CHEM 0960

General Chemistry for Engineers 1

Fall 2022

This syllabus is originated from Dr. Xinfeng (Kevin) Quan's work

Instructor and TA information

- **Lecturer:** Dr. Wenwen Xu
- **Office:** Rm 226, Zone 4, SCUPI
- **Office hour:** 8:15-11:00 Monday (Section 2);
  8:15-11:00 Tuesday (section 4);
  8:15-11:00 Wednesday (Section 3);
  Or by appointment
- **TA:** Zhenrui Bai (Wednesday, 13:50-16:25);
  Haojin Zhang (Thursday, 13:50-16:25);
  Yixin Zhang (Thursday, 8:15-11:00)
- **TA office hour:** by appointment
- **Class QQ group:** 827424145 (Wednesday, 13:50-16:25);
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Catalog Description

Chem 0960 is the first part of the introductory-level chemistry class to help students build a solid foundation with this diverse, complex and yet critical discipline. Important topics covered in this course include, but are not limited to, scientific method, atomic structure, periodic trends of elements, molecular geometry and bonding theories, stoichiometry, chemical reaction in aqueous solutions, chemical properties of metals, coordination chemistry, and organic chemistry. No prerequisites are needed.

Credit hours: 3.0

Course Objectives

Fundamental concepts and principles of chemistry are important to engineers. Knowledge on chemistry will help engineers to communicate with chemists, and more importantly, to understand the properties of working objects. To gain such knowledge, we will have two semesters of Chemistry covering a relatively broad and important range of topics. Learning objectives related to specific topics will be listed in the lecture slides as each chapter goes. Upon successful completion of this course (including Chem 0970), you should gain some “global” skills as follows:

- Be able to communicate chemistry using basic chemistry vocabulary.
- Predict material properties using basic concepts and principles of chemistry.
- Explain scientific methods e.g. how theory is constructed and tested via experimental efforts, particularly in chemistry.
- Demonstrate both qualitative and quantitative problem solving skills using knowledge on structural chemistry, stoichiometry, thermochemistry, chemical equilibrium, and reaction kinetics.

Required Textbook

- Chemistry: Atoms First, 4th edition by Julia Burdge and Jason Overby. (Chapter 1-12).
- Online system: blackboard (BB), where you can find the class announcements, handouts, assignments as well as grades.

Course Format

We will adopt a study format combining both lecture and group study. Students will be assigned to small groups. Students in the same group will have the same score for group projects so all group members’ performance is critical. Intensive individual practice and student - instructor interaction are highly expected. We also use blended learning to maximize your learning effectiveness.

Each lecture is 2h 35 min long, including three 45-minute segments and 2 breaks of 10 minutes. The first segment is focused on lecturing; the second segment is devoted both to the leftover lecture topic as well as student exercise; the last segment is involved student group discussion, problem solving and communication with lecturers and TAs.

Homework

Homework is assigned for you to understand and apply course materials better. Usually there are 10 problems covering major concepts and principles of the lecture content. Since you have access to all sorts of help when doing homework, some of the problems are designed to be very difficult. Homework is for leaning purpose. Exam may be easier. (But not that easy!)

Make sure to apply the required format listed below to avoid points deduction:

- Homework is due the BEGINNING of the class in the week after. Late homework will not be accepted.
- Please put your name, ID last four digits, and section number on the upper right corner and staple on the upper left corner. Use A4 size sheets. For online classes, the homework will be submitted through BB.
- If your hand writing is illegible, print your homework.

Grades

Exams 1 & 2	200 pts
Final Exam	150 pts
Homework	50 pts
Studio work/Group Discussion	100 pts
Total	500 pts

Please expect a midterm exam after lecture 4 and lecture 8. Each midterm exam will last one and a half hour covering all content after the previous exam.

The final exam is three hours long and will cover content thought out the course with emphasis on the content after the second midterm.

Studio assignment and homework will be given weekly to help you practice and check your mastery of class content. Remember that altogether they take 18% of the total grade. Failure in doing those can cost you more than a letter grade (A to B, B to C, etc.)!

If you have any questions for any of your grades, you should contact Prof. Xu within three days after the grade is released. Any requests for regrading will be denied after this three-day period.

Letter Grade

Final letter grade will be given according to the following scheme:

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
≥ 88 %	≥ 85 %	≥ 81 %	≥ 78 %	≥ 75 %	≥ 71 %	≥ 68 %	≥ 65 %	≥ 61 %	≥ 55 %	≥ 50 %	< 50%

Grades will be curved at the end of the semester if the class average is low. The standard is listed as follows:

Grade	*% of Class*
A	15
B	34
C	40
D	8
F	3

However, curving is not guaranteed. You should only rely on your performance in all the assignments and exams.

Absence and Makeup

In principle, any absence in exams is not allowed except for irresistible reasons (diseases, accidents, deaths, etc.). For other reasons, you should contact me in advance. Make-up exams may not be guaranteed.

Failure of the Course

If you unfortunately failed the course, you can either retake the course or pass a make-up exam at the beginning of the next semester. Based on your performance in the make-up exam, a “D” or an “F” should be expected as the final grade.

Copyrights

If not specifically pointed out, all materials used in this course are copyrighted, meaning that without my explicit permission you do not have the right to copy any of the materials for any purpose other than your own personal academic use. The copyrighted materials used in this course include but do not limit to syllabi, exams, class slides, problem sets, and other handouts.

Academic Integrity

Upon accepting admission to SCUPI, you immediately assume to follow the SCUPI academic integrity guidelines. See a staff in the administrative office if you are not aware of it. The guidelines should be followed in homework, examinations, and other academic work. Violations of these guidelines may result in zero points for an exam or failure of the course.

Study Tips

- Do your homework ON YOUR OWN!!! You can discuss with a friend, but do it independently. Make sure you can solve similar problems after completion.
- Come to classes and take notes. Even if you have learned some of the topics in high school, you may find it quite different in this course. Every year there are students losing points in the exam because of this.
- Consult a text book in Chinese if you have trouble understanding the required text book. However, make sure you learn all the terminology in English. The exam is in English!

- Study your notes every day. Memorizing basic laws, facts, terms, and principles is a must. Chemistry is a subject based on workings of this objective world!
- Use office hours and let me know any trouble you might have.

Course Schedule

Week	Topics
1	The Scientific method, Classification of matter, the Properties of matter, Scientific measurement, Uncertainty in measurement
2	Subatomic particles and atomic structure, Atomic number, mass number, and isotopes, Average atomic mass, Mole and molar mass, The nature of light, Quantum theory, Bohr's model of the hydrogen atom
3	Wave properties of matter, Quantum mechanics, Quantum numbers, Atomic orbitals, Electron configuration
4	National Day
5	The modern periodic table, Effective nuclear charge, Periodic trends in properties of elements, Electron configuration of ions, Ionic radius
6	Exam1
7	Lewis dot symbols, Ionic compounds and bonding, Covalent bonding and molecules, Naming compounds, Covalent bonding in ionic species, The octet rule and exceptions, Percent composition of compounds, Molar mass
8	Electronegativity and Bond polarity, Lewis structures, Formal charge, Resonance, Exceptions to the Octect Rule, Molecular geometry
9	Molecular polarity, Intermolecular forces, Valence bond theory, Hybridization of atomic orbitals (containing multiple bonds)
10	Molecular orbital theory, Bonding theories and descriptions

	of molecules with delocalized bonding, chemical equations, combustion analysis, Balancing equations and calculation, Limiting reactants, Periodic trends in reactivity of the main group elements
11	Exam2
12	Electrolytes (weak and strong), Reaction type in aqueous solutions (precipitation, acid-base, oxidation-reduction), Solubility guidelines, Molecular equations, (net) Ionic equations, Acid and base (type and strength), Acid-base neutralization, Oxidation numbers, Balancing reactions, Metal activity series
13	Thermodynamics of chemical reactions, enthalpy, calorimetry, Hess's law, standard enthalpies of formation, bond enthalpy, lattice energy, stability of covalent and ionic compounds
14	The kinetic molecular theory of gases, gas pressure, the gas law, the idea gas equation, real gas, mole fractions and Dalton's law of partial pressures, reactions with gaseous reactants and products
15	Properties of liquids and solids, types of crystalline solids, phase changes, phase diagrams
16	Review

*** Schedule might be slightly changed based on class performance.**