

MITx
3.091X – Introduction to Solid State Chemistry
September 7, 2016

1 Welcome!

3.091X is a first-year course where chemical principles are explained by examination of the properties of materials. The electronic structure and chemical bonding of materials is related to applications and engineering systems throughout the course. The material taught in 3.091X is equivalent to that taught in the MIT class 3.091. The on-campus version has been taught for more than 40 years and is one of the largest classes at MIT. The class will cover the relationship between electronic structure, chemical bonding, and atomic order, and characterization of atomic arrangements in crystalline and amorphous solids: metals, ceramics, semiconductors, and polymers (including proteins). There will be topical coverage of organic chemistry, solution chemistry, acid-base equilibria, electrochemistry, biochemistry, chemical kinetics, diffusion, and phase diagrams. Examples will be drawn from industrial practice (including the environmental impact of chemical processes), from energy generation and storage (e.g. batteries and fuel cells), and from emerging technologies (e.g. photonic and biomedical devices).

2 Prerequisites

High School Algebra / Precalculus

3 Course Overview

The course is organized by weeks. To keep pace with the class, you are expected to complete all the work by the due dates indicated. Homework must be completed by Sunday night, 11:30 PM (EST) approximately two weeks after they are posted. For individual due dates, see the Schedule or the left-hand side navigation in the Courseware tab. Weekly coursework includes:

- Interactive learning sequences;
- Readings from the textbook and notes;
- Homework.

The course will also have two midterm exams and a final exam. Those who successfully earn enough points will receive a certificate of mastery from MITx.

4 Interactive learning sequences

Videos are presented in interactive learning sequences (or *sequences* for short), and are posted in the *Courseware* section of the website. Each sequence includes a succession of short video clips and online exercises, arranged in a logical progression. Please take the time to watch each video and each exercise in the sequence they are provided. Answer-check mechanisms are provided in these exercises, but they will not contribute towards your grade.

5 Textbook and notes

The class materials for this course consists of two “textbooks”:

- General Chemistry: Principles, Patterns, and Applications V1.0.1, authored by Bruce Averill and Patricia Eldredge

- 3.091 Lecture Notes, authored by various 3.091 professors at MIT in the past 40 years.

Online versions of both of these textbooks are available, free of use, in the tabs marked Textbook: Averill and Textbook: Readings on the 3.091x website. If you would like to purchase a physical textbook, Flat World Knowledge has created a page specifically for 3.091x:

<http://students.flatworldknowledge.com/course/1170663?mooc=1>

Note: There is also a .pdf download of the Averill Textbook on the Course Info page, available under a Creative Commons License. However, 3.091x was designed to work with the online version on the 3.091x website, not this .pdf version – thus, this .pdf version has not been vetted to make sure that all equations, figures, and text matches closely to the official online version. We make the .pdf available so those of you with slower internet connections can still access a form of the textbook.

6 Homework

A variety of chemistry problems will be assigned as homework. They will be issued at the start of most weeks, in the *Courseware* section under their corresponding weeks. **Late submissions in any format will not be accepted.**

While collaboration is welcomed and encouraged, **you are not allowed to post full solutions.** In the forums when discussing homework, talk through your approach to solving a problem and any comments you may have regarding the science behind a problem. Many times in forcing yourself to think logically about explaining your problem to others, you end up answering your own questions!

7 Data to be used for solving problems

There are a number of sources on the web for fundamental data needed to solve problems. Please only use resources provided in the course materials for such data. These include the table of [physical constants](#) and the [periodic table of the elements](#) with links on the landing page. The reason is that there are slight differences among the values from various sources. These differences can lead to problem answers that are outside of the set tolerances. If you use such data and get an incorrect answer, we can't give you credit.

8 Midterms and Final Exam

A significant portion of your final grade in 3.091x will be determined by the midterms and the final exam. The course calendar lists when the exam deadlines are. Exercises and homework are critical to learning the material and for doing well on the exams. Once you view an exam, you must work on your own until you have submitted all your work, and do not discuss the exam until the deadline for exam submissions is past. While the exams will be open book, we encourage you to create a couple of sheets of notes for each exam. These notes will not only help you prepare, but they will also serve as a convenient reference during the exam. You may use a calculator if needed.

You are not allowed to post answers to exam problems. Collaboration of any form is strictly forbidden in the midterms and the final exams.

9 Discussion Forum

We will provide a discussion forum on our website for all students of 3.091X. You

may use these forums to discuss course concepts, problem solving approaches, interesting references, or other topics related to the course. You may just use it to ask questions. Please observe the appropriate online etiquette as outlined in the Forum Guidelines posted in the Course Handouts section of Course Info tab. The forum is moderated by course staff and community TAs.

10 Grading

Letter grades will be based on the following weighting: homework 30%, midterms 20% each, and final exam 30%. Each of the homework carries equal weight. You will need to get a total mark of 60% for a C, 70% for a B, and 87% for an A.

Homework will be graded based on the best seven out of eight individual grades. Therefore, one homework assignment may be missed without a grade penalty.

11 Certification

Online learners who achieve a passing grade in 3.091X earn a certificate of mastery. These certificates will indicate you have successfully completed the course, but will not include a specific grade. Certificates will be issued by edX under the name of MITx. For the courses in Fall 2016, honor code certificates will be free.