Instructor: Dr. Arrington, RMSC M-306-A
Phone: 597-4633
E-mail: caleb.arrington@wofford.edu

Time and Place: Lecture: M, W, & F 10:30 a.m. - 11:20 a.m. (Rm 308)

P. Atkins, C. Trapp, M. Caddy, and C Giunta; Solution Manual for Physical Chemistry; W. H. Freeman; 2002 (supplemental)

Course Website: http://webs.wofford.edu/arringtonca/pchem/chem_311.htm

Objectives: At its purest physical chemistry provides an underlying explanation to all subdisciplines in chemistry. In this course you will: 1) Demonstrate how the development of theories explaining physical events leads to mathematical equations that accurately describe chemical behavior. 2) Show how experiments can be interpreted with the aid of these theories to improve our understanding of chemical systems.

Assessment: The following categories and point breakdown is a close representation of the system to be used. These numbers may vary slightly based on the material covered.

Homework: 5 @ 20 points 100 points
Assignment folder: =15 @ 5points 75 points
Exams: 3 @ 100 points 300 points
Final Exam: (ACS Exam in Thermodynamics) 200 points
Total 675 points

Exam Schedule: Exams over the material that we have covered to date in the course will occur periodically. The ACS exam in thermodynamics is the final exam. The tentative exam dates are:

Wed, Oct. 1 Mon, Oct. 27 Wed, Dec 3 Mon, Dec. 8 at 9:00 am
Final Exam

Only under extenuating circumstances may arrangements for taking an exam at an alternate time be made by scheduling with me prior to the exam. Please check your schedules early. Missed exams may not be retaken. Calculators are not to be used as information storage devices. Using calculators as such will constitute cheating.
**Homework:** **Working together on homework is encouraged.** The need to work many problems in p-chem cannot be overstated. The understanding of physical chemistry is reflected in the ability to calculate specific physical quantities. Regular homework assignments will be made throughout the semester. These assignments will reflect a sampling of the material that will be covered on course exams. Additional, textbook problems will be suggested as points of emphasis for your studying (often these questions will appear on exams.) The homework assignments will have two components. There will be traditional textbook problems assigned for which significant help can be found in the solutions manual. These problems still must be worked neatly. Secondly, there will be group problems assigned that require detailed work presented in an electronic format. These electronic problems will be submitted to the course public folder and posted on our website. See our course webpage for an example of an electronic problem and solution. Most of the homework grade will be based on your work on the electronic problems. Homework is designed to develop an applied understanding of course material and constitutes a beginning point to mastering physical chemistry.

**Assignment Folder:** The assignment folder will contain two types of assignments during the semester: *computer assignments* and *traditional problems*, performed. You will keep this work in a binder that will be collected the day of each exam. Our website will provide an updated list of the assignments.

*Computer Assignments:* An important advancement in all sciences in the last 30 years is the use of the computer in facilitating scientific exploration. Computer assignments will explore physical chemistry with the aid of the personal computer. This will primarily be accomplished with the use of spreadsheet software (Excel) and symbolic processing mathematics software (MathCAD). These exercises will, in general, be fun and will provide a tie to our lecture material. In some cases, new lecture material will be presented in the form of a computer exercise. You can expect that lecture concepts presented in this format will be covered on class examinations.

*Traditional Problems:* Textbook assignments made in class separate from homework assignments will periodically be given in class. To be given credit for the work you have done, these assignments must be present in your assignment folder.

**Office Hours:** Receiving help outside class is encouraged. My office hours will change throughout the semester as other duties are scheduled. Check our webpage for current office hours. Feel free to stop by outside office hours as well, but please realize that I may not always be available.

**Late work:** All late assignments receive a 3-point per day penalty (including Sat/Sun).
Final Grade: Final grades will be based on the total number of course points accumulated throughout the quarter. Skipping a 5-point assignment is the same as skipping a 5-point problem on an exam. Based on a percentage of the total course points a grade distribution similar, **but not identical**, to that given below will constitute the final grade.

<table>
<thead>
<tr>
<th>Percentage Range</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% - 85%</td>
<td>A</td>
</tr>
<tr>
<td>85% - 75%</td>
<td>B</td>
</tr>
<tr>
<td>75% - 60%</td>
<td>C</td>
</tr>
<tr>
<td>60% - 50%</td>
<td>D</td>
</tr>
<tr>
<td>Below 50%</td>
<td>F</td>
</tr>
</tbody>
</table>

If you believe that you possess a disability that may require accommodation, see me by the end of the first week of class. I am happy to work with anyone requiring accommodation.

**Learner outcomes for thermodynamics:**

- Apply the equations of state (i.e. perfect gas, van der Waals and Redlich-Kwong) to determine P, V, or T of a gas
- Plot the mathematical functions of thermodynamics utilizing commercial software
- Know that energy is conserved during a process (chemical reaction)
- Know that a reaction is spontaneous when: $\Delta S_{\text{universe}} > 0$ or $\Delta G_{\text{p,T}} < 0$
- Master the manipulation of partial derivatives applied to thermodynamics
- Determine the efficiency of a heat engine and a refrigerator
- Use Maxwell’s equations to convert between the partial quantities of thermodynamics
- Describe how an engine turns heat into work in the context of the first and second law of thermodynamics
- Use tables of $\Delta G$ standard to predict spontaneity
- Explain the relationship between chemical potential and phase equilibria
- Identify the characteristics of a first order phase transition
- Be able to convert $\Delta G^0$ at 298 K to other T and p using: $dG = Vdp - SdT$
- Know when a reaction will stop and the conditions for equilibrium
- Know how to use the phase rule
- Construct and interpret single and binary phase diagrams
- Calculate state functions and equilibrium constants from electrochemical measurements

*The instructor reserves the right to change any part of this syllabus during the quarter if changes are necessary. When made, these changes will be announced in class.*