CH 131 Fall 2018
General Chemistry for the Engineering Sciences

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Lectures: Tuesday and Thursday 8:00-9:15 AM
Location: HAR 105

Course content: This course is intended to provide an intensive one-semester introduction to the fundamentals of chemical reactivity with special emphasis on macroscopic aspects of chemistry, chemical periodicity, simple models of chemical bonding, thermodynamic control of reactivity, and equilibria phenomena such as acid-base reactivity and electrochemistry. **Emphasis will be placed on developing the analytical tools required for the quantitative measurement and description of chemical reactions, the role chemical concepts play in connecting molecular structure to macroscopic properties, and for preparing you for your upper-level engineering courses.**

In the laboratory portion of the course, students will gain experience in measuring, interpreting and reporting chemical phenomena.

Some previous study of chemistry is assumed, competence in algebra, analytic geometry, and integral calculus is very helpful.

HUB Units/Tools Scientific I Outcome 1: Students will identify and apply the major concepts of general chemistry to understand phenomenon in the material world and to discover how the interplay of general chemistry and engineering can address real-world needs. This includes introduction to the way scientists explain chemical change at microscopic and macroscopic levels, differentiation between empirical laws and scientific theories, and strategies for exploiting fundamental chemistry to achieve desired results in realms spanning from day-to-day living to material science.

Quantitative I Outcome 1: Quantitative reasoning figures prominently in all aspects of this course: students deal with mathematical formulas and algebraic manipulation on a routine basis.

An important point of departure is stressing to students that quantities in the chemical and engineering sciences are associated with units: students are discouraged from simply plugging numbers into a mathematical formula in order merely to arrive at a numerical answer without taking into account the physical meaning of the quantity (grams, liters, moles, etc.) being calculated. The quantitative reasoning skills that follow from an appreciation of units include unit conversion and developing a fine feeling for the reasonableness of a calculated result.

The laboratory portion of the course stresses aspects of the theory of measurement. Students develop an understanding of the difference between precision and accuracy;

they employ statistical concepts (mean and standard deviation, confidence intervals, etc.) to assess the quality and reliability of data collected.

Quantitative I Outcome 2: Students present data collected in the laboratory in the form of tables and graphs. Computer use is encouraged so that the finished result is more easily edited, shareable, and interpreted by others.

Quantitative I Outcome 3: This outcome will be relevant in the lab reports the students write for each lab experiment.

Quantitative I Outcome 4: Students develop an understanding of experimental error, how to identify sources of experimental error, suggest changes to experiment design that will minimize uncertainty and unreliability. The statistical concepts (mean and standard deviation, confidence intervals, etc.) are brought to bear when evaluating the quality of data. Understanding the meaning and necessity of expressing quantitative results to the correct degree of significance is an important aspect of communicating results.

Course website: Blackboard. https://learn.bu.edu

Course texts and Supplies:

Principles of Modern Chemistry. D. W. Oxtoby, H. P. Gillis, and A. Campion. Thomson Brooks/Cole, Belmont, CA, 2008.

Principles of General Chemistry: A Laboratory Manual. B. Rubio. W.H. Freeman, New York, 2009. (Download at *Course website:* Blackboard. https://learn.bu.edu)

Study Guide and Student Solution Manual to accompany "*Principles of Modern Chemistry*". (Online version bundled with the text.)

A lab notebook that has the facility of making carbon-copy pages. "Laboratory Research Notebook", published by Jones and Bartlett and available at the BU Barnes & Noble bookstore is recommended.

Safety glasses that have side-shields and that are approved for lab use (i.e., meeting the ANZI Z87 standard). They can be purchased at the BU Barnes & Noble bookstore and at some hardware stores. **Safety glasses must be worn in the lab at all times!**

A calculator with 10^x, log, and ln functions. The ability to solve quadratic equations automatically is a timesaver; graphing capability is not necessary on the calculator.

A Turning point ResponseCard RF LCD (model: RCRF 03, manufactured by turning technologies) with license. This can be purchased at the BU Barnes and Noble Bookstore or online from Turning Technologies)

Lecture Schedule:

The course will cover topics from the first ~1-3 and 9-17 chapters of *Principles of Modern Chemistry* in nearly sequential order. The subject of these chapters will be organized as follows:

9/4/18 Lecture 1: INTRODUCTION & The Atom (Chapters 1 and 2)

9/6/18 Lecture 2: Chemical Formulas & Equations (Chapter 2)

9/11/18 Lecture 3: Chemical Bonding: The Classical Description (Chapter 3)

9/13/18	Lecture 4: Chemical Bonding: The Classical Description (Chapter 3)
9/18/18	Lecture 5: Chemical Bonding/Gases (Chapter 9)
9/20/18	Lecture 6: Gases (Chapter 9)
9/25/18	Lecture 7: Gases (Chapter 9)/ Solids, Liquids and Phase Transitions (Chapter 10)
9/27/18	Lecture 8: Solids, Liquids and Phase Transitions (Chapter 10)
10/2/18	**EXAM I (TUESDAY)**
10/4/18	Lecture 9: Solutions (Chapter 11)
10/9/18	NO CLASS – MONDAYS are TUESDAYS
10/11/18	Lecture 10: Solutions (Chapter 11)
10/16/18	Lecture 11: Thermodynamic Processes and Thermochemistry (Chapter 12)
10/18/18	Lecture 12: Thermodynamic Processes and Thermochemistry (Chapter 12)
10/23/18	Lecture 13: Spontaneous Processes and Thermodynamic Equilibrium (Chapter 13)
10/25/18	Lecture 14: Spontaneous Processes and Thermodynamic Equilibrium (Chapter 13)
10/30/18	**EXAM II (TUESDAY)**
11/1/18	Lecture 15: Chemical Equilibrium (Chapter 14)
11/6/18	Lecture 16: Chemical Equilibrium (Chapter 14)
11/8/18	Lecture 17: Acid-Base Equilibrium (Chapter 15)
11/13/18	Lecture 18: Acid-Base Equilibrium (Chapter 15)
11/15/18	Lecture 19: Acid-Base Equilibrium (Chapter 15)
11/20/18	Lecture 20: Heterogeneous Equilibrium; Solubility and Precipitation (Chapter 16)
11/22/18	NO CLASS Thanksgiving Recess
11/27/18	Lecture 21: Heterogeneous Equilibrium; Solubility and Precipitation (Chapter 16)
11/29/18	Lecture 22: Heterogeneous Equilibrium; Solubility and Precipitation (Chapter 16)
12/4/18	**EXAM III (TUESDAY)**
12/6/18	Lecture 23: Electrochemistry (Chapter 17)
12/11/18	Lecture 24: Electrochemistry (Chapter 17)
12/20/18	**Final**

Exams: **October 2, October 30, December 4 (8:00 AM – 9:15 AM).** These exams are based on chapters covered to the lecture before the exam (and since the previous exam). The **final** is currently scheduled for **Thursday, December 20, 2018, 9:00 AM – 11:00 AM. Room assignments will be given during the class prior to the exam.** The Final will cover all the topics discussed in the course including the concepts introduced in the laboratories. The exams are not open book. A sheet containing all equations and constants will be provided.

Grading System:

Point Distribution

Exam I	100
Exam II	100
Exam III	100
Final Exam	200
Laboratory	200
Total	700

Grading Scale

Letter grades	Cutoff	
A	630	(90% of 700)
A-	595	(85%)
B+	560	(80%)
B	525	(75%)
B-	490	(70%)
C+	455	(65%)
C	420	(60%)
C-	385	(55%)
D	350	(50%)
F	< 350	(<50%)

We implement the above absolute grading scale in the class. You are encouraged to check your total points on blackboard and to estimate your grade at any point during the course. It also provides an incentive for working together, rather than competing for grades.

Any question about a grade should be brought to the attention of the Professor Yang, Dr. Rubio, or the Teaching Staff within one week of earning the grade. Please prepare a written statement as to the reasons for the re-grade request. The entire work will be re-graded.

Makeup Exams: No makeup exams will be given. Unexcused absences will be assigned a zero score. Excused Exam grades will be given only in legitimate circumstances, such as illness and require attendance at an official BU activity (e.g., athletics). You must contact Prof. Yang as soon as possible before the exam, except for emergency situations, to discuss your situation. Appropriate documents may be needed to judge the merit of the excuse. More than one exam will not be excused. Missing the final exam cannot be excused. At the end of the semester, an excused grade will be replaced by the average score of the exams that you did take.

Calculators: Calculators can be used on the exams. It may or may not be faster to do a problem with a calculator. No phones/ipads/smart phones or other electronics can be used.

Bonus points

There are two ways to earn bonus points. (1) Each exam includes bonus questions of 10 points. (2) Clicker questions will be used in class. The main goal of using Clicker questions is to facilitate and stimulate in-class discussion. You can earn bonus points up to 20 points by participating and correctly answering Clicker questions. For each Clicker question, participation is worth 0.5 and the correct answer is worth 0.5.

Registering *Turning points* Clicker in blackboard and testing Clicker remotes in class are scheduled in the first week of class. We will start Clicker questions in class starting the second week. Turning points Clicker can be purchased at Textbook department at Barnes Noble at BU. Registration of your Turning points on blackboard is required in the first week.

Homework:

Problem sets and reading from the text are assigned for each chapter as below. Homework is not collected or graded. **Students are responsible to do all the problems in order to gain a quantitative understanding of the material**. It is the best way to master the chemical and physical concepts covered in this course. Solutions to the problems assigned can be found in the Student Manual.

Assignment #1
Read: 1.1–1.4, 3.1, A.1–A.3, B.1
Problems in Chap. 1: 5, 7, 11, 13, 15, 17, 19, 21
Problems on p. A.7: 1, 7, 11, 13, 17
Problems on p. A.19: 7, 9, 11

Assignment #2
Read: 2.1–2.6
Problems in Chap. 2: 1, 3, 7, 9, 11, 13, 17, 19, 23, 25, 31, 33, 35, 37, 39, 41, 43, 47, 49

Assignment #3
Read: 3.1–3.11
Problems in Chap. 3: 9, 15, 21, 23, 33, 39, 41, 43, 45, 47, 51, 53, 55, 57, 59, 61, 65, 69

Assignment #4
Read: 9.1–9.6
Problems in Chap. 9: 5, 9, 11, 19, 21, 25, 27, 31, 33, 35, 37, 41, 43, 49, 51, 53

Assignment #5
Read: 10.2–10.6
Problems in Chap. 10: 15, 17, 21, 23, 25, 27, 31, 35, 37, 39, 43, 45, 47

Assignment #6
Read: 11.1, 11.5–11.6
Problems in Chap. 11: 1, 3, 5, 11, 41, 43, 45, 47, 51, 53, 55, 57, 59, 61

Assignment #7
Read: 12.1–12.4, 12.6, 12.7.
Problems in Chap. 12: 1, 7, 9, 11, 17, 19, 21, 27, 31, 33, 35, 39, 43, 45, 47, 55, 57

Assignment #8
Read: 13.1–13.7
Problems in Chap. 13: 3, 9, 11, 13, 15, 17, 21, 25, 29, 31, 33, 35, 57

Assignment #9
Read: 14.1–14.9
Problems in Chap 14: 1, 5, 9, 11, 13, 15, 17, 19, 21, 25, 27, 31, 33, 39, 41, 45, 49, 51, 53, 61, 63, 65, 67

Assignment #10

Read: 15.1–15.7
Problems in Chap. 15: 1, 13, 15, 17, 21, 23, 27, 29, 31, 33, 35, 37, 39, 41, 51

Assignment #11
Read: 16.1–16.4, 16.6.
Problems in Chap 16: 3, 5, 7, 9, 13, 15, 17, 19, 21, 23, 25, 27, 31, 33

Assignment #12
Read: 17.1, 17.2, 17.4, 17.6
Problems in Chap. 17: 1, 3, 5, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 51, 53, 57

Section registration: Each CH131 student must be registered for four sections: the "AA" lecture section, a "B" discussion, a "P" pre-lab lecture, and an "L" laboratory. All questions regarding laboratory section scheduling should be directed to Dr. Rubio.

Discussion: A one-hour discussion section, taught by members of the Chemistry Department staff, will meet each week. Questions regarding all course material and problem sets can be addressed in these sections.

Monday discussion sections begin 10 September; Wednesday discussion sections begin 12 September; Friday discussion sections begin 7 September. The discussion times are:

Monday 12:20 PM–1:10 PM	KCB 104 (BA)
Monday 1:25 PM–2:15 PM	KCB 104 (B8)
Monday 3:35 PM–4:25 PM	CAS 116 (BC)
Wednesday 8:00 AM–8:50 AM	SCI 117 (BB)
Wednesday 10:10 AM–11:00 AM	MCS B25 (B7)
Wednesday 12:20 PM–1:10 PM	SED 212 (B1)
Wednesday 3:35 PM–4:25 PM	CAS 318 (B2)
Thursday 3:35 PM–4:25 PM	SAR 300 (B4)
Friday 8:00 AM–8:50 AM	SCI 117 (BD)
Friday 12:20 PM–1:10 PM	COM 217 (B3)
Friday 1:25 PM–2:15 PM	PRB 148 (B5)
Friday 2:30 PM–3:20 PM	COM 217 (B6)

Pre-Lab Lecture: Students attend one pre-lab lecture each week before performing the experiment. The pre-lab lectures, conducted by Dr. Rubio, present the theory of the experiments as well as practical advice for successfully and safely performing them. All questions regarding the laboratory component of the course should be directed to Dr. Rubio. The pre-lab lecture times are:

Tuesday 12:30 PM–1:20 PM	SCI 113 (P1)
Wednesday 2:30 PM–3:20 PM	CGS 511 (P2)

The first Tuesday pre-lab lecture is 4 September; the first Wednesday pre-lab lecture is 5 September.

Lab dress code: Lab safety dictates a rigorously enforced dress code whose essence is: *Don't show any skin.* The highly recommended, but not absolutely required, method of complying in part with the dress code is to **wear a lab coat**. Lab coats are available at the BU Barnes & Noble bookstore.

Lab times: Students attend lab once a week, either on Friday, Monday or Wednesday in SCI 268. You must attend the lab section for which you are registered. State laws, safety concerns and logistical constraints forbid overcrowding in the labs.

Monday 8:00 AM–10:45 AM	SCI 268D (LB)
Monday 2:30 PM–5:15 PM	SCI 268D (LA)
Monday 6:30 PM–9:15 PM	SCI 268A (LC)
Monday 6:30 PM–9:15 PM	SCI 268B (LD)
Monday 6:30 PM–9:15 PM	SCI 268C (LE)
Monday 6:30 PM–9:15 PM	SCI 268D (LF)
Thursday 3:30 PM–6:15 PM	SCI 268C (L4)
Thursday 3:30 PM–6:15 PM	SCI 268D (L5)
Friday 8:00 AM–10:45 AM	SCI 268B (L3)
Friday 8:00 AM–10:45 AM	SCI 268C (L2)
Friday 8:00 AM–10:45 AM	SCI 268D (L6)
Friday 11:15 AM–2:00PM	SCI 268D (L4)
Friday 2:30 PM–5:15 PM	SCI 268B (L1)

The first Monday labs meet on 17 September; the first Thursday labs meet on 20 September; the first Friday lab meets on 21 September.

Missed labs: A complement of make-up labs is currently scheduled for Monday 26 November, Thursday 29 November, and Friday Nov 30 November for those students who missed a regularly scheduled lab for a valid reason. Students are allowed to make up **ONLY ONE** missed lab.

Incompletes & withdrawals Incomplete grades require the instructor's approval on a form that specifies the work to be made up and a proposed time table for completing the work. An unsatisfied incomplete grade is automatically changed to a failing grade 12 months after the completion of the course. The last day to withdraw from the course **without a W grade is October 9th**; the Last Day to Change Standard Classes from Credit to Audit Status is **September 17**; the last day to withdraw from the course **with a W grade is November 9th**.

Misconduct: All students entering Boston University are expected to maintain high standards of academic honesty and integrity. It is the responsibility of every student in this course to be aware of the Academic Conduct Code's contents and to abide by its provisions, as detailed in *Student Academic Handbook*. Instructors must report all cases of suspected academic misconduct to the Academic Conduct Committee, which will investigate and take appropriate action.
http://www.bu.edu/academics/resources/academic-conduct-code/