

SYLLABUS - CHEM 171, ADVANCED GENERAL CHEMISTRY (Fall 2017)

Class Meets: M 1130-1220, TR, 1200-1315, in BIL 335

INSTRUCTOR: Prof. Tom Apple EMAIL: tapple@hawaii.edu

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Professor Apple's Office Hours: Mon. 9:00-10:30, Thursday 9:00-10:30

GENERAL COURSE INFORMATION

REQUIRED TEXT: Principles of Modern Chemistry, 8th Edition, Oxtoby, Gillis & Butler

Publisher: Cengage

TEXTBOOK & SUPPLEMENTAL MATERIAL:

- The online access to the publisher's site <https://login.cengagebrain.com/course/E-24YEG8T4ZTH6> is included in the cost of a new book. Here is the course ID:UH CHEM 171

The TUTORIAL ROOM is a good place for you to seek help. The TA's will be available to provide help with lecture and lab material. Schedule TBA.

Course Grading

Exams: There will be a weekly test each Monday. Your best 10 grades will be averaged.

Homework: This will account for 20% of your grade. Full credit will accrue by completing 10 points for each assignment.

Final grade:

Option 1: 80% of grade from weekly test average as calculated above plus 20% from homework.

Option 2: 60% of grade from weekly test average, 20% from final exam, 20% from homework.

OTHER IMPORTANT REGISTRATION & PROGRAM NOTES related to this course and your academic plans:

- As always, you should check with your academic advisors to confirm the minimum grade you need to make progress towards graduation with your desired degree.
- The prerequisite for Organic Chemistry I (CHEM 272) is a C (not C-minus) or better in CHEM 162 or 171.
- Your degree program will count *either* CHEM 161-162 *or* 171 (not both!) towards fulfilling your requirements.

"How do I know that I learned enough stuff in my high school chemistry class?"

Before the end of the first week of classes, you should review the first two chapters of the book. We will not cover this material to any great extent in lecture, as **it is expected that these topics have been covered in your most recent chemistry course.**

Ch. 1 – The Atom in Modern Chemistry

Ch. 2 – Chemical Formulas, Equations, and Reaction Yields

TENTATIVE SCHEDULE OF TOPICS

UNIT 1 – ATOMIC STRUCTURE, PERIODIC TRENDS, BONDING (WEEKS 1-4)

CHEM 171 begins with a discussion of the atom and quantum mechanics. By consideration of atomic structure we will develop the Periodic Table. This is followed by application of these ideas to predict properties of the elements, such as electronegativity, electron affinity and reactive tendencies. This will lead into formation of molecules and molecular structure. We make use of the idea of valence electrons (of atoms) to draw structures on paper, as in Lewis theory. Key concepts include Lewis structures, and the representation of ionic and covalent bonds using this formalism.

Chapters 3-6

UNIT 2 – MOLECULAR STRUCTURE, CONDENSED MATTER, THERMODYNAMICS (WEEKS 5-8)

We continue with structures of organic molecules and inorganic transition metal complexes. We then move into the attractions between molecules and the phases of matter with particular emphasis on solid materials. Crystal structures of solids and mechanical, electrical and optical properties of materials will be interpreted in light of their microscopic structure.

Chapters 7-10

UNIT 3 – EQUILIBRIUM; (WEEKS 9-12)

We introduce enthalpy, entropy, free energy and chemical potential in order to understand equilibria, colligative properties, and phase changes. We expand the concept of acid-base chemistry, while incorporating quantitative and qualitative aspects of chemical equilibrium. We define strong and weak acids and bases and also cover concepts such as the relationship of molecular structure to acid (or base) strength, acid-base titrations & buffer chemistry, as well as solubility equilibria.

Chapters 12-16

UNIT 4 – ELECTROCHEMISTRY; KINETICS (WEEKS 13-16)

In this last set of classes redox chemistry, electrochemical cells, batteries and corrosion will be addressed. Chemical kinetics covers the relationship of time and chemistry. Key concepts include rate laws, the integrated rate law, collision theory, and reaction mechanisms. The application and relevance of catalysis are described here.

STUDENT LEARNING OUTCOMES

Student Learning Outcomes (SLO's) for General Chemistry are listed at the UHM Chemistry website, as follows:

“Upon completion, the student should understand:

- 1. The basic structures of atoms, ions, and molecules, and ways to quantitatively describe the properties of atoms and molecules in the various phases of pure matter and in mixtures.*
- 2. The reactivity of atoms, ions, and molecules, and the various qualitative and quantitative methods for describing or depicting chemical reactions.*
- 3. The concept of chemical equilibrium, and the energies that drive chemical reactions: an introduction to the field of thermodynamics.*
- 4. The concept of chemical kinetics and the energy required to initiate a chemical reaction.*
- 5. The relationship between the electronic configurations of atoms and molecules and their chemical properties: an introduction to the field of quantum mechanics.”*

In CHEM 171, this material will also be complemented by examples of particular interest to students who are either pre-engineering or physical science majors. Thus, an additional SLO is:

- 6. Upon completion, the student should be able to cite numerous examples of the applications of these chemical concepts to problems in engineering and the physical sciences.*