Michigan Technological University Chemistry Department’s Syllabus
1400 Townsend Drive
Houghton, Michigan 49931-1295
www.chemistry.mtu.edu

1. Course Number, Title, Semester, and Year.

CH1120 University Chemistry II, Summer, 2009. MTWRF 9:35-10:35
This course is a second level course in the chemistry department’s listing of courses for the chemistry major
certified by the American Chemical Society (ACS) and other majors requiring two semesters of chemistry.

2. Instructors, Address, Telephone Number, and Office Hours.

Course Lecturer: Rudy Luck, 19-701b, (487-2309)
rluck@mtu.edu

Office Hours: M,T,W,R,F 1:00 PM - 2:00 PM

Lab Supervisor: Lorri Reilly, 19-508B, (487-2044) lareilly@mtu.edu

3. Purpose of this Syllabus.

Welcome to University Chemistry II. This syllabus outlines the content of the course and contains the rules
and regulations by which your performance will be assessed. It is important that you spend some time reading this in
order to understand how the course is graded and when assignments are due. Furthermore, by having this detailed
description of the course, you are in a position to read the relevant chapters in advance of the discussion of material
in the lectures. This is helpful for a thorough comprehension of the course and it also helps you to comprehend the
material faster and not be lost during the lectures.

4. Introduction.

This course completes an introduction to freshman chemistry, which was started in University Chemistry I,
CH1110, and includes studies on reaction rates, equilibrium and its relation to thermodynamics, chemistry of the
environment, acid-base chemistry, electrochemistry, nuclear chemistry, inorganic and organic chemistry. The course
builds a sound foundation of vocabulary and conceptual knowledge in chemistry and students will attain an
understanding of equilibria, solubility, radiation, and, classical inorganic chemistry (by study of metals and
coordination chemistry). This course should improve your quantitative and computing skills. The means of
instruction for the course consists of five 60-minute lectures and two labs for 3 hours each every week.

5. Short Course Description and Prerequisites.

A major objective of this course is to help students acquire knowledge of chemistry as the central,
experimental natural science, which deals with the composition of materials, their structures and properties, and related
energy conversions in inert and living systems. This second semester of a two-semester sequence of chemistry courses
will provide students with an informed understanding of the nature of scientific reasoning, discovery, and invention
through a systematic exploration of the basic concepts and practices of chemistry. The course will also demonstrate the
applicability of scientific concepts and thinking processes to significant current issues in science. These aims will be
accomplished by a comprehensive understanding of approximately the second half of the required text.
Prerequisite: CH 1110 University Chemistry I or some equivalent from your home institution.

6. Textbooks.

The book listed below should be available from the bookstore and a set of problems will be freely distributed.
Required. Brown, Le May and Bursten
"CHEMISTRY, THE CENTRAL SCIENCE",
Prentice Hall, Tenth edition, 2006
7. Course Objectives.

A. Philosophy.

This is the second course in Freshman Chemistry and this course will also consider scientific inquiry in historical and cultural contexts. Historical examples of scientific creativity will be provided as appropriate to the topic being covered. The course will also address the progress of physical and chemical discoveries and their impact on our way of life. In this way they should learn to develop a respect for limits on resources and responsibilities which face modern citizens.

Overall, this course will explore the distinctive nature of scientific thinking, emphasizing:
* distillation of seemingly disparate data into unifying concepts derived from theoretical constructs having wide applicability.
* quantitative precision based on observation and experimental measurements; this requires the ability to do multiple, controlled laboratory experiments which can be replicated by other investigators.

Students will develop a critical appreciation of the ways that scientists develop concepts and methods with practical applications, which have direct implications for contemporary life.

B. Summary of Content

This course covers units on intermolecular forces, chemical kinetics and equilibria, acids and bases, complex ion formation, entropy and the second law of thermodynamics, electrochemistry, metals and coordination chemistry, inorganic, environmental, organic and nuclear chemistry.

8. Teaching Methodology.

Lectures, assisted with transparencies, will constitute the major form of instruction for this course. Attendance at the lectures will be noted as there is a direct correlation between attendance and course performance. From the outset, students will be advised to read and study the required text. In fact you should read the relevant chapter before coming to the lecture. There will be problem sets assigned. There are varying numbers of questions listed for each chapter and only the letter choice should be indicated on the answer sheets. I also expect you to try problems at the back of the chapters in the text. To begin, try the first three questions given for each group of questions. If you experience difficulty with any of them do some more questions from that section. There will be two term exams and one final exam based on material covered in the lectures, the appropriate chapters in the text and from the problem sets. Please note that there are no resurrection points or make up exams.

Laboratory

Attendance at the two laboratory sessions every week is required. If you miss two lab periods (quizzes or experiments) or more, you will automatically fail the entire course. You will not be allowed to work in the lab unless you wear proper clothing and Visorgogs. Furthermore, wearing contact lenses during labs is strongly discouraged. Even the slightest amount of laboratory chemical trapped between the lens and the cornea can result in permanent damage to the eye. There are no scheduled makeup labs. If a severe crisis (illness etc.) occurs, contact Lorri Reilly and arrangements may be made to make-up lab work. If you are sick and wish to do a make-up lab get a note from a doctor testifying to the extent and severity of the illness. Arrangements may be made in this case for make-up lab work. If you represent the university in athletics and there is a scheduling conflict, it is possible to make allowances for this. Please get a note from the coach. In this regard, it would be useful to let Lorri Reilly know, far in advance, of conflicts arising out of athletic requirements. If you do get special permission from Lorri Reilly to switch sections or makeup lab work, be sure to bring your permission form with you to your make-up lab.

The laboratory section consists of 10 experiments. You must read the experiment before coming to the lab and be ready to answer a short quiz at the start of each lab. This quiz will consist of at least three questions some of which may be selected from the prelab questions contained for each experiment. Therefore, it is important for you to know in advance the answers to the prelab questions for each experiment before you enter the lab. This will ensure that you have understood the experiment. It is crucial that you arrive on time for your lab since the quiz will be handed out at the start of each lab. Ten minutes will be allotted for this purpose and then the TA will give a brief introduction to the lab. Those who are consistently late will lose points. Data should be recorded in INK and not pencil in the sections provided for the report section of the experiment. In recording your data note that no erasures are to be made; simply strike through incorrectly written data. The report sheets, together with written responses to the questions at the end and a summary conclusion paragraph detailing whatever you wish to assess regarding the experiment, must be handed in at the end of the experiment. Failure to hand in these reports at the time specified will result in the following penalties: For the final reports; a reduction of 25% for failure to hand this in at the end of the experiment and a further
25% per day for subsequent days. It is hoped that none of these penalties will be applied so please learn these rules and try to get the reports in on time. All it really implies is that you have to know the experiment before you start the procedure and you should have an idea about the calculations. The lab syllabus contains more detailed information regarding the running of the labs.

Please note that there are no make-up exams.

9. Academic Integrity Policy.

Standards of academic conduct are set forth in the University's Academic Integrity Code, which can be found in the MTU Student Handbook or at www.admin.mtu.edu/dos/academic.htm. By registering for this course, you have acknowledged your awareness of the Academic Integrity Code, and you are obliged to become familiar with your rights and responsibilities as defined by the Code. Violations of the Academic Integrity Code will not be treated lightly, and disciplinary actions will be taken should such violations occur. This includes plagiarism or receiving inappropriate assistance on examinations and laboratory assignments. Cheating is an extremely serious academic offense. Allegations of cheating will be referred to the Dean of Student Affairs (Gloria B. Melton) for appropriate action. Please see me if you have any questions about the academic violations described in the Code or as they relate to particular requirements of this course.

10. Grading Policy.

The lecture part of this course will account for 75% of the final grade. The laboratory section is worth the remaining 25%. The lecture part will be assessed on the basis of two 60-minute exams (40% of the total grade), the problem sets (10% of the total grade) and one 2-hour final exam (25% of the total grade). The laboratory grade will be decided on the basis of successful completion of the assigned experiments (25% of the final grade).

<table>
<thead>
<tr>
<th>Lecture part of the course</th>
<th>% of the final grade</th>
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<tbody>
<tr>
<td>Two 1 hour term exams</td>
<td>40</td>
</tr>
<tr>
<td>Problem Sets</td>
<td>10</td>
</tr>
<tr>
<td>one 2 1/2 hour final exam</td>
<td>25</td>
</tr>
<tr>
<td>Laboratory section</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

A grade of A and AB, (AB 80-85%, A 86-100%) in this course will imply that the student has mastered the full range of topics covered in the lectures and can very successfully apply these to solve the problems presented. The student can derive the important factors that lead to the best solution and makes particularly insightful contributions to tutorial and class discussions.

A grade of B or BC (BC, 70-74%; B, 75-79%) would imply that the student has a thorough understanding of the subject. The student can think things through and makes helpful contributions to tutorial and class discussions.

A grade of C or CD (CD, 55-59%, C, 60-69%) would suggest that the student understands the subject matter but there are gaps in the scope of understanding. Some topics need more work. The student takes part in tutorial and class discussions and listens carefully when not actively participating.

A grade of D (D, 50-54%) implies that the student has only partial knowledge of the subject. The student is unable to make effective use of this knowledge and does not understand what is going on in the classroom. Makes little or no contribution to the discussions in tutorial sessions or in the class.

The F grade (F, <50%) suggests that the student wasted a semester (i.e., 1.2 summer months) at MTU.

11. Description of Types of Examinations.

The two 60 minute exams will be a mixture of multiple choice and short answer questions. The exact ratios will be determined later. The final exam will also follow the same format.
Examples of these questions are:

1/ What kind of isomerism is exhibited by the following pair of complexes:
red \( [\text{Co(NH}_3)_2\text{SO}_4]\text{Br} \) and violet \( [\text{Co(NH}_3)_3\text{Br}]\text{SO}_4 \)
   a. optical isomerism
   b. geometrical isomerism
   c. structural isomerism
   d. stereoisomerism

2/ What is the pH of a 0.50 M sodium benzoate solution?
   \( K_a \) for benzoic acid = \( 6.0 \times 10^{-5} \).
   a. 18.74
   b. 3.92
   c. 8.96
   d. 5.04
   e. 2.26
   f. 10.08

A possible long answer type question would be as follows:

1/ Sketch the standard hydrogen electrode and explain how it is used to determine reduction potentials.

12. Detailed Schedule of Lectures and Examinations.

The lectures will be held in CH102 at 9:35-10:35 AM on Mondays to Friday, every day.

<table>
<thead>
<tr>
<th>Date</th>
<th>Chapter</th>
<th>Topic</th>
<th>Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 29 - July 1</td>
<td>25</td>
<td>Chemistry of Life</td>
<td>After you have finished reading the chapter</td>
</tr>
<tr>
<td>2 - 7</td>
<td>13</td>
<td>Properties of Solutions</td>
<td>and have worked out the problems in there</td>
</tr>
<tr>
<td>8 - 10</td>
<td>14</td>
<td>Chemical Kinetics</td>
<td>solve the first three questions in each section.</td>
</tr>
<tr>
<td>13 - 15</td>
<td>21</td>
<td>Nuclear Chemistry</td>
<td>Do these before attempting the problem set</td>
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<tr>
<td>16</td>
<td>Chapters 25, 13, 14, 21</td>
<td>First Term Exam</td>
<td></td>
</tr>
<tr>
<td>17 - 21</td>
<td>15</td>
<td>Chemical Equilibrium</td>
<td>Questions. If you find these first three questions</td>
</tr>
<tr>
<td>22 - 24</td>
<td>16</td>
<td>Acid-Base Equilibria</td>
<td>easy, move on to the next section. If not do</td>
</tr>
<tr>
<td>27 - 29</td>
<td>17</td>
<td>Additional Aspects of Aqueous Equilibria</td>
<td>more questions from that section.</td>
</tr>
<tr>
<td>30 - August 3</td>
<td>19</td>
<td>Chemical Thermodynamics</td>
<td></td>
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<tr>
<td>4</td>
<td>Chapters 15, 16, 17, 19</td>
<td>Second Term Exam</td>
<td></td>
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<tr>
<td>5 - 7</td>
<td>20</td>
<td>Electrochemistry</td>
<td></td>
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<tr>
<td>10-12</td>
<td>24</td>
<td>Chemistry of Coordination Compounds</td>
<td></td>
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<tr>
<td>13</td>
<td></td>
<td>Review</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>All Material</td>
<td>Final Exam</td>
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