Brandeis University, Department of Chemistry

CHEM 15B: Honors General Chemistry II, Spring 2017

Lectures: Monday, Wednesday, Thursday 10 – 10:50 AM, Wed. 6:30 – 7:50 PM, GZ 121
Recitations: Mo, We, or Th 10 – 10:50 AM (see Course Plan below) Gerstenzang 121
Instructor: Professor Klaus Schmidt-Rohr, Edison-Lecks 118A, srohr@brandeis.edu
Office hours: Tuesday, 4:15 – 5:15 PM & Thursday 1:00 – 2:20 PM; or by appointment.

TA: Gregory Hatzis, ghatzis@brandeis.edu
Office hours: Monday, 1 – 2 PM & Wednesday 2 – 3 PM, 1st floor of Shapiro Science Center

Course web site: On LATTE (http://lts.brandeis.edu/courses/newlatte/ or http://latte.brandeis.edu)

Textbook: Chemical Principles (Atkins, Jones, Laverman), 7th ed. (same as for CHEM 15A)

Course description: CHEM 15B is a continuation of CHEM 15A. We will discuss general aspects of chemical reactions, including: thermodynamic criteria that predict whether a reaction might occur or is forbidden; the dependence of the reaction rate on product concentrations and temperature (kinetics); thermodynamics and kinetics of chemical equilibrium; acid–base and solubility equilibria; and electrochemical reactions with their many applications. Then we will turn our attention to the nuclei and discuss radioactive isotopes, the energy of nuclei, and nuclear magnetic resonance spectroscopy. I will provide (outlines of) real explanations, sometimes at a fairly high level, but test mostly the standard material. The lectures are timed to prepare you for many of the experiments in CHEM 19B.

Prerequisite: A satisfactory grade (C- or better) in CHEM 15A or equivalent.

Attendance: Attendance of lectures and recitations is required. Lectures are meant to promote learning and will often provide explanations not included in the textbook. Please take your seat in time for start of class. An absence for medical reasons should be documented and discussed with the instructor before the missed class, to the extent possible. Simple quizzes may be given in class, to check and reward attendance. I encourage you to ask questions in class, or by email.

Expected effort: For this course, as for others at our university, you are expected to expend at least three hours of out-of-class effort (e.g. reading, working on problem sets, studying for exams, etc.) for each hour of classroom instruction (i.e. a minimum of 11.5 hours per week).

Homework: Homework will be assigned and posted weekly on LATTE. Homework will not be collected, but it is in your best interest to work the problems, in order to do well on the quizzes and exams. The answer keys will be posted on LATTE about one week after problems are assigned.

Quizzes: Quizzes will be given weekly during recitation except when an hour exam is scheduled. They will resemble the homework assigned in the preceding week.
Exams: There will be three in-class exams given on Wednesday evenings. Exams will be based on the material covered in lecture, recitation, homework/quiz problems, and textbook readings. If an exam is missed without a medical excuse or without prior arrangement with the instructor, a grade of zero will be recorded for that exam. If a student has a documented conflict (religious observance, sporting event, etc.) with a scheduled quiz/exam, s/he may take the quiz/exam shortly before or after the scheduled time, but only if the instructor has been informed at least one week in advance. In some cases, at the instructor’s discretion, the missed exam may be waived and the final grade will then be based on the other exams and assignments, each taking on a proportionally higher weighting.

All exams are closed-book, in the regular classroom, unless other instructions are given. **Bring a nonprogrammable calculator and enough writing implements to all quizzes and exams.**

No cell phones, laptops, iPhones, iPads or any other devices capable of remote communication or contacting the Internet are allowed in exams or quizzes.

Note: Illegible exams or quizzes will not be graded. All work must be presented reasonably neatly & logically.

Exams: There are three hour exams during the term, plus a comprehensive final exam.

**Make-up exams will be administered only in exceptional cases, which must be discussed with the instructor ahead of time or as soon as the conflict is known, and which absolutely require documentation.**

Grading: Quizzes: 10%; Hour exam 1: 18%; Hour exam 2: 18%; Hour exam 3: 18% Final exam: 36%

Final letter grades will be determined taking into account the posted grades in the hour exams, as well as the class average and the distribution of scores.

Regrade requests: You are always encouraged to carefully check the point totals on quizzes and exams, and inform me about incorrect totals, which I will check and correct. You may also request that an exam be regraded if you suspect errors in grading. The exam in question must be submitted to me, along with a note explaining what grading errors you suspect, within a week after the exam is returned. Note that the entire exam may be regraded.

Students with disabilities: *If you are a student with a documented disability on record at Brandeis University and wish to have a reasonable accommodation made for you in this class, please see me immediately. Please present your letter of accommodation to ensure provision of the accommodation. An accommodation cannot be granted retroactively. If you have questions about documenting a disability or requesting academic accommodations, you should contact Beth Rodgers-Kay in Academic Services (x6-3470 or brodgers@brandeis.edu).*

Academic integrity: You are expected to be honest in all of your academic work. Cheating (which includes copying or sharing information with a fellow student on an exam or quiz) will not be tolerated, since it is unfair to the other students. Please consult Brandeis University Rights and Responsibilities ([http://www.brandeis.edu/studentlife/srcs/rr/](http://www.brandeis.edu/studentlife/srcs/rr/)) for all policies and procedures related to academic integrity. Allegations of alleged academic dishonesty will be forwarded to the Director of Academic Integrity. Sanctions for academic dishonesty can include failing grades and/or suspension from the university.
I will try to teach the course in a way that you can succeed without cheating. If you attend lectures and recitations, and invest enough time into homework and exam preparation, you’ll do well. If all students do well relative to my standard from teaching similar classes before, all will get good grades (i.e., I won’t curve the grades down significantly). If you feel that we had not prepared properly for a quiz or exam problem, tell me (rather than trying to copy the answer from someone else).

**Communications:** If necessary, I will send you emails (out of LATTE). Lecture notes and other course-related materials will be posted on LATTE.

**Other policies**
Collaborative work: Collaboration with your peers on homework sets is welcome and encouraged. However, no “collaboration” is permitted on quizzes or exams.

Cell phones: Audible cell-phone use during class is distracting to other students and to me and is therefore not allowed. If I hear a cell phone, I reserve the right to confiscate the cell phone.

Laptops: Laptop use in class will be prohibited if I get the impression that it distracts students.

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**CHEM 15B Course Plan (Spring 2017)**

**January**

18, **Wed** AM: Course overview
Review: 1st law of thermodynamics
PM: 1st law of thermodynamics in chemistry

19, **Thu** Enthalpy changes; chemical energy; why combustion is exothermic

23, **Mon** Entropy; 2nd law of thermodynamics

25, **Wed** AM: *Recitation*
PM: Entropy of mixing; Gibbs free energy

26, **Thu** Gibbs free energy

30, **Mon** Gibbs free energy and spontaneous processes

**Feb. 1, Wed** AM: *Recitation*
PM: Chemical potential

2, **Thu** Chemical equilibrium

6, **Mon** Law of mass action

8, **Wed** AM: *Recitation; equilibrium calculations*
PM: Equilibrium calculations

9, **Thu** Le Chatelier’s principle

13, **Mon** Strong & weak acids & bases; acid–base equilibria

15, **Wed** AM: pH scale, $\text{pK}_a$
PM: **EXAM 1**

16, **Thu** pH buffers

20, 22, 23 (Midterm recess)

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**Atkins, Jones, Laverman:**

**Focus 4: Thermodynamics**

**Focus 5: Equilibrium**

**Focus 6: Reactions**

**Topic 5G**

**Topic 5I**

**Topic 5J**

**Topic 6A.1**

**Topic 6C**

**Topics 6B & 6D**

**Topic 6G**
Review of pH calculations
March 1, Wed AM: Titration
              PM: Polyprotic acids
2, Thu       Recitation
6, Mon       Solubility product
8, Wed       AM: Recitation: Review of redox reactions
              PM: Electrochemical cells
9, Thu       Standard reduction potentials
13, Mon      Thermodynamics of electrochemical reactions
15, Wed      AM: Recitation
              PM: Nernst equation
16, Thu      Concentration cells
20, Mon      Batteries
22, Wed      AM: Corrosion prevention
              PM: EXAM 2
23, Thu      Electrolysis & electrometallurgy
27, Mon      Reaction rate and its t-dependence;
              forward, reverse, & initial rate
29, Wed      AM: Rate constants, rate laws, reaction order
              PM: Integrated rate laws
30, Thu      Recitation

April 3, Mon Elementary reactions, reaction mechanisms
5, Wed       AM: Temperature dependence of reaction rates
              PM: Equilibrium from kinetics; catalysts
6, Thu       Recitation
10, 12, 13, 17 -- (Passover & spring recess & Patriots Day)
19, Wed      AM: Isotopes and energy of nuclei;
              magic numbers
              PM: -- (Brandeis Monday)
20, Thu      Nuclear fusion & fission; mass defect
24, Mon      Recitation
26, Wed      Radioactive decay; dangerous isotopes
              PM: EXAM 3
27, Thu      Radioactive isotopes and chemistry

May 1, Mon   NMR, stable isotopes with nuclear spin
3, Wed       AM: NMR spectroscopy, chemical shift
              PM: Course review
8, Mon      (very tentative date) Final Exam

Note: The dates on which the topics will be presented are tentative.