Welcome to 3.091
Donald R. Sadoway
John F. Elliott Professor of Materials Chemistry
Dept. of Materials Science & Engineering (Course III)

born Toronto, Ontario, CANADA

attended University of Toronto

1972 B.A.Sc. (Engineering Science)
1973 M.A.Sc. (Chemical Metallurgy)
1977 Ph.D. (Chemical Metallurgy)

1977 NATO Postdoctoral Fellow, MIT
1978 joined MIT faculty
basic research:

*electrochemistry* in nonaqueous media

molten salts & polymers

applied research:

- environmentally sound technologies for extraction, refining, and recycling of metals

- lithium solid polymer batteries

- production of oxygen, structural metals, and photovoltaic materials from lunar & Martian soils
workmanship

\[ \downarrow \]

performance \(= f(\text{design, construction})\)

\[ \uparrow \]

choice of materials

\[
\begin{align*}
\text{composition} & \quad + \\
\text{atomic arrangement} &
\end{align*}
\]

\[ \Rightarrow \]

properties

\textit{the thesis of 3.091:}

electronic structure of the elements holds the key to understanding

\[ \Rightarrow \text{syllabus} \]
3.091 Syllabus

- 1. General Principles of Chemistry
- 2. Solid State Chemistry: Basic Concepts and Applications
3.091 Introduction to Solid State Chemistry
Fall Term 2004

**Lecturer**  Professor Donald R. Sadoway


**Lectures**  Monday, Wednesday, and Friday, 11:00-12:00 (L01)
               Monday, Wednesday, and Friday, 1:00-2:00 (L02)
Recitations  Sections meet on Tuesdays and Thursdays each week. See separate listing for times, instructors, and locations. Students have been assigned to lecture and recitation sections by the Registrar. Movement between lecture and recitation sections is allowed only with permission which can be obtained by meeting with one of the Subject Administrators.

Underpopulated
Sections  Section 21 TR 2
        Section 32 TR 1
        Section 33 TR 11

Complementary Subject STS.021 History, Society and Solid State Chemistry
TR 11  CI-H
**Homework**  Weekly. Distributed along with model solutions in recitation. One week later, in recitation, students will take a 10-minute quiz based on the subject matter of the homework. The scores on these weekly quizzes will count as the “homework” portion of the cumulative grade in the subject. All scores count -- no dropping of lowest score(s) from the average.
3.091 Homework No. 1

- assigned September 8
- tested September 14

from SBR Core Text:

Ch. 1  # 9, 39, 47-51, 62, 88
Ch. 2  # 83, 102, 123, 129, 173

- issued along with model solutions
Tests

#1 Wednesday, September 29, 11:05-11:55 (L01); 1:05 - 1:55 (L02).
#2 Wednesday, October 27, 11:05-11:55 (L01); 1:05 - 1:55 (L02).
#3 Wednesday, November 17, 11:05-11:55 (L01); 1:05 - 1:55 (L02).

permissible aids: periodic table, table of constants, one sheet of paper calculator

FINAL EXAM: 3 hours. Time and location to be set by the Registrar and published by October 1. Final Exam Period is December 13 – 17. Do not plan to leave town until after your last final.
Grading  Freshmen -- Pass/No Record
(Institute requirement for Pass is performance at C level or better)

Upperclassmen -- A, B, C, D, F

Final grade composition:
  16.75% homework
  16.75% each for three tests
  33% final exam

Passing grade (C-level) = 50% absolute (no grading on a curve)
Academic Honesty

It is expected that students in 3.091 will maintain the highest standards of academic honesty. In particular, it is expected that in the course of taking a test or examination, students will not (1) accept information of any kind from others; (2) represent as their own the work of anyone else; or (3) use aids to memory other than those expressly permitted by the examiner. Following a test or examination, students will not try to deceive the teaching staff by misrepresenting or altering their previous work.

Departures from the above standards are contrary to fundamental principles of MIT and of the scientific community at large. Such departures are considered serious offenses for which disciplinary penalties, including suspension and expulsion, can be imposed by the Institute.

Classroom Behavior

To maintain a fertile learning environment in a lecture theater seating as many as 450 people, it is necessary for the instructor to expect adherence to certain rules of conduct. During lecture, students may not (1) hold conversations; (2) consume food or drink; (3) engage in disruptive behavior. Wireless communications devices must be silenced. Violations will not be tolerated.
3.091 Introduction to Solid-State Chemistry
Prereq: –
U (Fall, Spring)
5-0-7 CHEMISTRY
recipe for success: 
venues for learning

lecture
recitation
reading
homework
weekly quizzes
monthly tests
final exam
recipe for success:
venues for learning

DRS  lecture
      recitation
      reading
      homework
weekly quizzes
monthly tests
final exam
recipe for success:
venues for learning

DRS lecture
staff recitation
reading
homework
weekly quizzes
monthly tests
final exam
recipe for success:
venues for learning

DRS lecture
staff recitation
you reading
homework
weekly quizzes
monthly tests
final exam
recipe for success:
venues for learning

DRS lecture
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you reading
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monthly tests
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DRS lecture
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final exam
recipe for success: venues for learning

DRS lecture
staff recitation
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you weekly quizzes
you monthly tests
you final exam
recipe for success:
venues for learning

DRS  lecture
staff  recitation
you   reading
you   homework
you   weekly quizzes
you   monthly tests
you   final exam

StackSize partnership!!!
Education is what remains when you have forgotten all your schooling.

- Benjamin Franklin
today’s lecture

taxonomy

classification

nomenclature

❖ William Shakespeare
origins of chemistry

* ancient Egyptian hieroglyphs refer to *khemeia*: chemical processes for embalming the dead

* khemeia expanded to other chemical processes, especially, metals extraction
basic research:

*electrochemistry* in nonaqueous media

- molten salts & polymers

applied research:

- environmentally sound technologies for *extraction, refining, and recycling of metals*

- lithium solid polymer batteries

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origins of chemistry

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~ 2400 years ago
1776

H

Fe Co Ni Cu Zn

Ag

Pt Au Hg

C N O

P S

As

Sn Sb

Pb Bi
1776

12, 13, 14 C alchemists
12, 13, 14 C alchemists

pre-Columbian South America

13th C India

1776

Fe Co Ni Cu Zn

Ag Pt Au Hg

C N O

P S

As Sn Sb Pb Bi
1776

13th C India

discovered
1735 1751

C N O

P S

As

Sn Sb

Pb Bi

Fe Co Ni Cu Zn

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Pt Au Hg

12, 13, 14 C alchemists

discovered
1772 1774

1766

discovered
1772 1774

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13th C India

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Fe Co Ni Cu Zn

pre-Columbian South America

Pt Au Hg

12, 13, 14 C alchemists

discovered
1772 1774

1766

discovered
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other classifications:

* “triads” 1829, Döbereiner (Jena)
other classifications:

* “triads” 1829, Döbereiner (Jena)
* “octaves” 1864, Newlands (London)
<table>
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**Note:** The image contains a periodic table of elements.
other classifications:

* “triads” 1829, Döbereiner (Jena)
* “octaves” 1864, Newlands (London)
* “periodic table”
  1869, Mendeléef (St. Petersburg)
  1870, Meyer (Tübingen)
Л. И. Менделеев (60-е годы).
но въ виду, мѣшкяя вмѣстѣ, уже ясно выражается примѣнность выравнивающего мною начала къ всемъ соотвѣствующимъ элементамъ, какъ который изъ нихъ съ удобствомъ. На этотъ разъ я и желалъ преимущественно найти общую систему элементовъ. Вотъ этотъ список.

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Въ этомъ предыдущемъ случаѣ можно увидѣть разнообразное изображеніе различныхъ разностей, которые входятъ въ главное числа предыдущей таблицы. Эти числа представляютъ при составлении системы не-ви-що простыхъ чиселъ. Такъ какъ въ другомъ случаѣ, мѣшкяя вмѣстѣ, находимъ естественные составляющія элементы системы (такимъ образомъ съ несходства), но и соотвѣтствія для ея образования нельзя идти на ихъ мѣстѣ въ результатѣ. Слѣдовательно, для системы могутъ полагать то разнообразное соотвѣтствіе, какое разумно при введеніи основанія параллельности, на основаніи которой ей, выказыванной въ этой статьѣ.

<table>
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Д. И. Менделеев.
Портрет работы И. Е. Репина.