CHEMISTRY 1420.001: GENERAL CHEMISTRY FOR SCIENCE

MAJORS



Class time is MTWR 9:00-9:50AMand recitation is MONDAY 2:00-3:50PM Attendance is mandatory and students more than 10 minutes late are marked absent and do not earn credit on assignments. We take attendance for Zoom meetings.

Exams are given during the recitation period from 2-250PM. Exams are only available during that time window on that day.

Textbook: OpenStax 2e Atoms First (chapters 11-17 and 20)

<https://openstax.org/details/books/chemistry-atoms-first-2e>

This is a free, online textbook. You may print out whatever you need from this textbook if you prefer a paper copy.

Homework is administered through Canvas, from the textbook. Each homework assignment is embedded in the module on that topic or chapter.



Professor: Dr. Amy Petros (PhD, Columbia University 2006)

Office: ~~363 Chemistry~~

e-mail: amy.petros@unt.edu

Office Hours: MW 10-1050AM via Zoom; email or message on Canvas for any appointment outside of those days/times

*How to succeed in this course:*

Go to our Canvas page and follow the schedule assigned for completing each module, **schedule the 4+ hours per week when you will watch the videos and take notes**

Watch EVERY assigned video (*even the external ones*) and take notes (can print out notes from device)

Be a good group member: come prepared, listen to your teammates thoughts, if there is a disagreement just ask one of the helpers for guidance by clicking the Ask for Help icon. Students do not have to use the Video on Zoom but MUST use the audio to communicate with team members. Screenshare is strongly encouraged!

Practice the homework problems that are assigned in addition to the group assignments. Students get 3 attempts and only the highest attempt is graded.

Use the learning outcomes at the end of this syllabus as a check-list for your learning

Attend SI sessions, put these in your schedule now

Reach out to Dr. Petros with any question; we are here to help you!

Preliminary Schedule (subject to change)

|  |  |  |
| --- | --- | --- |
| Week | Beginning date | Chapter covered |
| 1 | July 6 | Chapter 11: Properties of Solutions  Chapter 13: Fundamental Equilibrium concepts |
| 2 | July 13 | **Exam 1: Monday 2-250PM (Ch. 11 and 13)**  Chapter 14: Acid-Base Equilibria  Chapter 15: Equilibria of other Reaction Classes |
| 3 | July 20 | **Exam 2: Monday 2-250PM (Ch. 14 and 15)**  Chapter 12: Thermodynamics  Chapter 16: Electrochemistry |
| 4 | July 27 | **Exam 3: Monday 2-250PM (Ch 12 and 16)**  Chapter 17: Kinetics  Chapter 20: Nuclear Chemistry |
| 5 | Aug 3 | **Exam 4: Monday 2-250PM (Ch 17 and 20)**  Review for Final; Final Exam |

**Friday August 7 at 8-10AM is our scheduled Final Exam time as scheduled by the Office of the Registrar**

**\*\*Always confirm date/time with Office of the Registrar\*\***



**Course Layout and Grading**

**GRADES ARE DETERMINED BY THE SUM OF ALL POINTS EARNED and EXTRA CREDIT ONLY.**

Letter grades are based on the following scale:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 90-100% of total points |  |  |  | Grade=A |
| 80-89% of total points |  |  |  | Grade=B |
| 70-79% of total points |  |  |  | Grade=C |
| 60-69% of total points |  |  |  | Grade=D |
| Below 60% |  |  |  | Grade=F |

*Grading*: The final grade is determined from 3 out of 4 regular exams, the final exam, which counts twice, homework, and group assignments. **THERE ARE NO MAKE-UP EXAMS. One exam is dropped.** If a student misses 2 exams, the 2nd missed exam will be replaced by the final exam percentage score. If a student has a University-approved absence (must provide documentation from Dean of Students), the student must meet with Dr. Petros immediately to discuss their options, which will include the choice of a make-up exam OR a drop. If a student with a UNT-approved absence requests a make-up exam, no exam will be dropped.

Each regular exam is worth 100 points; the final exam is worth 200 points.

Top 3 exams + final = 500 points possible

Group Assignments (top 16) are 10 points each, total 160 points possible.

Homework (on Canvas) are worth a maximum of 100 points

Total points = 760

*Exams*:

* Exams (not including the final) are 50 minutes in length on Mondays from 2-250PM. Exams are not available outside of this window.
* No extra time will be provided for late starts.
* Cheating will result in a zero. Exams with identical wrong answers will result in an automatic F for all students involved.
* Students using an alternate device to search for answers online will receive an F for the course. Instructor writes exams questions that will yield a wrong answer from an internet search as calculated values differ from experimental values.
* Students are responsible for all technology requirements, including but not limited to keeping an updated browser, having a stable internet connection, using the ideal browser, etc. No points will be given for images that aren’t loading (click Refresh)

An **incomplete** grade is only given if the student meets the requirements as set forth by the university. The incomplete for the course is only given during the last one-fourth of a semester and only if a student: (1) gives notice to the instructor of being required to participate in active military service, or (2) is **passing the course** and has justifiable reasons why the work cannot be completed on schedule. The UNT Undergraduate Catalog delves into greater detail for these requirements.

The University of North Texas makes reasonable academic accommodation for students with disabilities. **Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility.** If a disability is verified, the ODA will provide you with an accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request accommodations at any time, however, **ODA notices of accommodation should be provided as early as possible in the semester** to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the Office of Disability Accommodation website at [http://www.unt.edu/oda.](https://webmail.unt.edu/OWA/redir.aspx?C=QwkPSKm9C0WEeBO5qvaKxFAO1g0yws8IfFyg_12JpxBwAOB_rp5XFbhqyl6BONquNsCTN2TWEfE.&URL=http%3a%2f%2fwww.unt.edu%2foda) You may also contact them by phone at 940.565.4323.

CHEM 1420 3-level model learning outcomes (**what you need to learn this semester**)

1. Students will understand chemical equilibria.
   1. Solubility as an equilibrium process
      1. Describe the relationship between temperature and solubility (gases and liquid solutions)
      2. Students will use Henry’s law to calculate solubility, constant, or pressure
      3. Students will apply the concept “like dissolves like” to predict relative solubility based on polarity
   2. Equilibrium constant expressions
      1. Set up the K expression
      2. Relationship between K value and Reactant- or Product-favored
      3. Relationship between Kc and Kp
      4. Comparing Q and K to determine equilibrium
      5. Students will use Le Chatelier’s Principle to determine “shift” needed to re-establish K
      6. Students will convert between Ksp and solubility of slightly soluble salts
   3. Using RICE/ICE tables to solve equilibrium problems
      1. Students will set up a RICE table
      2. Students will use the RICE table to solve for K given equilibrium conc/P
      3. Students will solve for equilibrium conc/P given K and initial amounts
   4. Students will solve for pH in aqueous solutions
      1. Students will calculate pH in strong acid solutions
      2. Students will calculate pH in strong base solutions
      3. Students will calculate pH in weak acid solutions (or solve for Ka given pH and initial concentration)
      4. Students will calculate pH in weak base solutions (or solve for Kb given pH and initial concentration)
      5. Students will convert between pH, pOH, [OH-], [H3O+], and Ka, Kb, Kw
2. Students will understand the kinetics of chemical and nuclear decay reactions
   1. Students will determine average rates of chemical reactions
      1. Students will calculate average rates from a table of time and concentration and a balanced reaction
      2. Students will select the correct average rate expression based on a balanced reaction, or write a balanced reaction from a series of average rates
   2. Students will use and understand rate laws
      1. Students will select the rate law based on a table of initial concentrations and initial rates
      2. Students will use the rate law to calculate rates, rate constants, or concentrations
      3. Students will write rate laws based on elementary steps, or select the rate-determining step based on the rate law
      4. Students will identify species involved in transition states based on rate law
   3. Students will use and understand integrated rate laws
      1. Students will select the correct order (0, 1, or 2) from a plot of concentration, ln concentration, or 1/concentration versus time
      2. Students will calculate time or concentration based on the order of reaction
      3. Students will apply integrated rate laws to determine half-life of nuclear decay reactions
   4. Students will draw and use Reaction-energy diagrams
      1. Students will draw and label R-E diagrams for endothermic and exothermic reactions
      2. Students will identify intermediates and transition states from R-E diagrams
      3. Students will identify “slow” or “fast” steps from R-E diagrams
3. Students will understand thermodynamics and energy exchange during chemical reactions
   1. Students will know the definition of entropy and how to apply it
      1. Students will define entropy and know the 2nd Law of Thermodynamics
      2. Students will qualitatively predict a change in entropy
      3. Students will calculate a change in entropy given a balanced reaction and a table of intrinsic entropy values
   2. Students will define and understand Gibbs Free Energy
      1. Students will predict sign of ΔG given signs of H and S
      2. Students will define spontaneous/nonspontaneous based on sign of ΔG
      3. Students will calculate ΔG using ΔH and ΔS
      4. Students will calculate ΔG given a balanced reaction and a table of Gibbs Free energy of formation values
      5. Students will calculate ΔG based on the equilibrium constant (ΔG=-RT ln K)
      6. Students will mathematically relate reduction potential to ΔG and K
4. Students will understand properties of solutions
   1. Students will know mathematical relationships of solution concentration units
      1. Students will identify solute, solution, and solvent
      2. Students will manipulate and solve the density formula (d=m/V)
      3. Students will manipulate and solve the molarity equation (M=mols of solute/L of solution)
      4. Students will manipulate and solve the molality equation (molal=mols of solute/kg solvent)
      5. Students will calculate ppm, ppb, and ppt
      6. Students will manipulate and solve mass fraction and mass percent
   2. Students will understand electrochemistry of aqueous solutions
      1. Students will draw and label components of an electrochemical cell
      2. Students will
      3. Students will identify half reactions
         1. Students will identify which half reaction takes place at the cathode or anode
         2. Students will balance electrochemical reactions based on the half reaction method
         3. Students will calculate values based on Ecell =Ecathode-Eanode
   3. Students will understand solubility and colligative properties
      1. Students will qualitatively describe Henry’s law of solubility
      2. Students will mathematically determine values using Henry’s law
      3. Students will predict solubility based on polarity of solute-solvent partners
      4. Students will qualitatively predict vapor pressure changes based on Raoult’s law
      5. Students will mathematically determine values using Raoult’s law
      6. Students will qualitatively predict changes in boiling point and freezing point
      7. Students will mathematically determine values using the change in boiling point and freezing point equation
      8. Students will mathematically determine values using osmotic pressure, derived from PV=nRT the Ideal Gas Law
5. Students will understand nuclear stability and decay
   1. Students will know subatomic particles and components
      1. Students will balance and complete nuclear decay reactions
      2. Students will predict mode of decay based on isotope given
   2. Students will use first-order kinetics and nuclear decay
      1. Students will convert between half-life and rate constant k
      2. Students will calculate time (age), amount remaining, or original amount of isotope