

# CHEM 0960

## General Chemistry for Engineers 1

Fall 2017

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### Catalog Description

Chem 0960 covers atomic structure, periodic trends of elements, molecular geometry and bonding theories, stoichiometry, energy changes in chemical reactions, properties of gases, liquids, and solids. 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 yet 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, 2nd edition* by Julia Burdge and Jason Overby.

## Course Format

We will adopt a study format combining both lecture and group study feature in intensive individual practice and student - instructor interaction. We also use flipped class to maximize your learning effectiveness.

In the first meet of the week, you will expect a “normal” lecture where mostly I talk. But please be prepared for random questions I would ask to get you involved.

After the first meet, you will be assigned to watch several short videos before we meet the second time. Those videos cover important topics I will NOT lecture in class but test in exams. However, I will check answers of the questions in the videos at the beginning of the second weekly meet. DO WATCH those videos to avoid confusion in lectures.

For the majority time of the second meet, you will have a group study on a studio assignment to solve a problem set before class ends. You will work in groups where in-group discussion is encouraged. Solve the problems together instead of break it into parts with everyone working on his or her part alone. At the end of the class, you should check with an instructor (professor or teaching assistant) before you leave the classroom. The Studio assignment is a pass/not-pass work which contributes to your overall grade.

For the after class homework, you can still discuss with others but should complete it INDEPENDENTLY, meaning that you can't copy others' work or let others copy yours.

## Recitation

There will be a one hour recitation each week during which an instructor will answer your questions. Although this session is not required to attend, I highly encourage you to come, provided that students who attend recitations in a regular basis have a better grade.

## Grades

Exams 1 & 2	200 pts
Final Exam	150 pts
Homework	35 pts
Studio Homework	30 pts
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Total	415 pts

Please expect a midterm exam after lecture 4 (week 7) and lecture 8 (Week 10). 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 slight 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 15% 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. Quan 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 might be curved at the end of the semester if the class average is low. However, curving is not guaranteed. You should only rely on your performance in all the assignments and exams.

### **Absence and Makeups**

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 will 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 for 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. You may find it's hard to understand your instructor. Keep on trying and it will get easier. Even if you have learned some of the topics in high school, you may find slight to big differences.
- ❖ Attend recitation sessions with questions.
- ❖ 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 facts, terms, and principles is a must. Chemistry is a subject based on workings of this objective world!
- ❖ Come to my office hour and let me know any trouble you might have.

## Course Schedule

Week	Topics
3	The Scientific method, Classification of matter, the Properties of matter, Scientific measurement, Uncertainty in measurement
4	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
5	<b>No class. National holiday</b>
6	Wave properties of matter, Quantum mechanics, Quantum numbers, Atomic orbitals, Electron configuration
7	The modern periodic table, Effective nuclear charge, Periodic trends in properties of elements, Electron configuration of ions, Ionic radius
8	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
9	Lewis structures and formal charge, Resonance, Molecular geometry

10	Polarity, Intermolecular forces, Valence bond theory, Hybridization of atomic orbitals (containing multiple bonds)
11	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
12	Introduction to thermodynamics, Enthalpy, Calorimetry, Hess's law, Standard enthalpies of formation
13	Properties of gases, The kinetic molecular theory of gases, Gas pressure, The gas law, The ideal gas equation, Real gas, Gas mixtures, Reactions with gaseous reactants and products
14	The condensed phases, Properties of Liquids, Properties of solids, Types of crystalline solids, Phase changes, Phase diagrams
15	Review week
16	Final week

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