

**CHEMISTRY 51- GENERAL CHEMISTRY (accelerated)**  
**FALL, 2008**

**Course Description and Syllabus**

Dr. Malkiat S. Johal, Seaver North 110, extension 74253, malkiat.johal@pomona.edu

**Lecture Schedule:** Mon, Wed, Fri, 09:00 AM – 09.50 AM; Seaver North, Room 202

**Laboratory Schedule:** Mon or Wed, 1:15 PM – 5:00 PM, Seaver North, Laboratory 6

Chemistry 51 is an accelerated, one-semester course in general chemistry intended for those who plan to major in one of the physical sciences and who have satisfied the prerequisites of two or more years of high school chemistry **and** a passing grade on the placement examination. The course covers atomic and molecular structure, molecular modeling, classes of chemical reactions, ionic equilibrium, chemical thermodynamics, chemical kinetics, transition-metal chemistry, and materials science. The laboratory emphasizes quantitative analysis, the statistical analysis of data, and scientific applications of the computer using Microsoft Excel and Wavefunction Spartan. The following materials are required:

- Textbook: Petrucci, Harwood, Herring, Madura, “General Chemistry: Principles & Modern Applications”, 9/E. 2007, Pearson Prentice Hall. ISBN: 9780132388269.
- Chemistry 51 Laboratory Manual, Pomona College, 2008 (available at the stockroom)
- Chemistry 51 Laboratory Notebook (available at the stockroom)
- Safety Glasses (available at the stockroom)
- Calculator (highly recommended)

Your grade in the course will be based on the four mid-term examinations, the comprehensive final examination, and your laboratory reports. Although attendance at lectures is up to the student's discretion, attendance at laboratory and the scheduled examinations is required. Make-up examinations are only given to those who are on the official sick list unless prior arrangements are made with the instructor. Those who are absent without a valid excuse will receive a zero. Note that there is no laboratory meeting on 24 (Monday) and 26 (Wednesday) November. Each mid-term examination and the lecture portion of the final count 15%; the laboratory reports, 25%. Exam questions will include problems and short essays; correct use of English is expected. In preparing your laboratory reports, refer to the section in the Laboratory Manual "Laboratory Grading Policies" so that you will not lose points for failing to follow the course guidelines. Pay close attention to the use of units and significant digits.

Chemistry 51 is a problem-solving course and success in the course depends on working on the homework assignments that are made each period. Previous experience has shown that those who fail to do the homework or who procrastinate until the week before the examination do poorly on the examinations. Budget up to 3 hours of study out of class for every hour spent in class. A group effort on the homework is encouraged as long as all members of the group participate in the activity. Your work will be checked as soon as possible by the student graders so that both you and the instructor will

have an indication of your progress in the course. Every effort will be made to return the corrected homework in class by the lecture period after it was submitted.

The laboratory work begins on Wednesday, 5 September, at 13:15. Our first meeting will be in the student lounge, Seaver North. Please purchase your lab materials at the stockroom on the first floor of Seaver North and if possible secure your computer password and user ID from ITS **before** the first lab meeting. For reasons of safety, shoes are required in lab; sandals are not an acceptable substitute. Computing is an integral feature of the course. A portion of the first two lab sessions will be dedicated to Microsoft Excel. One lab experiment will focus on molecular modeling and the sophisticated modeling program Spartan '06. Some homework exercises will utilize Odyssey, a versatile modeling program produced by the developers of Spartan.

An optional weekly discussion session is a traditional component of General Chemistry at Pomona College. This review session will normally be held on Monday evening at 18:00. If an exam is scheduled on Monday, the review session will be held on the preceding Friday at 18:00. The review session is your opportunity to ask questions about obscure material. Students at each session may be divided into small groups that will work on problems that unify the course material. The problems are designed to develop your skill in solving chemical problems. Strategies in solving the problems will be discussed.

Most handouts including laboratory protocols are available on the instructor's Web pages. The URL for the index page is <http://pages.pomona.edu/~msj04747>. Material relating to just Chemistry 51 will be found on its own page. Other material germane to both Chemistry 1a,b and Chemistry 51 such as an extensive collection of sample examinations will be found on the instructor's General Chemistry page. The Chemistry Department also maintains MolData, a Web-based, annotated bibliography of links to sources of reliable, useful chemical data on the WWW. For a serious search of the scientific literature, the instructor recommends Web of Science that is accessed via Honnold Library's Web page <http://voxlibris.claremont.edu>. Honnold provides Web access to an impressive number of journals. You don't have to enter the library to use the library.

**Important Information:** My office hours are Monday and Friday from 1:00pm to 3:00 pm, or by appointment. Homeworks will be graded by TAs. Your TAs are Jenny Lin, Kelvin Lee, and Michael Gormally. Homeworks are not awarded specific grades, but rather evaluated according to either a satisfactory or an incomplete performance. The homework is a learning exercise only and it will only be factored into the final grade in unusual circumstances or if the student's grade is borderline. The evaluation of homework is based on the following system:

- ✓+ (or 3) - Most problems were completed satisfactorily, with only a few minor errors/computational mistakes.
- ✓ (or 2) - Most problems were attempted or a few major mistakes were made on some of the problems.
- ✓ - (or 1) - Some problems were attempted, but the homework was mostly incomplete.

## **LECTURE TOPICS**

### *Unit I. Statistics, Classes of Reactions, and Ionic Equilibrium*      **[8 lectures + mid term]**

Following a short rundown on statistics, this unit will begin with a discussion on acid-base reactions, redox reactions, and chemical equilibria. Equilibria will form a significant component of the unit, and some emphasis will be given to the effects of external stresses on chemical equilibria. The unit will end with an in-depth look at acid-base equilibria. The lectures will be based on Chapters 5, 15, 16, 17, and 18 of the textbook.

### *Unit II. Chemical Thermodynamics*      **[7 lectures + 1 review + mid term]**

This unit will focus on the thermodynamics of chemical reactions in the context of enthalpy, entropy, and Gibbs free energy. There will be particular emphasis on spontaneous changes in redox and electrochemical processes. The unit will conclude with a discussion on electrochemistry and electrochemical cells. The lectures will be based on Chapters 7, 19, and 20.

### *Unit III. Atomic and Molecular Structure*      **[8 lectures + mid term]**

Unit 3 will introduce quantum mechanics and provide a detailed picture of the electronic structure of atoms and molecules. These ideas will lead into discussions on periodicity and chemical bonding. The unit will also cover molecular orbital theory and basic spectroscopy. The lectures will be based on Chapters 8, 9, 10, and 11.

### *Unit IV. Spectroscopy and Transition-Metal Complexes*      **[7 lectures + mid term]**

This unit will cover the structure, formation, and properties of coordination complexes. There will be significant coverage of crystal field theory. The unit will conclude with an in-depth look at structure and bonding in solids. The lectures will be based on Chapters 23 and 24. Additional material not covered in the textbook will also be distributed.

### *Unit V. Chemical Kinetics*      **[7 lectures]**

The final unit will focus on the rates of chemical reactions. Topics will include rate laws, the effect of temperature on the rate constant, and reaction mechanisms. The lectures will be based on Chapter 14.

Please note that Wednesday 10 December is the last day of classes. No written work will be accepted after 17:00 on that date. An optional review session will be held at 09:00, the normal class period, on Friday, 12 December. The comprehensive final examination which will have laboratory and lecture components will be held during the exam week. The final exam will cover all the semester's work but will emphasize the material in Unit V.