Course Syllabus

Chemistry 1C - Dr. Peter Weiss, Instructor

What is Covered

- This course covers thermodynamics (the 1st, 2nd, and 3rd laws), electrochemistry, the nature of pure substances, properties of solutions, and nuclear chemistry.
- In our textbook, Zumdahl and Decoste, 8th ed., we cover chapters 9, 10, 11, 16, 17, and 20. The textbook is available with your Cengage WebAssign subscription. Go to the **Cengage website (https://www.cengage.com/unlimited/)** and purchase Cengage Unlimited. The cost includes the e-textbook and a subscription to the homework platform WebAssign.

What Students Will Do

- Read the assigned pages in the textbook. These are specified on the pages called "Topics Covered" for each week.
- Review the lecture slides listed in each week's module.
- Watch 2-3 prerecorded video lectures per week and complete the associated video quizzes (lowest score dropped).
- Attend hybrid discussions sections with TAs in person or on zoom.
- Log into Canvas regularly, our web portal for the course.
- Post general discussion questions and respond to other students' questions on Chat or Discussions (on Canvas). Post homework problem-specific questions to Web Assign Messages (Ask Your Teacher).
- Complete 6 end-of-chapter problem homework assignments.
- Take 6 60-min quizzes, one after each chapter, lowest score dropped
- Take 1 3-hr final exam, cumulative.

General Learning Outcomes

- Recognize how energy flow controls the outcome of a chemical reaction.
- Develop a quantitative understanding of why a reaction goes forward or backward or not at all.
- Utilize electrochemical potentials to predict reaction outcomes.
- Analyze the forces attracting molecules to one another.
- Know the microscopic structures of pure solids, liquids, and gases.
- Predict outcomes of the solution processes by knowing the physical properties of solutions.
- Solve problems involving nuclear decay processes and mass to energy conversions.

Required Materials

- Cengage Web Assign Subscription, which includes access to our textbook *Chemical Principles*, 8th edition, by Zumdahl and Decoste. Click here to learn how to purchase a subscription.

- You should also have a hand-held scientific calculator but an online calculator will also do.

Graded Elements of the Course

- **End of Chapter Problems (Homework) (25% of your grade):** Found on WebAssign, these problems are from the end of each chapter we are covering (6 problem sets total). 5 tries per problem. The main focus is on quantitative problems. Use the Ask Your Teacher message platform to communicate with the teaching team if you have questions about these problems.
- **Video Quizzes (25% of your grade, lowest score dropped):** These questions will be available at the completion of video segments. They will focus mostly on the conceptual aspects of the material. Use Chat or Discussion on Canvas to ask questions to the teaching team and other students about these problems. 2-tries for each video quiz. Note that Yuja does not provide the correct answer after the quiz. The key for each week's video quizzes will be posted to Canvas after each due date.
- **Chapter Quizzes (25% of your grade, best 5 out of 6):** There are 6 quizzes on WebAssign (one for each chapter). These are timed tests (60 min) that can be accessed during a 3-day window. The questions are mostly quantitative.
- **Final Exam (25% of your grade):** This test will be cumulative of the course and will be given on Web Assign. It is a 3-hour test that can be accessed during a 48-hour window.
- All assessments are open-book, open-note, open-internet. You must work independently and cannot post material to Chegg or similar sites. Abuse of the honor system will not be tolerated. See the page on Academic Integrity for more information
- Late Policy: Assignments may be turned in late for a 10% per day penalty, max 40% deduction. Video quizzes require no instructor-granted extensions but all WebAssign assignments must be granted extensions by the instructor.

Time Budget for this Course

A 5 credit course in a 5-week summer session assumes a median workload of 26 hours per week, with some students spending more time and some spending less time. For this course, estimates of weekly workload are:

- Reading the textbook – 2 hours
- Watching the lecture videos – 7 hours
- Completing the video quizzes – 3 hours
- Completing the end of chapter problems – 6 hours
- Attending discussion sections on Zoom or in person – 3 hours
- Reviewing and studying for the quizzes and final exam – 5 hours

Letter grade equivalent of percentage score:

- A+: 96.50-100
- A: 92.50-96.49
- A-: 89.50-92.49
- B+: 85.50-89.49

- B: 81.50-85.49
- B-: 76.50-81.49
- C+: 71.50-76.49
- C: 59.50-71.49
- D: 54.50-59.49

Discussion Section Schedule

Discussion sections are optional but are encouraged since interacting with a live human will improve your learning experience.

Class	Days & Times	In person location	Zoom link	TA
Section 1	Thursdays at 3:00 pm - 4:30 pm	EMS B210	https://ucsc.zoom.us/j/99084177685?pwd=TlQvazFWRFFvUEdVbTgrcU9zMGFVQT09 (https://ucsc.zoom.us/j/99084177685?pwd=TlQvazFWRFFvUEdVbTgrcU9zMGFVQT09)	McKenna Smith

The Teaching Team

Instructor

- Dr. Peter Weiss – Lecturer
  - pweiss@ucsc.edu (mailto:pweiss@ucsc.edu)
  - (831) 459-1616
  - Office hours: Fridays 1:30-3:30 on Zoom https://ucsc.zoom.us/j/9775776872?pwd=dmR4M1VOMG10QUxON3dYNm1mdzFkUT09 (https://ucsc.zoom.us/j/9775776872?pwd=dmR4M1VOMG10QUxON3dYNm1mdzFkUT09)
  - Peter Weiss-Penzias research website: fognet.ucsc.edu (https://research.pbsci.ucsc.edu/metx/pweiss/)

TA

- McKenna Smith mcesmith@ucsc.edu

Topics Covered in Week 1

Reading in Zumdahl and Decoste, 8th ed.

- 9.1, 9.2, 9.3

Key Topics

- Basic energy concepts and definitions

- State variables
- Gases in pistons
- Equations for Heat, Work, and Internal Energy
- Sign conventions for Heat, Work and Internal Energy
- Exothermic and Endothermic processes
- The difference between heat and temperature
- Solve problems using the 1^{st} law equations
- State vs. path functions
- Constant P, V, and T conditions in 1^{st} law problems
- Enthalpy and molar heat capacity
- Calculations of thermodynamic variables using ideal gas and 1^{st} law equation and P-V diagrams
- Exothermic and endothermic chemical reactions

Reading in Zumdahl and Decoste, 8th ed.

- 9.4, 9.5, 9.6

Key Topics

- What is calorimetry and an isolated system?
- Calorimetry calculations for the four types of experiments: heat capacity of metal, heat of reaction for aqueous solution, bomb calorimetry, and heat of phase changes
- Hess' Law and Standard Enthalpy of Formation reactions

Topics Covered in Week 2

Reading from Zumdahl and Decoste 8th ed.

- 10.1 through 10.6, and 10.8

Key Topics

- Introduction to the 2^{nd} law
- Reversible and irreversible processes
- Definition of entropy and calculation of entropy for physical processes
- Entropy in terms of randomness and the probability of an outcome
- Entropy of the system, surroundings, and universe and definition of a spontaneous process
- Calculations using standard molar entropy and the 3^{rd} law
- Comparing entropies of different substances
- Calculation of entropy of the system, surroundings, and universe to determine spontaneity

Reading from Zumdahl and Decoste 8th ed.

- 10.7, 10.9, 10.10, 10.11, 10.12, 10.13

Key Topics

- Gibbs free energy (ΔG^o) in terms of enthalpy and entropy of a chemical reaction
- Sign conventions of ΔG^o, ΔH, and ΔS
- Using the spontaneity grid and predicting the effect temperature on spontaneity
- Standard ΔG^o of formation
- The relationship between ΔG^o and useful work for reversible and irreversible processes
- Non-standard ΔG: accounting for changing pressures and concentrations during the course of a reaction
- Reaction quotient Q and its relation to the equilibrium constant K
- Calculating non-standard ΔG to determine spontaneity at any point in the reaction
- Calculating the direction a reaction will shift in relation to Le Chatelier's Principle

Topics Covered in Week 3-4

Reading in Zumdahl and Decoste, 8th ed.

- 4.10, 4.11, 11.1, 11.2, 11.3

Key Topics

- Oxidation-reduction reactions terminology
- Assigning oxidation numbers
- Balancing redox equations
- Standard reduction potentials
- Free energy DG^o and cell potential E^o
- The galvanic cell: calculating cell potentials from 1/2 reaction E^o values.
- Predict reaction spontaneity using data from the table of standard reduction potentials
- Choose the strongest oxidizing or reducing agent from a list of choices

Reading in Zumdahl and Decoste, 8th ed.

- 11.4 through 11.8

Key Topics

- The Nernst Equation and non-standard E of the cell
- Application of Le Chatelier's Principle to the galvanic cell
- Concentration Cell calculations
- Equilibrium Constant for Solubility (Ksp)
- Electrolysis reactions and electrochemical stoichiometry
- Batteries and Corrosion

Reading in Zumdahl and Decoste, 8th ed.

- 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.10, 16.11

Key Topics

- Intermolecular Forces (IMFs)
- Electronegativity, Bond Polarity, Ion Sizes, and Molecular Structure
- Predict trends in boiling points and melting points
- Apply IMF rules to organic compounds
- Properties of liquids
- Properties of solids
- Crystalline elemental solids and the cubic unit cell
- Calculations of the atomic radius and density using unit cell equations
- Vapor pressure as a function of temperature given by the Claussius-Clapeyron equation
- Phase diagrams

Topics Covered in Week 4-5

Reading in Zumdahl and Decoste, 8th ed.

- 17.1, 17.2, 17.3

Key Topics

- The nature of solutions
- Concentration calculations with solutions
- Thermodynamics of the solution process
- Predicting solubility trends based on the IMF rules
- Solids dissolved in liquids and the concept of supersaturation
- Henry’s Law of gas solubility in liquids

Reading in Zumdahl and Decoste, 8th ed.

- 17.4, 17.5, 17.6, 17.7

Key Topics

- Raoult’s Law with a non-volatile solute
- Raoult’s Law with two volatile solutes
- Deviations to Raoult’s Law
- Boiling point elevation and freezing point depression
- Osmotic pressure
- Colligative properties of electrolyte solutions and the Vant Hoff factor

Reading in Zumdahl and Decoste, 8th ed.

- 20.1, 20.2, 20.3, 20.5, 20.6

Key Topics

- Sub atomic particles
- Balancing nuclear equations
- Predicting nuclear stability
- Kinetics and nuclear decay reactions
- Use half-life and rate of decay equations
- Mass defect and binding energy
- Fission reactions

Course Summary:

Date	Details	Due
Fri Jul 29, 2022	Introduction to Web Assign (https://canvas.ucsc.edu/courses/55262/assignments/367805)	due by 11:59pm
Sun Jul 31, 2022	Homework 1 (https://canvas.ucsc.edu/courses/55262/assignments/367806)	due by 11:59pm
	Quiz 1 (https://canvas.ucsc.edu/courses/55262/assignments/367807)	due by 11:59pm
	Course Introduction and Practice Video Quiz (https://canvas.ucsc.edu/courses/55262/assignments/366368)	due by 11:59pm
	Video Quiz Lecture 1 (https://canvas.ucsc.edu/courses/55262/assignments/366383)	due by 11:59pm
	Video Quiz Lecture 2 (https://canvas.ucsc.edu/courses/55262/assignments/366394)	due by 11:59pm
	Video Quiz Lecture 3 (https://canvas.ucsc.edu/courses/55262/assignments/366396)	due by 11:59pm
	Video Quiz Lecture 4 (https://canvas.ucsc.edu/courses/55262/assignments/366397)	due by 11:59pm
Sun Aug 7, 2022	Homework 2 (https://canvas.ucsc.edu/courses/55262/assignments/367808)	due by 11:59pm
	Quiz 2 (https://canvas.ucsc.edu/courses/55262/assignments/367809)	due by 11:59pm

Date	Details	Due
	Video Quiz Lecture 5 (https://canvas.ucsc.edu/courses/55262/assignments/366398)	due by 11:59pm
	Video Quiz Lecture 6 (https://canvas.ucsc.edu/courses/55262/assignments/366399)	due by 11:59pm
	Video Quiz Lecture 7 (https://canvas.ucsc.edu/courses/55262/assignments/366400)	due by 11:59pm
	Video Quiz Lecture 8 (https://canvas.ucsc.edu/courses/55262/assignments/366401)	due by 11:59pm
	Video Quiz Lecture 9 (https://canvas.ucsc.edu/courses/55262/assignments/366402)	due by 11:59pm
Sun Aug 14, 2022	Homework 3 (https://canvas.ucsc.edu/courses/55262/assignments/367812)	due by 11:59pm
	Quiz 3 (https://canvas.ucsc.edu/courses/55262/assignments/367813)	due by 11:59pm
	Video Quiz Lecture 10 (https://canvas.ucsc.edu/courses/55262/assignments/366384)	due by 11:59pm
	Video Quiz Lecture 11 (https://canvas.ucsc.edu/courses/55262/assignments/366385)	due by 11:59pm
	Video Quiz Lecture 12 (https://canvas.ucsc.edu/courses/55262/assignments/366386)	due by 11:59pm
Sun Aug 21, 2022	Homework 4 (https://canvas.ucsc.edu/courses/55262/assignments/367811)	due by 11:59pm
	Quiz 4 (https://canvas.ucsc.edu/courses/55262/assignments/367810)	due by 11:59pm
	Video Quiz Lecture 13 (https://canvas.ucsc.edu/courses/55262/assignments/366387)	due by 11:59pm

Date	Details	Due
	Video Quiz Lecture 14 (https://canvas.ucsc.edu/courses/55262/assignments/366388)	due by 11:59pm
	Video Quiz Lecture 15 (https://canvas.ucsc.edu/courses/55262/assignments/366389)	due by 11:59pm
Fri Aug 26, 2022	Final Exam (https://canvas.ucsc.edu/courses/55262/assignments/367814)	due by 11:59pm
	Homework 5 (https://canvas.ucsc.edu/courses/55262/assignments/367818)	due by 11:59pm
	Homework 6 (https://canvas.ucsc.edu/courses/55262/assignments/367816)	due by 11:59pm
	Quiz 5 (https://canvas.ucsc.edu/courses/55262/assignments/367817)	due by 11:59pm
	Quiz 6 (https://canvas.ucsc.edu/courses/55262/assignments/367815)	due by 11:59pm
	Video Quiz Lecture 16 (https://canvas.ucsc.edu/courses/55262/assignments/366390)	due by 11:59pm
	Video Quiz Lecture 17 (https://canvas.ucsc.edu/courses/55262/assignments/366391)	due by 11:59pm
	Video Quiz Lecture 18 (https://canvas.ucsc.edu/courses/55262/assignments/366392)	due by 11:59pm
	Video Quiz Lecture 19 (https://canvas.ucsc.edu/courses/55262/assignments/366393)	due by 11:59pm
	Video Quiz Lecture 20 (https://canvas.ucsc.edu/courses/55262/assignments/366395)	due by 11:59pm