 Stoichiometry And Non-Ideal Gases	*CS - Limnic Eruptions*	9/28 Obj. 5 Due **FRI**
10/1 – M	6.1-6.3 Energy As Heat & 1st Law Of Thermodynamics		10/2 Obj. 6 Due **TUE**
10/3 – W	6.4 State Functions And Enthalpy		
10/5 – F	6.6 Hess' Law & Energy Required-For/Evolved-By Rxns	*CS - Thermosiphons*	10/5 Obj. 7 Due **FRI**
10/8 – M	7.1-7.2 Properties Of Electromagnetic Radiation		10/9 Obj. 8 Due **TUE**
10/10 – W	**Exam 2**	*CS - Atomic Models (Handout)*	
10/12 – F	**Fall Break** – No Class		
10/15 – M	7.3-7.4 Bohr's Atom and the electron		10/16 Obj. 9 Due **TUE**
10/17 – W	7.5-7.7 Quantum Numbers		
10/19 – F	7.8-7.9 Electron Configurations	*CS - Brass Pots*	10/19 Obj. 10 Due **FRI**
10/22 – M	8.1-8.2, 8.4-8.5 Atomic Trends		10/23 Obj. 11 Due **TUE**
10/24 – W	9.1 Valence Electrons & Lewis Dot Structures		
10/26 – F	9.4-9.5 Covalent Bonds	*CS - Lewis Structures*	

10/29 – M	9.6-9.7 Covalent Bonds - Octet guidelines		10/30 Obj. 12 Due **TUE**
10/31 – W	9.8-9.10 Where Lewis Structures Break Down		
11/2 – F	10.1-10.2 Molecular Geometry and VSEPR	*CS - Ozone*	
11/5 – M	10.3 Valence Bond Theory - Hybrid Orbitals		11/6 Obj. 13 Due **TUE**
11/7 – W	**Exam 3**		
11/9 – F	10.5 Sigma and Pi Bonding	*CS - Retinol*	
11/12 – M	10.5 Atomic and Molecular Orbitals		11/13 Obj. 14 Due **TUE**
11/14 – W	10.6-10.7 Molecular Orbital Theory		
11/16 – F	10.8 Delocalized Orbitals	Your Case Study **Due**	
11/18 - 25	**Thanksgiving Break** – No Class		11/25 Open Pie Closes **SUN**
11/26 – M	14.1 What Is Chemical Equilibria		
11/28 – W	14.2-14.3 Equilibrium Constants And Rxn Quotient		
11/30 – F	14.4-14.5 Equilibrium Constants And Rxn Quotient & Using K	*CS - Decaffeinated*	11/30 Obj. 15 Due **FRI**
12/3 – M	15.1 Brønsted-Lowry Acids & Bases		12/4 Obj. 16 Due **TUE**
12/5 – W	15.2-15.3 Water And pH		
12/7 – F	15.4 Strength Of Acids & Bases	*CS - Atropine*	12/7 Obj. 17 Due **FRI**
12/10 – M	15.5-15.6 Weak Acid/Bases And Ionization Constants		
12/12 – W	15.7-15.8 Diprotic Acids, Structure & Strength Of Acids/Bases		
12/14 – F	**Flex Day**	*CS - e-cigarettes*	12/14 Open Pie Closes **FRI**
12/19	**Final Exam (December 19th, 6:30 pm)**		