

# Chemistry 4A Fall 2012: General Information

- Instructors:                   **Professor K. Birgitta Whaley**, 219 Gilman Hall  
  e-mail: whaley@berkeley.edu  
  office hours: Monday 1-2 pm, Wednesday 3-4 pm  
  Prof. Whaley is the instructor for the first half of this class
- Professor Ronald Cohen** B45 Hildebrand Hall  
  e-mail: rccohen@berkeley.edu  
  office hours: Wednesday 1-2 pm, Friday 1-2 pm  
  Prof. Cohen is the instructor for the second half of this class.
- Lectures:                       Mondays, Wednesdays, and Fridays 12-1 pm  
  1 Pimentel Hall
- Class web site:               <http://bspace.berkeley.edu>
- Textbooks:                   We will make use of two textbooks during the semester.  
  (1) *Principles of Modern Chemistry*,  
  Oxtoby, Gillis and Campion, 7<sup>th</sup> edition, Cengage Learning 2012  
  (required)  
  (2) *Quantitative Chemical Analysis*,  
  Harris, 8<sup>th</sup> edition, Freeman 2010  
  (recommended, on reserve at Chemistry Library, relevant sections will be  
  made available on bspace)
- Lab Manual:                   Prelab assignments, lab instructions, and lab reports will be located on bspace
- Assessment:                   30% for three 1-hour mid-term exams (in class)  
  30% for one 3-hour cumulative final exam. (December 10, 3-6 pm)  
  30% for laboratory (see Lab Manual on bspace for details)  
  10% for weekly homework
- General comments:
- (1) Weekly reading: There is weekly assigned reading, which is listed below. Do this reading on a steady basis before lectures (20-30 minutes/lecture) to help you get more out of the lectures (which don't duplicate the book!)
  - (2) Weekly homework: There is a weekly set of assigned homework problems, which will be posted weekly on bspace. These will generally be collected before lecture on the Monday of the following week. They will be graded on a scale of 0 to 4. Doing these problems is essential to doing well in this class! 10% of your grade will come from them directly, but your success on the exams will depend on doing the problems. Homework solutions will be posted on bspace. No late homework will be accepted.

- (3) Work expectations – plan to spend *at least* 2 hours reading/problem solving per hour of lecture, and stick to it. Steady work is the pathway to good progress. Lack of sustained work is a pretty sure guarantee of trouble.
- (4) Grade expectations – we grade on an absolute scale, so everyone can do well!
- (5) Get help early when you need it: Chem 4A goes fast, and your first semester at Cal also goes by fast! So, if you need help, use the available resources as soon as possible – TA office hours, mid-term review sessions, undergraduate chemistry tutoring, etc. Delay is the usual cause of real problems. Our mid-terms come along about every 4 weeks...

### Graduate Student Instructors

#### **Michael Moore**

Head GSI

Office Hours: Mon 5:30-6:30 pm

Hildebrand B46

michael.moore@berkeley.edu

#### **Erika Warrick**

Section 106 - Mon 1-5 pm - Rm F

Office Hours: Wed 3-4 pm

Bixby South

warricke@berkeley.edu

#### **Philip Mudder**

Section 103 - Tue 8-12 pm - Rm G

Office Hours: Thursday 3-4 pm

Bixby South

pmudder@berkeley.edu

#### **Jenny Lin**

Section 104 - Tue 8-12 pm - Rm F

Office Hours: Tue 1-2 pm

Bixby South

lin.jenny@berkeley.edu

#### **Marcus Carr**

Section 105 - Tue 1-5 pm - Rm F

Office Hours: Mon 1:30-2:30 pm

Stanley B1 Atrium

carr@berkeley.edu

#### **Ashley Hoover**

Section 110 - Thurs 10-2 pm - Rm G

Office Hours: Tue 10-11 am

Bixby South

amhoover@berkeley.edu

#### **Benjamin Cotts**

Section 108 - Thurs 1-5 pm - Rm F

Office Hours: Tue 11-12 pm

Bixby South

cottsb@berkeley.edu

#### **Andrew Wong**

Section 111 - Thurs 3-7 pm - Rm G

Office Hours: Fri 11-12 pm

Bixby South

andrew.b.wong@berkeley.edu

#### **Marissa Weichman**

Section 109 - Fri 1-5 pm - Rm G

Office Hours: Wed 4-5 pm

Bixby South

marissatheGSI@gmail.com

#### **Nik Hlavacek**

Section 101 - Fri 2-6pm - Rm F

Office Hours: Thurs 10-11 am

TBA

nik.hlavacek@berkeley.edu

# Chemistry 4A Fall 2012: Course Outline

Readings are from *Principles of Modern Chemistry* (Oxtoby et al), unless otherwise noted.

## 1. A Reminder about Stoichiometry

8/24: Moles, molecular formulas and chemical equations.

Week 1 reading: Chapters 1-2

## 2. Elementary ideas of chemical bonding

8/27: Electronegativity and ionic bonding

8/29: Covalent bonding and Lewis structures

8/31: Molecular shape

Week 2 reading: Chapter 3

## 3. Quantum concepts – I

9/3: Labor Day Holiday (no lecture)

9/5: Waves, electromagnetic radiation, blackbody radiation, Planck relation

9/7: Photoelectric effect, quantization in atoms, the Bohr atom and atomic spectra

Week 3 reading: Chapters 4.1-4.3

## 4. Quantum concepts - II

9/10: Diffraction and the de Broglie relation

9/12: Schrodinger equation and quantum mechanics of a particle in a 1-D box

9/14: Particles confined in 2-D/3-D and the harmonic oscillator

Week 4 reading: Chapters 4.4-4.7

## 5. Atomic structure

9/17: Energy levels of 1-electron atoms

9/19: Energy levels of many-electron atoms, periodicity

9/21: **Mid-term 1**

Week 5 reading: Chapter 5

## 6. Chemical bonding in molecules – I

9/24: Molecular bonding – first concepts (Born-Oppenheimer, valence bond)

9/26: VSEPR descriptions of molecular structures

9/28: Molecular orbital description of simplest chemical bonds

Week 6 reading: Chapters 6.1 – 6.8

## 7. Chemical bonding in molecules - II

10/1: Orbital Hybridization and MO diagrams for polyatomic molecules

10/3: Bonding in organic molecules and aromaticity

10/5: Molecular vibrations and rotational energy levels

Week 7 reading: Chapters 6.9-6.12, 7.1-7.5, 8, 20.3

## 8. Introduction to Molecular Spectroscopy

10/8: Introduction, Rotational and vibrational spectroscopy

10/10: Electronic spectroscopy

10/12: **Mid-term 2**

Week 8 reading: Chapter 20

## 9. Gases and Earth's Atmosphere

10/15: Structure & Spectroscopy of Earth's Atmosphere  
10/17: Gas Laws  
10/19: Kinetic theory of gases  
Week 9 reading: Chapters 20.6, 9

## 10. Intermolecular forces and phase transitions

10/22: Real gases, intermolecular forces  
10/24: Phase transitions  
10/26: Colligative properties, Raoult's and Henry's Laws  
Week 10 reading: Chapters 9.6-9.7, 10, 11.5-11.7

## 11. Thermodynamics 1: Energy

10/29: Chemical bonds: World Energy Source  
10/31: The First Law of Thermodynamics  
11/2: Extracting Energy from Chemical Bonds  
Week 11 reading: Chapter 12

## 12. Thermodynamics 2: Entropy

11/5: Entropy and the Second Law  
11/7: Entropy Limits on Energy Use  
11/9: Heat Engines: Harnessing Chemical Energy  
Week 12 Reading: Chapters 13.1-13.6

## 13. Thermodynamics 3: Entropy

11/12: Veterans' Day Holiday (no lecture)  
11/14: Gibbs Free Energy: The Predictor  
11/16: **Mid-term 3**  
Week 13 reading: Chapter 13.7

## 14. Chemistry and Climate

11/19: Energy, Chemistry and the Earth's Carbon Cycle  
11/21: Climate Change  
11/23: **THANKSGIVING HOLIDAY**  
Week 14 reading: handouts will be posted on bspace

## 15. Equilibrium

11/25: Equilibrium  
11/27: Proton Transfer Equilibria: Acids and Bases  
11/29: Complex equilibria and the Ocean  
Week 15 reading: Chapters 14-16

## 16. RRR Week

12/5 – 12/9: **REVIEW WEEK**

## Final Exam: Cumulative

Monday, December 10  
3-6 pm  
Location TBA