

**Chemistry 1312 and 1112
Spring 2022**

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Office Hours: Mon-Fri. 8:15AM -8:50AM (except Mon.) and 4:00PM – 5:00PM

Course Description

In this class, you will study the fundamental laws and theories of chemistry, chemical nomenclature, chemical equilibrium, metals and non-metals and their compounds, nuclear chemistry and the quantum theory of structure. This study will include atomic structure, chemical bonding and molecular geometry, stoichiometry, chemical nomenclature, the periodic table, properties of solutions and gases, and thermochemistry. The laboratory will be quantitative in nature.

Prerequisites: Chemistry 1311 and Chemistry 1111 is to be completed before Chemistry 1312 and Chemistry 1112. Proficiency in algebra required. Only students eligible to take college-level mathematics courses may take Chemistry 1312 and 1112.

Course Implementation:

CREDIT: Four semester hours.

TEXT [Provided at FHS campus for academic year 2018-2019]:

Zumdahl, Steven S., Zumdahl, Susan, *Chemistry*, 9th ed. AP* edition.

Belmont, California, Brooks/Cole 2014 [CR1]

LAB MANUAL [Provided at FHS campus]: Little, John G., *Lab*

Manual AP Experimental Chemistry* 9th edition, Brooks/Cole 2014

Concerning this excellent textbook: Each of the chapters we'll cover contains short (1/2-1 page) articles titled “**Chemical connections**” concerning the influence of chemical understanding or research on society or technology. You are expected to read these, as they will at times inspire questions for your tests. Also, at year's end, you'll be called upon to conduct literature research and present concerning a particular advance in chemical understanding (of your choice) and its expected influence on future products, technologies, or medicine.
[CR4]

Attendance Policy: You are expected to attend all class meetings. You are expected to arrive on time and to stay until the end of the lecture.

If you have the flu, please stay home. Do not help spread the flu to everyone else. Keep your professor informed as to your status by email (preferred) or telephone (if necessary). Your faculty will work with you to keep up to date in the class. Students are responsible for all class work covered during absences from class, even in cases for which they are able to satisfy the instructor that the absence was unavoidable.

Angelo State University grades for this class will be assigned on the following basis:

| <u>%</u> | <u>Grade*</u> |
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| 93+ | A |
| 85-92.9 | B |
| 77-84.9 | C |
| 70-76.9 | D |
| < 70 | F |

*Dual-credit students who do not achieve at least a grade of C in each dual-credit class may not be allowed to enroll in further ASU dual-credit courses. Because of the different constraints at the two institutions, grades at Frenship may not match ASU grades.

Note: The final exam for this course will be in 2 parts, administered in class April 26- April 29, and cannot be exempted.

The content of this course will revolve around the following major concepts: [CR2]

Big Idea 1: The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangements of atoms. These atoms retain their identity in chemical reactions.

Big Idea 2: Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them.

Big Idea 3: Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.

Big Idea 4: Rates of chemical reactions are determined by details of the molecular collisions.

Big Idea 5: The laws of thermodynamics describe the essential role of energy and explain and predict the direction of changes in matter.

Big Idea 6: Any bond or intermolecular attraction that can be formed can be broken. These two processes are in a dynamic competition, sensitive to initial conditions and external perturbations.

The lab portion of this course will hold the student to the following standards:

Science Practice 1: The student can use representations and models to communicate scientific phenomena and solve scientific problems.

Science Practice 2: The student can use mathematics appropriately.

Science Practice 3: The student can engage in scientific questioning to extend thinking or to guide investigations within the context of this college-level course.

Science Practice 4: The student can plan and implement data collection strategies in relation to a particular scientific question. [Note: Data may be collected from many different sources, e.g., investigations, scientific observations, the findings of others, historic reconstruction, and/or archived data.]

Science Practice 5: The student can perform data analysis and evaluation of evidence.

Science Practice 6: The student can work with scientific explanations and theories.

Science Practice 7: The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains.

Your **grade** for this course will be calculated using the following values for assessments:

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| Exams | 40% |
| Quizzes | 25% |
| Daily Work | 10% |
| Labs | 25% |

Tests will be comprehensive and may consist of both multiple choice and free-response questions.

Labs [CR5a] will frequently require more time than has been allotted during the scheduled 90 minute class period. You may complete these labs during the morning activity periods (about 2 activity periods per week) prior to the start of classes for the day. You must observe all posted and stated safety rules, as well as rules of common sense and sound chemical judgment. Labs will also require your best attention to detail and best efforts at proper lab technique. You will be expected to **write a thorough lab report** that includes the following sections:

Introduction/Overview - The introduction should describe the reason/intent for the investigation and any background information related to the investigation. This would be the appropriate portion of a lab report for laying out a hypothesis.

Experimental Method - This section should consist of a narrative of the experimental apparatus and procedure. It should be written in the third person and should describe what was done (not what one should do). Nevertheless, the reader should be able by reading this section to perform the identical experiment in order to verify your observations and results.

Data - This section should detail ALL measurements taken during the investigation. These should be recorded in a clear, neat manner that follows the sequence of the procedure. It should show calculations that were conducted using the data. Also, it should show statistical treatments of the data (e.g. % yield, % error, standard deviation) as well as helpful graphical representations. Many of these data items can be carried out in a spreadsheet (i.e. Microsoft Excel), which should be incorporated into the lab report document.

Results/Conclusion – This portion of a lab report should address whether or not (or to what extent) the data support the hypothesis. If a hypothesis was not involved, it should describe the meaning of the investigation's findings.

Your completed lab reports should be saved and submitted as pdf files, in Schoology, to preserve formatting. It would be wise for you to keep a file containing electronic copies of your graded lab reports for later reference. Some universities may want to see hardcopies of these before awarding credit to you.

Quizzes may be daily and will likely consist of a question or questions similar to problems assigned for homework.

Daily problems will be assigned for nearly every class day. Many of these assignments will need to be completed online. For hardcopy problems you will earn a grade upon showing work in an orderly, legible and logical sequence that leads to the solutions. Note that what is most important is not just whether the correct answer is supplied, but that you understand how to solve the problem and can show that you do.

| <p align="center">Course Content – note that because of FHS scheduling, some of the content for 1312/1112 was covered in December of 2021</p> | <p align="center">AP Chem Topics</p> | |
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| <p>IV. Chemical Bonds and Molecular Structure</p> <p>A. Molecular substances vs. ionic vs. covalent network solids Problems 10.69-10.85, Problems 8.23, 8.55-8.59</p> <p>B. Intermolecular forces (dipole-dipole interaction hydrogen bonding, London dispersion forces) and their effects upon phase changes Problems 10.21,10.27</p> <ol style="list-style-type: none"> Vapor pressures above solutions and Raoult's law Problems 11.51-61 Colligative properties with analysis in terms of enthalpic and entropic factors. Problems 11.65-75. <p>C. Geometry of molecules and ions, and its effects upon dipole moments and steric hindrance, Isomerism</p> <p>D. Relating ionic, covalent and metallic bond characteristics to the periodic table Problems 8.15- 39</p> | <p>BI 2 [CR3b]</p> | <p>12/6/21 - 12/10/21</p> |

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| <p>X. Chemical Equilibria</p> <p>B. K_a and K_b, pK_a and pK_b and pH; weak acids and bases, their salts, buffer systems and indicators; the Henderson-Hasselbach equation, titration curves Problems 14.19-103, 15.9-33,55-59, 69-75</p> <p>[LO 2.2 The student is able to explain the relative strengths of acids and bases based on molecular structure, interparticle forces, and solution equilibrium.</p> <p>Activity: Student pairs present to the class verbally and with data and/or drawings using concepts of stability of leaving groups based upon predictions concerning London dispersion forces, polarity, and/or resonance structures to justify differences between K_a values for pairs of acids.] [CR3b]</p> <p>C. Polyprotic acids Problems 14.105-111</p> <p>D. Relating molecular structure to relative strengths of acids and bases</p> | | 2/18 - 2/25/22 |
| <p>(<i>Lab 7 –Titration curves –Expt. 14 in lab manual - Guided Inquiry.</i>) (2 periods) LO 1.2,6.13, SP 4.2,5.1 [CR5] [CR6]</p> <p>Spring Exam 2 –identifying and distinguishing Arrhenius, Bronsted-Lowry and Lewis acids and bases, Le Chatelier’s principle, equilibrium constant expressions, auto-ionization of water, pH of strong and weak acid solutions, K_a, K_b, predicting the direction of shift due to stress of a chemical equilibrium, use of RICE tables reaction quotient, pH of weak acid/base systems, predicting concentrations of solution components of weak acid/base systems, identifying titration curves based upon pH at equivalence point and $\frac{1}{2}$ equivalence point, relating acid/base strength to K_a or K_b or pK_a or pK_b values</p> | [CR3b] | 2/28 – 3/1/22 3/2 - 3/3/22 |
| <p>D. Solubility product constants (K_{sp}) and their applications to precipitation and dissolution of slightly soluble compounds Problems 16.9-13, 19-39, 47-57, 61-67</p> <p>E. Electrochemistry: Galvanic and electrolytic cells, standard reduction potentials, standard cell potentials, Faraday constant and the Nernst equation and predicting the direction and rate of electron transfer Problems 18.29-31, 35-55, 67-73</p> <p>Relationship of change in free energy to equilibrium constants and electrode potentials Problems 18.19-27, 35-63</p> | <p>BI 3 [CR3c]</p> <p>BI 6 [CR3f]</p> | 3/4-3/23/22 |

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| Spring Exam 3 – K_{sp}, Galvanic and electrolytic cells, standard reduction potentials, standard cell potentials, Faraday constant and the Nernst equation and predicting the direction and rate of electron transfer, relating free energy change to equilibrium constants and electrode potentials, | | 3/24 - 3/25/22 |
| XII. Representative reactions - Problems 20.11-65, 21.29-43 A. Alkali metals B. Alkaline earth metals C. Group 3A-6A metals D. Transition metals E. Halogens | BI 1, BI 2, BI 3 [CR3a], CR3b], [CR3c] | 3/28-4/4/22 |
| (Lab 8- Analysis by Oxidation-Reduction Titration –Expt. 8 in lab manual - Guided Inquiry.) (1 period) LO 3.9, SP 4.2,5.1 [CR5] [CR6] (Lab 9- Spectrophotometric determination of K_{eq} for the ferric thiocyanate complex.) (1 period) SP 2.1, 4.2,5.1, 7.1 [CR5] [CR6] Comprehensive review and application of course content including conducting labs that were missed earlier in the semester | | 4/5 -4/25 |
| Semester Final Part 1 – Free response - Comprehensive Exam Semester Final Part 2 – Multiple choice – Comprehensive Exam Topics: – IMFs and phase properties, factors influencing the energetics of phase changes, vapor pressure and Raoult's law, molality, van 't Hoff factor, freezing point depression, boiling point elevation, ionic, covalent, and polar covalent bonds, formal charge, VSEPR predictions for numbers and types of bonds and for molecular geometry MOs, paramagnetism, diamagnetism, identifying and distinguishing Arrhenius, Bronsted-Lowry and Lewis acids and bases, Le Chatelier's principle, equilibrium constant expressions, auto-ionization of water, pH of strong and weak acid solutions, K_a, K_b, predicting the direction of shift due to stress of a chemical equilibrium, use of RICE tables, predicting the direction of shift due to stress of a chemical equilibrium, use of RICE tables, reaction quotient, pH of weak acid/base systems, predicting concentrations of solution components of weak acid/base systems, identifying titration curves based upon pH at equivalence point and $\frac{1}{2}$ equivalence point, relating acid/base strength to K_a or K_b or pK_a or pK_b values, Galvanic and electrolytic cells, | | 4/26-4/27/22 4/28-4/29/22 |

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| standard reduction potentials, standard cell potentials, Faraday constant and the Nernst equation and predicting the direction and rate of electron transfer, relating free energy change to equilibrium constants and electrode potentials, K _{sp} , relating free energy change to equilibrium constants and electrode potentials, reaction rate, method of initial rates, reaction mechanism, intermediates, catalysts, rate determining step, reaction order, rate constant, interpreting linear plots indicating reaction order | | |
| XIII. Organic Chemistry -Problems 22.13-33 A. Nomenclature review and extension B. Reactions by functional groups C. Industrially important reactions | BI 1, BI 2, BI 3 [CR3a], CR3b], [CR3c] | 5/2-5/6/22 |
| XIV. Biochemistry -Problems 22.83-99 A. Biomolecules – structure and function B. Enzymes – catalytic mechanisms | BI 1, BI 2, BI 3 [CR3a], CR3b], [CR3c] | 5/9-5/13/22 |
| XV. Metal ions and Coordination Chemistry, and Nuclear Reactions | | 5/16-5/17/22 |

Student Disability Services

ASU is committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs or activities of the university, or be subjected to discrimination by the university, as provided by the Americans with Disabilities Act of 1990 (ADA), the Americans with Disabilities Act Amendments of 2008 (ADAAA), and subsequent legislation. The Office of Student Affairs is the designated campus department charged with the responsibility of reviewing and authorizing requests for reasonable accommodations based on a disability, and it is the student's responsibility to initiate such a request by contacting:

Ms. Dallas A. Swafford Director of Student Disability Services
325-942-2047
dallas.swafford@angelo.edu
Houston Harte University Center Title IX Statement

Angelo State University is committed to the safety and security of all students.

If you or someone you know experience sexual harassment, sexual assault, domestic or dating violence, stalking, or discrimination, you may contact ASU's Title IX Coordinator:

Michelle Nicole Boone, J.D. Director of Title IX Compliance 2
Michelle.boone@angelo.edu
325-486-6357
Mayer Administration Building 204

Student Absence for Observance of Religious Holy Days

A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence.

See

<https://www.angelo.edu/live/files/14206-op-1019-student-absence-for-observance-of>

Incomplete Grade Policy

It is policy that incomplete grades be reserved for student illness or personal misfortune.

Please contact faculty if you have serious illness or a personal misfortune that would keep you from completing course work. Documentation may be required. See ASU Operating Policy 10.11 Grading Procedures for more information.

<https://www.angelo.edu/live/files/14197-op-1011-grading-procedures>

Student Conduct Policies Academic Integrity

Students are expected to maintain complete honesty and integrity in all work. Any student found guilty of any form of dishonesty in academic work is subject of disciplinary action and possible expulsion from ASU.

<https://www.angelo.edu/live/files/27603-student-handbook-2020-21#page=96>

Plagiarism

Plagiarism is a serious topic covered in ASU's Academic Integrity policy in the Student Handbook. Plagiarism is the action or practice of taking someone else's work, idea, etc., and passing it off as one's own. Plagiarism is literary theft. In your discussions and/or your papers, it is unacceptable to copy word-for-word without quotation marks and the source of the quotation. It is expected that you will summarize or paraphrase ideas giving appropriate credit to the source both in the body of your paper and the reference list. Papers are subject to be evaluated for originality via Turnitin. Resources to help you understand this policy better are available at the ASU Writing Center.

https://www.angelo.edu/current-students/writing-center/academic_honesty.php

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General Policies Related to This Course

All students are required to follow the policies and procedures presented in these documents:

<https://www.angelo.edu/current-students/student-handbook/>

<https://www.angelo.edu/live/files/28080-undergraduate-catalog>