

**3 Credits****COURSE DESCRIPTION**

In Chemistry 325 you will learn fundamental thermodynamic principles including properties of gases, partition functions, the first law of thermodynamics, the second law of thermodynamics, the third law of thermodynamics, Helmholtz and Gibbs energies, phase equilibria and solutions. By the end of the course, you should have a firm grasp on these concepts and how they apply to the world around you. You are responsible for learning, understanding, and applying all subjects and concepts presented throughout the course. Prerequisites for Chemistry 325 include Chem 178, Math 166. Phys 222 recommended.

**Lecture:** In-person. Section 2: MWF 8:50 – 9:40 am, Gilman 1104  
Section 4: MWF 1:10 – 2:00 pm, Gilman 0611

**Instructor:** Dr. David Appy  
**Office:** 3754 Gilman Hall  
**Email:** dvappy@iastate.edu  
**Office Hours:** WF 2-3 pm, or by appointment

**Head TA:** Sayan Das  
**Office:** 0235 Hach Hall  
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**Office Hours:** WF 10-11 am, or by appointment

**Course Materials:**

**Textbook** - (Required) “Molecular Thermodynamics” by McQuarrie and Simon, 1999.

**Calculator** – (Required) Any scientific or graphing calculator that is not a communication device (eg. cell phone, laptop, etc.)

**Canvas** will serve as our official electronic course interface. [www.canvas.iastate.edu](http://www.canvas.iastate.edu)

**Technology phone policy:**

NO cell phones in class. Laptops and tablets are permitted if they lay flat and are used for class purposes only.

**Grading Structure:**

**Exams** – 4 midterm exams (100 pts each, drop 1 lowest) and 1 cumulative final exam (150 points, cannot be dropped)

**Homework** – 12 assignments @ 1 pt each = 12 points (\*HW Comments (via Canvas gradebook) will be the primary method of providing feedback to students regarding quality of work.)

Total = 462 pts.

**Appropriate Standard of Rigor**

Students are expected to read the text and digest it at least the day before lecture. Homework assignments represent the minimum set of suggested practice, and students should practice regularly and to the extent of mastering the material within reasonable time constraints (2-3 hours for every in-class hour). The appropriate time for questions is during lecture or during the scheduled office hours, and preferably before assignments are due, not after. This is the standard against which final grades are drawn.

\*Note – “Review” is not practice and does not result in meaningful learning. There are no review sessions or formalized exam prep for this course. Students are expected to take exams as if it were an average day.

**Grading Scale:**

The grading scale will be set by the instructor at the midterm and again at the final.

**Late Work:**

Late Homework will be marked 0 and will not receive comment from the instructor(s). Exams are not given late but may be taken early and/or remotely (see Missing/Rescheduling Exams, below).

**Missing Lecture:**

There is no need to alert anyone that you will be absent from lecture. If you are absent, get the notes from a friend or attend the other section's lecture.

**Missing/Rescheduling Exams:**

Midterm exams may be rescheduled before or same-day as, but not later than the actual exam. The exam may be proctored virtually (via Webex) if need be. Contact the Head TA as far in advance as possible to reschedule a midterm exam. No documentation is required (but see below regarding the Final Exam). In cases of sudden emergency where a midterm exam simply cannot be taken (eg. car trouble, sudden illness, etc.) the exam will be recorded as a zero and will be automatically dropped (1 lowest midterm exam dropped). Rescheduling the Final Exam requires documentation of valid excuse (not vacation-related).

**Tentative Schedule for Chem 325 (Spring 2023)**

Week	Dates	Topics/Events	Homework Assignments
1	M 1/16	<b>MLK Holiday – no class</b>	<b>Ch. 2 HW (end of chapter problems) – 2, 4, 6, 11, 16, 25, 35, 45</b> *Tip - Also be sure to have a good conceptual understanding of the charts and graphs in the text, for instance, being able to explain the shapes of curves and how they relate to physical reality. Expect the exams to contain a mixture of calculation questions and conceptual questions.  <b>Ch. 5 HW (end of chapter problems) – 2, 5, 6, 12, 20, 21, 26, 35, 36, 38, 60</b>  <b>Ch. 1 HW (end of chapter problems) – 6, 8, 9, 15, 19, 21, 23, 29, 36, 37, 44, 46</b>
	W 1/18	Ch. 2 – Properties of Gases	
	F 1/20	Ch. 2	
2	M 1/23	Ch. 2	
	W 1/25	Ch. 2	
	F 1/27	<b>Ch. 2 HW Due in Canvas by 11:59 pm (pdf only)</b> Ch. 5 – The First Law of Thermodynamics	
3	M 1/30	Ch. 5	
	W 2/1	Ch. 5	
	F 2/3	Ch. 5	
4	M 2/6	<b>Ch. 5 HW Due in Canvas by 11:59 pm (pdf only)</b> Ch. 1 – The Energy Levels of Atoms and Molecules	
	W 2/8	<b>Exam 1 in class</b>	
	F 2/10	Ch. 1	
5	M 2/13	Ch. 1	
	W 2/15	<b>Ch. 1 HW Due in Canvas by 11:59 pm (pdf only)</b> Ch. 3 – The Boltzmann Factor and Partition Functions	
	F 2/17	Ch. 3	

6	M 2/20	Ch. 3	<b>Ch. 3 HW (end of chapter problems) – 10, 12, 13, 15, 28, 30, 35, 40</b>
	W 2/22	<b>Ch. 3 HW Due in Canvas by 11:59 pm (pdf only)</b> Ch. 4 – Partition Functions and Ideal Gases	
	F 2/24	Ch. 4	
7	M 2/27	<b>Ch. 4 HW Due in Canvas by 11:59 pm (pdf only)</b> Ch. 6 – Entropy and the Second Law of Thermodynamics	<b>Ch. 4 HW (end of chapter problems) – 4, 8, 12, 21, 22, 23, 24, 39</b>
	W 3/1	<b>Exam 2 in class</b>	
	F 3/3	Ch. 6	
8	M 3/7	Ch. 6	<b>Ch. 6 HW (end of chapter problems) - E-4, E-6 (from p.234 Match Chapter E), 8, 10, 17, 18, 19, 25, 26, 29, 37, 38</b>
	W 3/9	Ch. 6	
	F 3/11	Ch. 6	
<b>Spring Break – March 13-17</b>			
9	M 3/20	<b>Ch. 6 HW Due in Canvas by 11:59 pm (pdf only)</b> Ch. 7 – Entropy and the Third Law of Thermodynamics	<b>Ch. 7 HW (end of chapter problems) – 2, 3, 8, 12, 30, 40, 41, 42, 45, 47</b>
	W 3/22	Ch. 7	
	F 3/24	Ch. 7	
10	M 3/27	<b>Ch. 7 HW Due in Canvas by 11:59 pm (pdf only)</b> Ch. 8 – Helmholtz and Gibbs Energies	<b>Ch. 8 HW (end of chapter problems) – 1, 8, 9, 14 (use eq. 8.34), 19 (eq. 8.39), 22, 28, 30, 55</b>
	W 3/29	<b>Exam 3 in class</b>	
	F 3/31	Ch. 8	
11	M 4/3	Ch. 8	<b>Ch. 9 HW (end of chapter problems) – 4, 6, 7, 19 (hint: start with 1<sup>st</sup> Law), 20, 27, 33, 46 (hint: the goal is to show that the sum of the areas along the f-d-b line is zero)</b>
	W 4/5	Ch. 8	
	F 4/7	<b>Ch. 8 HW Due in Canvas by 11:59 pm (pdf only)</b> Ch. 9 – Phase Equilibria	
12	M 4/10	Ch. 9	<b>Ch. 10 HW (end of chapter problems) – 4 (refers to 2), 20, 26, 48, 49</b>
	W 4/12	<b>Ch. 9 HW Due in Canvas by 11:59 pm (pdf only)</b> Ch. 10 – Solutions I: Liquid-Liquid Solutions	
	F 4/14	Ch. 10	
13	M 4/17	Ch. 10	<b>Ch. 11 HW (end of chapter problems) – 2, 3, 4, 24, 28, 29, 31, 40</b>
	W 4/19	<b>Ch. 10 HW Due in Canvas by 11:59 pm (pdf only)</b> Ch. 11 – Solutions II: Solid-Liquid Solutions	
	F 4/21	<b>Exam 4 in class</b>	
14	M 4/24	Ch. 11	
	W 4/26	<b>Ch. 11 HW Due in Canvas by 11:59 pm (pdf only)</b> Ch. 12 – Chemical Equilibrium	
	F 4/28	Ch. 12	
	M 5/1	Ch. 12	

15	W 5/3	<b>Ch. 12 HW Due in Canvas by 11:59 pm (pdf only)</b> Flex	<b>Ch.12 HW (end of chapter problems) – 1, 2, 8, 10, 16, 17, 21, 23, 33 (math review), 62</b>
	F 5/5	Flex	
<b>Final Exam – TBD... I will try to arrange for both sections to take the Final Exam on the same day.</b>			
*ISU Final Exam Policy applies ( <a href="http://www.registrar.iastate.edu/exams/">http://www.registrar.iastate.edu/exams/</a> ).			