Chemical Engineering Thermodynamics
Winter 2010
http://classes.engr.oregonstate.edu/cbee/winter2010/che312/

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Class Times:
Lecture: MF 10:00-10:50 200 Gleeson
Recitation: W 10:00-11:50 200 Gleeson

Prerequisites: ChE 311

Office Hours:
MK: M 3-4, T 11:30-12:30, R 12:30-1:30 201 Gleeson
BB: T 4-6 208 Gleeson

You can also schedule an appointment with either the instructor or TA via email; please list at least three available times in your email.

Student Learning Outcomes:
By the end of the course, you will be able to:

1. Describe the role of Gibbs energy in determining pure species phase equilibrium. Apply the Clapeyron equation to relate $T$ and $P$ for a pure species in phase equilibrium.

2. Apply thermodynamics to mixtures by defining and finding values for pure species properties, total solution properties, partial molar properties, and property changes of mixing. Apply the Gibbs-Duhem equation to relate partial molar properties.

3. Find the fugacity and fugacity coefficient of pure gases and gases in mixtures using tables, equations of state, and general correlations.

4. For liquids and solids, identify Lewis/Randall and Henry’s Law reference states for ideal solutions. Correct the reference states for pressure. Solve for non-ideality by determining activity coefficients through models for excess Gibbs energy, $g^E$.

5. Solve phase equilibria problems for Vapor-Liquid equilibria (VLE), Liquid-Liquid equilibria (LLE), vapor - liquid - liquid equilibria (VLLE) and Solid-Liquid equilibria (SLE). Identify and solve problems for systems containing azeotropes (VLE) and partially miscible solutions (LLE).

6. Use thermochemical data to determine the equilibrium composition for a chemical reaction. Calculate the equilibrium constant at different temperatures. Determine the equilibrium composition for a system with multiple chemical reactions.

Textbook:
Course Grades:
The grades will be based upon examination of course work. An *approximate* breakdown is as follows:

- Laptop - WISE: 7% + 5% bonus
- Homework: 13%
- Exams: 50%
- Final Exam: 25%
- Attendance: 5%

**Laptop – WISE (7% + 5% bonus)**
We will be doing graded interactive activities in class using the WISE Learning Tool: [https://secure.engr.oregonstate.edu/che/WISE/](https://secure.engr.oregonstate.edu/che/WISE/). You need to bring a wireless laptop to class every Wed, and whenever else announced by the instructor. All students are required to have a laptop as part of the College of Engineering’s wireless laptop initiative: [http://engr.oregonstate.edu/students/wireless/](http://engr.oregonstate.edu/students/wireless/).

**Homework (13%):**
*Unless otherwise stated by the instructor, you are not allowed to look at any previously worked solutions of the assigned problems (e.g., from previous years, the Web, solutions manual, your classmates etc.), before the homework due date - even to check your work. Using worked solutions will be considered as a case of academic dishonesty and may result in an F grade in the class. Assisting others to do this is also considered as academically dishonest.*

Homework is instrumental in helping you grasp fundamental thermodynamic concepts and in exposing you to techniques and skills for applying these principles to real-life situations. Homework should be done in several sittings; you cannot expect to be successful doing homework quickly the night before it is due. Homework will be available on the web by Wed. and due at the **beginning** of class the following Wed. Any late homework will receive a grade of 0 unless arrangements are made with the instructor before it is due. Failure to turn in more than 2 homework assignments will result in a grade of F in the class.

You may **discuss** homework problems with your classmates (NOT COPY THEIR SOLUTIONS), but please try them on your own first. **Additionally solutions must be written up independently.**

Use the following guidelines for homework preparation:

- Use clean, 8.5 x 11 inch paper. Engineering paper is preferred; neatness is important and appreciated.
- Write the following in the upper right corner of each page:
  - ChE 312
  - Your Name
  - Due date, Problem Set No.
  - Page number/Total pages
- Securely staple all pages; do not fold or paper clip together.
- **Show all of your work.** Draw a block around your final answer(s).
• For graphical solutions, use graph paper or computer generated plots. Label the axes of your graph and include units.
• Provide computer program listings or output, if used, on a separate sheet.

Exams (50%) and Final Exam (25%):
There will be approximately four exams, tentatively scheduled for 1/22, 2/5, 2/19, and 3/5. You will be asked to apply the fundamental principles that have been covered in the course to entirely new problems and to answer conceptual question (questions that are designed to be conceptually challenging and typically require no computation so that students cannot rely on equations to obtain the answer). Your lowest normalized exam score will count half as much as the others.

The Final Exam is scheduled for Tuesday March 16, 6:00 – 7:50 PM, room TBA. If the entire class agrees, we can relax the time limit to this exam.

If you MUST miss an Exam or the Final Exam for an emergency situation, please let me know as soon as possible. If you oversleep or skip an exam you will not have an opportunity to make it up. If you have a valid (according to me) time conflict and you let me know in advance, there is the possibility of taking an exam at an alternate time.

Class Attendance (5%):
Attendance is MANDATORY! You are expected to attend every class and participate in discussion. Lectures are designed to supplement, not replace, the reading material, and to develop problem-solving skills. If you are not able to make class, notify the instructor before class. Unexcused absences may lower your final course grade. If you do miss class, it is your responsibility to find out what was covered and any administrative information that was discussed.

Disruptive Behavior
While the University is a place where the free exchange of ideas and concepts allows for debate and disagreement, all classroom behavior and discourse should reflect the values of respect and civility. Behaviors which are disruptive to the learning environment will not be tolerated. As your instructors, we are dedicated to establishing a learning environment that promotes diversity of race, culture, gender, sexual orientation, and physical disability. Anyone noticing discriminatory behavior in this class, or feeling discriminated against should bring it to the attention of the instructors or other University personnel as appropriate.

The following specific behavior is not allowed:
• No cell phones or pagers in class. No text messages!
• No use of Laptops or other electronic devices for activity outside of its use in THIS class (i.e, surf the web, email, pictures)
• No reading the Barometer during class
Cheating and Student Conduct:

The instructors of this class take the issue of academic honesty very seriously. You are expected to be honest and ethical in your academic work. There is a “zero tolerance” policy in effect for cheating in this class. Any instance in which a student is caught cheating will be handled in strict accordance with the policies outlined at http://www.orst.edu/admin/stucon/achon.htm. In order to provide students with a positive learning environment, OSU has adopted a pledge of civility, which can be found at http://osu.orst.edu/admin/stucon/index.htm.

Academic dishonesty is defined as an intentional act of deception in one of the following areas:

- **Cheating** - use or attempted use of unauthorized materials, information or study aids
- **Fabrication** - falsification or invention of any information
- **Assisting** - helping another commit an act of academic dishonesty
- **Tampering** - altering or interfering with evaluation instruments and documents
- **Plagiarism** - representing the words or ideas of another person as one's own

*Using solutions worked by others to prepare your HW will be considered as a case of academic dishonesty and may result in an F grade in the class.*

When evidence of academic dishonesty comes to the instructor's attention, the instructor will document the incident, permit the accused student to provide an explanation, advise the student of possible penalties, and take action. The instructor may impose any academic penalty up to and including an "F" grade in the course after consulting with his or her department chair and informing the student of the action taken.

Disability:

Students with documented disabilities who may need accommodations, who have any emergency medical information the instructor should know of, or who need special arrangements in the event of evacuation, should make an appointment with the instructor as early as possible, no later than the first week of the term. Students with disabilities are encouraged to contact the Services for Students with Disabilities Department (SSD) and obtain professional opinion and recommendation. SSD website: http://ssd.oregonstate.edu/. These documents are needed for specific accommodation and should be presented to the instructor as early as possible.