Course Syllabus for CH3510 Spring 2015
Physical Chemistry I: Thermodynamics, Equilibrium, Kinetics
Department of Chemistry

Instructor Information

Instructor: Dr. Sarah A. Green
Office Location: Great Lakes Research Center 320
Telephone: (906) 487-3419
E-mail: sgreen@mtu.edu
Office Hours: MWF 2:00 PM – 3:00 PM
Or by appointment

Course Identification

Course Number: CH3510
Course Name: Physical Chemistry I: Thermodynamics, Equilibrium, Kinetics
Course Location: EERC 229
Class Times: MWF 1:05 pm - 1:55 pm

Course Description/Overview

To introduce concepts used to explain and interpret the physical and chemical properties of matter. This course will cover the following areas of Physical Chemistry: thermodynamics, chemical equilibrium, and chemical kinetics.

Course Learning Objectives

• Students will learn to apply fundamental thermodynamic principles to explain and predict chemical phenomena.
• Students will develop their quantitative reasoning, problem solving, and rigorous thinking, as well as enhance their physical-chemical intuition.

Course Resources

Online Resources
• Canvas: http://courses.mtu.edu
• E-mail List: ch3510-sp15-L@mtu.edu

Required Course Text

Other useful sources may be represented by:

- A comprehensive little wonderful (and cheap) reference is: Enrico Fermi, *Thermodynamics*, Dover Publication Inc., New York, 1936

**Grading Scheme**

<table>
<thead>
<tr>
<th>% of total Points</th>
<th>Letter Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>93-100</td>
<td>A</td>
</tr>
<tr>
<td>87-92</td>
<td>AB</td>
</tr>
<tr>
<td>82-86</td>
<td>B</td>
</tr>
<tr>
<td>76-81</td>
<td>BC</td>
</tr>
<tr>
<td>70-75</td>
<td>C</td>
</tr>
<tr>
<td>65-69</td>
<td>CD</td>
</tr>
<tr>
<td>60-64</td>
<td>D</td>
</tr>
<tr>
<td>0-59</td>
<td>F</td>
</tr>
</tbody>
</table>

**NO CURVING will be applied!**

**Grading Policy**

Your grade for this course will be based on the following:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Max points per type of assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly Online Quizzes (13 – 5 points each)*</td>
<td>50*</td>
</tr>
<tr>
<td>Homework (4 – 25 points each)</td>
<td>100</td>
</tr>
<tr>
<td>Mid-Term Exams (3 – 25 points each)</td>
<td>75</td>
</tr>
<tr>
<td>Final Exam (1 – 50 points)</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total Points</strong></td>
<td><strong>275</strong></td>
</tr>
</tbody>
</table>

* Only your best 10 quizzes will be considered for your final grade.
** Your total score in the Course will be converted to 100% to assign letter grades.
Late Assignments
No late assignment will be considered.

Attendance

*Attendance in class is not compulsory but it is highly recommended to keep track of the topics covered, and to develop good reasoning skills.*

Course Policies

Your grade will be based on:

- **13 online quizzes** assigned via Canvas. At the end of the course, only the best 10 quizzes will be considered for your final grade. This is an attempt to balance missed assignments, silly mistakes, and so forth. Note that the weight of these online quizzes equals almost 20% of your Final Grade in the Course (!) therefore my friendly suggestion to you is to try not to miss them;

- **4 homeworks**;

- **3 midterm exams**;

- **1 final term exam**.

Weekly (every Tuesday), I will assign **online quizzes via Canvas, 13 in total**. Typically, you will be asked to answer 5 questions. You will have a 24 hours window to access the quiz and solve it in 10 minutes, so that you’ll have on average 2 minutes per question as during Exams.

**The 4 Homeworks** will be assigned **roughly every 2 weeks** and will be collected in class the same day one week after (example: homework assigned on Friday, 7th will be due on Friday, 14th). No late homework will be accepted. Students who fail to turn in homework without a satisfactory and documented explanation will receive a grade of 0.0 (see the last page of this document “Excused Absense”).

**The 3 “Midterm” and Final Exams** will be assigned in the form of **multiple-choice questions and problem solving**: in both cases, you will be asked both to show the development of your reasoning skills and your capabilities in solving and deriving equations to solve thermodynamic problems. Students who fail to show up for Midterm and Final Exams without a satisfactory and documented explanation will receive a grade of 0.0 (see the last page of this document “Excused Absense”).

Laptops are allowed in class only, not during exams. The following are not allowed at any time: cell phones, Blackberries, iPods, PDAs, or any other electronic devices. Calculators on these or other devices are strictly prohibited during the exams; only standard calculators may be used. Information exchanges on electronic devices during class and exams are also prohibited and violate the Academic Integrity Code of Michigan Tech. 
University Policies

Student work products (exams, essays, projects, etc.) may be used for purposes of university, program, or course assessment. Any work used for assessment purposes will not include any individual student identification.

Academic regulations and procedures are governed by University policy. Academic dishonesty cases will be handled in accordance University policies.

If you have a disability that could affect your performance in this class or that requires an accommodation under the Americans with Disabilities Act, please see me as soon as possible so that we can make appropriate arrangements. The Affirmative Action Office has asked that you be made aware of the following:

*Michigan Tech complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disabilities Act of 1990. If you have a disability and need a reasonable accommodation for equal access to education or services at Michigan Tech, please call the Dean of Students Office, at 487-2212. For other concerns about discrimination, you may contact your advisor, department head or the Affirmative Action Office, at 487-3310*

**Academic Integrity:**
http://www.studentaffairs.mtu.edu/dean/judicial/policies/academic_integrity.html

**Affirmative Action:**
http://www.admin.mtu.edu/aaq/

**Disability Services:**
http://www.admin.mtu.edu/urel/studenthandbook/student_services.html#disability

**Equal Opportunity Statement:**
**Tentative Course Schedule**

<table>
<thead>
<tr>
<th>Main Topics</th>
<th>Chapter</th>
<th>Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Concepts, $0^{th}$ Law, Equation of State, Mathematical Techniques, Gas Laws, Ideal vs Real Gases</td>
<td>1, 8</td>
<td>1-2</td>
</tr>
<tr>
<td>Work, Heat, Internal Energy, $1^{st}$ Law of Thermodynamics, Enthalpy, Heat Capacities, Joule-Thompson Experiment</td>
<td>2</td>
<td>2-3</td>
</tr>
<tr>
<td>Carnot Cycle, Entropy, $2^{nd}$ Law of Thermodynamics</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Spontaneity Conditions, Gibbs and Helmholtz Energies, Natural Variable Equations, Maxwell Relationships, Chemical Potential</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Standard Thermodynamic Functions of Reactions, Hess’s Law, Kirchoff’s Law, $3^{rd}$ Law of Thermodynamics</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Reaction Equilibrium and Ideal Gases, Equilibrium Constant and Temperature Dependence (van’t Hoff Equation)</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>One-Component Phase Equilibrium: Phase Rule, Phase Diagrams, Clapeyron Equation</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Solutions: Ideal Solutions and Raoult’s Law, Ideally Dilute Solutions and Henry’s Law</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Non-Ideal Solutions: Activities, Excess Functions, Gas mixtures and Fugacity</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Two-Component Liquid-Vapor Equilibrium</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Kinetics and Rate Laws, Arrhenius, Reversible, Parallel, and Consecutive Reactions</td>
<td>16</td>
<td>13,14</td>
</tr>
</tbody>
</table>

Throughout the Course I will provide specific information about where to find, on the textbook, the topics covered in class.

Sometimes I will provide external notes that will be posted on Canvas. Some of the classes will be flipped to allow for discussion and problems solving sessions during lecture time.

Topics listed above and not covered in class will not be part of any assignment.

**More Information about Online Quizzes, Homework, Midterm and Final Exams**

The textbook contains problems at the end of each chapter I suggest you try even though they will not be specifically assigned as homework. Homework and Exams may be partially based on them and/or related to them.

**Online Quizzes** will be assigned through Canvas: please, read carefully the description provided before in this document. Note that you are allowed to use books, notes, and calculators. You are allowed to work in groups but remember that you will be alone during Exams. Online quizzes are specifically thought and designed to get you acquainted with the procedure that will be adopted during Midterm and Final Exams.
**Homework** will be assigned and returned in class according to the following schedule:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Assigned</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework #1</td>
<td>Wed, January 28th 2015</td>
<td>Wed, February 4th 2015</td>
</tr>
<tr>
<td>Homework #2</td>
<td>Fri, February 20th 2015</td>
<td>Fri, February 27th 2015</td>
</tr>
<tr>
<td>Homework #4</td>
<td>Mon, April 13th 2015</td>
<td>Mon, April 20th 2015</td>
</tr>
</tbody>
</table>

Homework can be solved with the support of books, notes, calculators. Students are allowed to work in groups.

**Midterm Exams** are scheduled for:

1) *Wednesday, 11 February 2015, EERC 229, 1:05 PM - 1:55 PM*
2) *Wednesday, 18 March 2015, EERC 229, 1:05 PM - 1:55 PM*
3) *Wednesday, 8 April 2015, EERC 229, 1:05 PM - 1:55 PM*

Midterm Exams can be completed with the support of calculators only. No books or notes will be allowed. A formula sheet will be provided.

**Final Exam** The final exam will be scheduled by the Registrar’s office later on in the semester.

The Final Exam can be completed with the support of calculators only. No books or notes will be allowed. I will provide the formula sheet.

The Final Exam will be a comprehensive 2-hour examination.

The last two/three lectures of the Course, before the Final will be devoted to a general Review of the material covered.
Getting Help in Learning

I want you to be successful in learning P-Che! I will help in any way I can. Do not hesitate to contact me for any problem or for guidance regarding the material covered in class.

In particular, my office hours are scheduled after each lecture (MWF, 2:00 PM – 3:00 PM) in my office, GLRC 320. In order to arrange for assistance by appointment you can contact me by email at s.green@mtu.edu or by phone at (906) 487-3419.

The last class before each Midterm will be devoted to a Review of the covered material. If requested, I will arrange for Evening Review Sessions before the three Midterms.

The last two/three class of the course will be devoted to a Review of the covered material. I will arrange for Evening Review Sessions Exam (extra-time, not compulsory, pizza and soda will be provided!) the night before the Final Exam.

On Canvas you will find all the slides presented in class, extra notes, text solutions of practice exams. Text and solutions of the 13 online quizzes, the 4 homeworks, and the 3 midterms will be published accordingly.
Excused Absenses

Events beyond your control may cause you to miss a homework deadline or an exam. Whenever possible, contact me prior to your absence to arrange to make-up missed work. If you are unable to notify me concerning an absence or if you need to notify several instructors on short notice, contact the Office of Student Affairs for assistance. The Dean of Students will then inform all your instructors that you face a situation that requires that you miss class, and you are granted an excused absence. It is then your responsibility to contact each of your instructors after you recover from your illness or return to campus.

An absence is excused under the following conditions:

- If you participate in off-campus University-sponsored activities such as field trips, fine arts performances, intercollegiate athletics, job fairs, etc., you are granted an excused absence if your activity conflicts with an exam. Furthermore, I consider plant trips, job interviews requiring travel, and professional society meetings as excusable. It is imperative that for an absence of this type, for which a conflict with an exam is known well ahead of time, that you arrange with me to take the exam earlier than its normally scheduled time.

- If you encounter circumstances beyond your control such as illness, the funeral of any relative or close friend, or other personal emergency, you are granted an excused absence. You must provide verification of the special circumstances that led to your absence. In the event of a missed exam due to an excused absence, it is not possible to make-up the exam. Instead, an excused absence from an exam will receive the score EX. At the end of the semester, exam EX scores will be replaced by a weighted average of all of your non-EX scores on exams (midterms and final exams). If the final exam is missed as a result of an excused absence, you will be awarded the letter grade of I (incomplete) and must take the CH 3510 final exam at the end of any one of the next semesters that you’re in residence. Two or more exams missed as a result of excused absences will be handled on an individual basis.

If a homework due date is missed as a result of an excused absence, the due date will be extended after you notify me.