INSTRUCTOR: Dr. Paul Charlesworth, addressing me as “Paul” is OK
OFFICE: 701C Chemical Sciences, PHONE: 2702
EMAIL: pcharles@mtu.edu please Put “CH103” in the title
WWW: http://www.chem.mtu.edu/chemistry
WebCT:http://courses.mtu.edu All online materials will be distributed through the WebCT system.
LECTURE TIMES: M W F: 2 – 3 p.m. in EERC 103
RECITATION TIMES: T: 1 – 2 p.m. and 2 – 3 p.m. in CHEMSCI 101

Introduction:
Welcome to CH103 Fall session, I hope that you will find the material presented during this class both stimulating and valuable to your future classes and careers. I do not know what you have heard about this class from people who have taken it during recent years. The class has again been rearranged to improve relevance, value and challenge.

The prerequisite for this course is a satisfactory performance in CH102. If one or more years have passed since you studied CH102 you must make sure that you are familiar with all the important concepts covered in the prerequisite. In particular, please ensure you are familiar with the following:

- Atomic structure, the periodic table, writing balanced chemical equations involving states of matter and solubility rules, even from word problems.
- The mole, mole calculations, stoichiometry, limiting reagents and word problems involving balanced equations.
- Solids, liquids and gases including intermolecular forces, crystal types and structures.
- Basics of kinetics including rate, concentration and catalysis.
- Basics of equilibria including equilibrium constant, reaction quotient, Le Chatelier’s principle, calculations and the relation to kinetics, and mechanisms.
- Basics Solutions including factors affecting dissolution, and colligative properties.
- Chemistry of acids and bases including Arrhenius, Brønsted and Lewis concepts; the pH scale and neutralization reactions.
- Thermochemistry, entropy and free energy including energy, heat, work, heats of reaction, heat capacity, Hess’s law, relationship to electrochemical processes, equilibrium and kinetic processes; and reaction spontaneity.
If any of the above are unfamiliar to you then you should brush-up on this material in addition to the CH103 material, we have no class time set aside for this purpose.

Policies and Procedures:
A significant portion of your grade will be based upon the online quizzes and exams. If you feel that you do not wish to take the online exams, you may request a written exam that can be taken under normal exam conditions. The grade structure and grade scale are presented below. The nature of each component of the grade structure is also outlined below.

- To allow for incidents, we will drop the lowest recitation quizzes. If you miss a quiz for any reason, this will be your drop. Missing more than those dropped will hurt your grade.
- The online exams are to be taken at during a set period of time (usually two days), failure to complete the exam in the allotted time will result in an automatic 10% per day penalty.
- Grade structure and scale is based on the results obtained in the Spring 98/Fall 98 CH103 classes:

<table>
<thead>
<tr>
<th>GRADE STRUCTURE:</th>
<th>GRADE SCALE:</th>
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<tbody>
<tr>
<td>Weekly quizzes: 100 pt.</td>
<td>A: 88 - 100 %</td>
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<tr>
<td>Recitation quizzes: 100 pt.</td>
<td>AB: 86 - 88 %</td>
</tr>
<tr>
<td>Pop-quizzes &amp; Surveys: 100 pt.</td>
<td>B: 76 - 86 %</td>
</tr>
<tr>
<td>One-hour exams: 300 pt.</td>
<td>BC: 74 - 76 %</td>
</tr>
<tr>
<td>ACS Standardized exam: 100 pt.</td>
<td>C: 60 - 74 %</td>
</tr>
<tr>
<td>Final exam: 200 pt.</td>
<td>CD: 58 - 60 %</td>
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<tr>
<td>Total: 900 pt.</td>
<td>D: 50 - 58 %</td>
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- Weekly online quizzes will cover material from the current and previous week that you may see on the next exam. You may work with friends, classmates, a coach, and even ask the instructor for help at anytime. Please remember you must submit the online work before the 12pm deadline on Tuesday prior to recitation.
- Recitation quizzes will cover material from the current and previous week that you may see on the next exam. Among other things we will use an active learning approach where you will complete the question (where required) and offer it to your class partner for them to complete. Your instructor will explain this in more detail during the first recitation.
- Pop-quizzes and surveys of methods used will be given in lecture and online. Your instructor is interested in chemical education methodology and technology, and wants your help to improve the quality of chemistry education at MTU. We have started this by providing Redi-Notes, WebCT, and PowerPoint lectures. Your feedback will be of great value, and we will offer class credit as our way of saying thank you.
- One-hour exams will be taken online. You will have two days to complete the exam and associated survey.
- The 55 minute American Chemical Society Examination, in General Chemistry covers the entire year, CH101-103. It covers, in approximately equal measure, descriptive chemistry, stoichiometry and thermochemistry, atomic and molecular structure and periodicity, solutions and states of matter, acids/bases and equilibrium, kinetics and thermodynamics, redox and electrochemistry. Review for this exam during the term is highly recommended.
- The two-hour final exam will test all material covered in the CH103 course and any CH101/102 concepts used during CH103. The exact format will be announced in class.
- A single 3x5-inch card, which is HANDWRITTEN, will be permitted for ALL hand-written exams except the American Chemical Society Examination. No cards that are reproduced mechanically, optically or any other way will be permitted. You may use a calculator in ALL exams except when specified.

The Chemistry Learning Center hours will be provided at the first class session and posted on the CLC door. The CLC is a valuable resource, use it. You may access the CLC & Textbook Information sites from the chemistry homepage at http://www.chem.mtu.edu/chemistry. Class notes and lecture outlines will be
available at this site. I am often in the Chemistry Learning Center and will hold “office hours” Monday and Wednesday evenings in the CLC.

**Practice Problems.**

It is very important to familiarize yourself with different types of problems. For many topics, you will be provided with handouts containing appropriate problems that will not be from your textbook. You must decide which problems from the textbook you wish to do. I have provided suggested reading; problems are integrated into the text and at the end of each chapter. I suggest you work through enough that you are confident in your skills. Do not rely on the study guide to plot a course to the correct answer. If you are having problems call for human help. It is recommended that you work one with answer and then one with out. You can always check with a coach to see if it is correct. The WebCT system is being developed to provide you with additional help, please make use of this as it becomes available.

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**At long last**

We have sufficient quantity for each of you to have your own. Guard it well.

These tuits have been hard to come by, especially the round ones.

**A ROUND TUIT**

This is an indispensable item. It will help you to become a much more efficient student. For years now we have heard people say *I’ll do it when I get round tuit,*

Now that you have a round tuit of your own, many things that have needed to be accomplished will get done.

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*Don’t leave your studying until the very last minute.*

*If you have any problems, talk to someone who can help.*

**Good Luck to you all.**
Assignment Schedule.

Recitation problem material for the following weeks recitation will be announced in class.

Sept. 14: Weekly Online Quiz 01 due before 12.00pm
Prepare Recitation Problems.

Sept. 21: Weekly Online Quiz 02 due before 12.00pm
Prepare Recitation Problems.

Sept. 28: Weekly Online Quiz 03 due before 12.00pm
Prepare Recitation Problems.

Oct. 05: Weekly Online Quiz 04 due before 12.00pm
Prepare Recitation Problems.

Oct. 12: Weekly Online Quiz 05 due before 12.00pm
Prepare Recitation Problems.

Oct. 19: Weekly Online Quiz 06 due before 12.00pm
Prepare Recitation Problems.

Oct. 26: Weekly Online Quiz 07 due before 12.00pm
Prepare Recitation Problems.

Nov. 02: Weekly Online Quiz 08 due before 12.00pm
Prepare Recitation Problems.

Nov. 09: Weekly Online Quiz 09 due before 12.00pm
Prepare Recitation Problems.

Nov. 16: Weekly Online Quiz 10 due before 12.00pm (May be cancelled because of exam week).

Exam Schedule.

The online exams take place approximately every 3 weeks. They will cover material introduced to you right up to the proceeding Friday and covered in some part by the appropriate homework and quizzes. The final is broken into two parts; the 55-minute ACS standardized exam and online comprehensive final. Students may elect to take the timed, handwritten exams in preference to online exams. Exam due dates have been set and are as follows:

Sept. 22: Written exam 01 from 6.00pm to 8.00pm for those electing this format.
Online exam 01 is due at 8.00pm.

Oct. 13: Written exam 02 from 6.00pm to 8.00pm for those electing this format.
Online exam 02 is due at 8.00pm.

Nov. 03: Written exam 03 from 6.00pm to 8.00pm for those electing this format.
Online exam 03 is due at 8.00pm.

Nov. 12: ACS Standardized Test. Do not make any plans that will result in you missing this exam.
Nov. 15: Written final exam for those electing this format. Online final exam is due at 7:15pm.
Tentative Lecture Schedule:
The instructor will attempt to address all points listed below. However, in the interest of remaining on schedule, material may be truncated to facilitate starting each new unit on, or before the day stated.

**Unit 01 (Sept. 07 – Sept. 24)**
**Acids and Bases:**
- Autoionization (15.2)
- pH – A measure of acidity (15.3)
- Ionization constants and Acid-base strength (15.4 – 15.7)
- Diprotic and polyprotic acids (15.8)
- Molecular structure and acid strength (15.9)
- Acid-base properties of salts (15.10)

**Equilibria and Solubility:**
- Common ion effect and buffers (16.2, 16.3)
- Acid – base titrations (16.4, 16.5)
- Solubility equilibria (16.6)
- Fractional Precipitation (16.7)
- Common ion effect and solubility (16.8)

**Quantitative Analysis.**
- Solubility product in qualitative analysis
- The essence of analysis and reading a problem
- Gravimetric and titrimetric methods
- Electrochemical methods
  (Practice problems available on the web site)

**Unit 02 (Sept. 27 – Oct. 15)**
**The Chemistry of Metals:**
- Metallurgical Processes (20.1, 20.2)
- Band theory of conductivity (20.3)
- Periodic trends (20.4 – 20.7)
- Transition metal Properties (22.1, 22.2)
- Coordination compounds (22.3 – 22.7)

**The Chemistry of Non-Metals:**
- Carbon (21.3)
- Nitrogen and phosphorus (21.4)
- Oxygen and sulfur (21.5)
- The halogens (21.6)

**Unit 03 (Oct. 18 – Nov. 12)**
**Organic Chemistry:**
- Orbital hybridization
- Aliphatic and aromatic hydrocarbons (24.2, 24.3)
- Functional Groups (24.4)
- Reactions of aliphatics (24.2 + WebNotes)
- Reactions of aromatics (24.3 + WebNotes)
- Reactions of functional groups (24.4)

**Spectroscopic Methods:**
- Spectroscopic fundamentals (7.1-7.4 + WebNotes)
- UV-Visible Spectroscopy (7.1-7.4 + WebNotes)
- Infrared Spectroscopy (7.1-7.4 + WebNotes)
- NMR Spectroscopy (7.1-7.4, 24 + WebNotes)

**Spectroscopic Analysis:**
- This last week will involve application of the methods developed during the previous nine weeks to real and hypothetical situations in science and industry.
**Suggested Textbook Problems:**

It is suggested that you attempt as many review questions as you can from the textbook, from the handouts, and from the online materials. I have suggested mainly odd numbered textbook problems (*they are different to review problems*) here, you may elect to attempt the even numbered problems, but do not be tempted to reverse-engineer your answer from the back of the book. Trust me, it will not help you much. If you need answer keys, they are in the Chemistry Learning Center.

**Unit 01 (Sept. 07 – Sept. 24)**

- **Chapter 15:** 3, 5, 7, 15, 17, 19, 23, 25, 31, 33, 35, 41, 43, 45, 47, 51, 53, 59, 61, 65, 67, 75, 77, 79
- **Optional:** 93, 95, 101, 105, 115, 119, 121, 123, 127, 129, 133

- **Chapter 16:** 3, 9, 11, 13, 15, 17, 21, 23, 25, 27, 41, 43, 45, 47, 49, 51, 55, 57, 59, 61, 63, 67, 69, 87, 93
- **Optional:** 83, 89, 91, 97, 103, 107, 109, 111, 113

**Quantitative Analysis:** See handouts and web site.

**Unit 02 (Sept. 27 – Oct. 15)**

- **Chapter 20:** 11, 13, 15, 16, 17, 19, 20, 21, 22, 27, 29, 33, 35, 39, 45, 47, 51
- **Optional:** 53, 57, 58, 63, 69

- **Chapter 21:** 25, 27, 29, 31, 33, 39, 43, 45, 47, 49, 53, 55, 57, 65, 67, 69, 71, 73, 75, 77, 81, 83, 85, 89
- **Optional:** 91, 93, 97

- **Chapter 22:** 1, 2, 4, 5, 6, 11, 13, 15, 17, 23, 25, 33, 35, 37, 45
- **Optional:** 49, 51, 53, 55, 59, 63, 65

**Unit 03 (Oct. 18 – Nov. 12)**

- **Chapter 24:** 3, 5, 6, 7, 11, 12, 13, 14, 15, 17, 19, 21, 23, 25, 27, 30, 31, 32, 35, 39, 41, 42, See handouts and web site for additional problems.
- **Optional:** 43, 45, 47, 49, 51, 53, 55, 59, 61, 63

**Spectroscopic Methods:** Chapter 7: 1, 2, 4, 6, 7, 8, 9, 14, 15, 16, 17, 19, 21, 22, 25, 29, 31, 33, See handouts and web site for additional problems.

**Spectroscopic Analysis:** See handouts and web site for associated problems.