Course Syllabus

CHEM 1412; CHEM 1412L – General Chemistry I I

Catalog Description: This course is for students majoring in the sciences, pre-medicine, pre-dentistry or pre-engineering. It covers the fundamental laws and theories of general chemistry and their applications which are necessary for further work in science and related subjects. Modern concepts of atomic and molecular structure and chemical bonding are stressed in interpreting the chemical and physical properties of matter. The laboratory is devoted primarily to quantitative analysis and techniques. (Lab Fee)

Prerequisites: CHEM 1411

Semester Credit Hours: 4
Lecture Hours per Week: 3
Laboratory Hours per Week: 3
Contact Hours per Semester: 90
State Approval Code: 4005015203

Course Subject/Catalog Number: CHEM 1412
Course Title: General Chemistry I I

Course Curriculum: State Criteria (those marked with an X reflect the state-mandated competencies taught in this course)

Basic Intellectual Competencies in the Core Curriculum	
☒	Reading
☒	Writing
☒	Speaking
☒	Listening
☒	Critical thinking
☒	Computer literacy
Perspectives in the Core Curriculum	
☒	Establish broad and multiple perspectives on the individual in relationship to the larger society and world in which he/she lives, and to understand the responsibilities of living in a culturally and

	ethnically diversified world.
☒	Stimulate a capacity to discuss and reflect upon individual, political, economic, and social aspects of life in order to understand ways in which to be a responsible member of society.
☒	Recognize the importance of maintaining health and wellness.
☒	Develop a capacity to use knowledge of how technology and science affect their lives.
☐	Develop personal values for ethical behavior.
☒	Develop the ability to make aesthetic judgments.
☒	Use logical reasoning in problem solving.
☒	Integrate knowledge and understand the interrelationships of the scholarly disciplines.

Core Components and Related Exemplary Educational Objectives

Communication (composition, speech, modern language)
The objective of a communication component of a core curriculum is to enable the student to communicate effectively in clear and correct prose in a style appropriate to the subject, occasion, and audience.

☐	To understand and demonstrate writing and speaking processes through invention, organization, drafting, revision, editing, and presentation.
☐	To understand the importance of specifying audience and purpose and to select appropriate communications choices.
☐	To understand and appropriately apply modes of expression, i.e. descriptive, expositive, narrative, scientific, and self-expressive, in written, visual, and oral communication.
☐	To participate effectively in groups with emphasis on listening, critical and reflective thinking, and responding.
☐	To understand and apply basic principles of proficiency in the development of exposition and argument.
☐	To develop the ability to research and write a documented paper and/or to give an oral presentation.

Mathematics
The objective of the mathematics component of the core curriculum is to develop a quantitatively literate college graduate. Every college graduate should be able to apply basic mathematical tools in the solution of real-world problems.

☒	To apply arithmetic, algebraic, geometric, higher-order thinking, and statistical methods to modeling and solving real-world situations.
☒	To represent and evaluate basic mathematical information verbally, numerically, graphically, and symbolically.
☒	To expand mathematical reasoning skills and formal logic to develop convincing mathematical arguments.
☒	To use appropriate technology to enhance mathematical thinking and understanding and to solve mathematical problems and judge the reasonableness of the results.
☒	To interpret mathematical models such as formulas, graphs, tables and schematics, and draw inferences from them.
☒	To recognize the limitations of mathematical and statistical models.

☒	To develop the view that mathematics is an evolving discipline, interrelated with human culture, and understand its connections to other disciplines.
Natural Sciences The objective of the study of a natural sciences component of a core curriculum is to enable the student to understand, construct, and evaluate relationships in the natural sciences, and to enable the student to understand the bases for building and testing theories.	
☒	To understand and apply method and appropriate technology to the study of natural sciences.
☒	To recognize scientific and quantitative methods and the differences between these approaches and other methods of inquiry and to communicate findings, analyses, and interpretation both orally and in writing.
☒	To identify and recognize the differences among competing scientific theories.
☒	To demonstrate knowledge of the major issues and problems facing modern science, including issues that touch upon ethics, values, and public policies.
☒	To demonstrate knowledge of the interdependence of science and technology and their influence on, and contribution to, modern culture.
Humanities and Visual and Performing Arts The objective of the humanities and visual and performing arts in a core curriculum is to expand students' knowledge of the human condition and human cultures, especially in relation to behaviors, ideas, and values expressed in works of human imagination and thought. Through study in disciplines such as literature, philosophy, and the visual and performing arts, students will engage in critical analysis, form aesthetic judgments, and develop an appreciation of the arts and humanities as fundamental to the health and survival of any society. Students should have experiences in both the arts and humanities.	
☐	To demonstrate awareness of the scope and variety of works in the arts and humanities.
☐	To understand those works as expressions of individual and human values within an historical and social context.
☐	To respond critically to works in the arts and humanities.
☐	To engage in the creative process or interpretive performance and comprehend the physical and intellectual demands required of the author or visual or performing artist.
☐	To articulate an informed personal reaction to works in the arts and humanities.
☐	To develop an appreciation for the aesthetic principles that guide or govern the humanities and arts.
☐	To demonstrate knowledge of the influence of literature, philosophy, and/or the arts on intercultural experiences.
Social and Behavioral Sciences The objective of a social and behavioral science component of a core curriculum is to increase students' knowledge of how social and behavioral scientists discover, describe, and explain the behaviors and interactions among individuals, groups, institutions, events, and ideas. Such knowledge will better equip students to understand themselves and the roles they play in addressing the issues facing humanity.	
☐	To employ the appropriate methods, technologies, and data that social and behavioral scientists use to investigate the human condition.
☐	To examine social institutions and processes across a range of historical periods, social structures, and cultures.
☐	To use and critique alternative explanatory systems or theories.
☐	To develop and communicate alternative explanations or solutions for contemporary social issues.
☐	To analyze the effects of historical, social, political, economic, cultural, and global forces on the area

	under study.
☐	To comprehend the origins and evolution of U.S. and Texas political systems, with a focus on the growth of political institutions, the constitutions of the U.S. and Texas, federalism, civil liberties, and civil and human rights.
☐	To understand the evolution and current role of the U.S. in the world.
☐	To differentiate and analyze historical evidence (documentary and statistical) and differing points of view.
☐	To recognize and apply reasonable criteria for the acceptability of historical evidence and social research.
☐	To analyze, critically assess, and develop creative solutions to public policy problems.
☐	To recognize and assume one's responsibility as a citizen in a democratic society by learning to think for oneself, by engaging in public discourse, and by obtaining information through the news media and other appropriate information sources about politics and public policy.
☐	To identify and understand differences and commonalities within diverse cultures.

Instructional Goals and Purposes: Chemistry 1412 is the second of a two semester general college chemistry course. Prerequisite for the course is successful completion of Chemistry 1411. There is a required laboratory section which meets once a week for four hours. The second semester course covers thirteen chapters of the text, surveying topics in materials, kinetics, equilibria, thermodynamics, electrochemistry, oxidation-reduction reactions, nonmetal and coordination chemistry, and nuclear chemistry, with a brief introduction to organic chemistry.

General Course Objectives:

1. Explain the general principles, laws, and theories of chemistry
2. Develop an awareness of the value of chemistry in our daily living
3. Use critical thinking and logic in the solution of problems
4. Explore chemical principles in the laboratory setting
5. Develop independent and cooperative learning skills
6. Recognize and acquire attitudes that are characteristic of the successful worker regardless of the major field of study

Specific Course Objectives:

1. List factors that affect reaction rates.
2. Write rate laws.
3. Compare first and second order reactions.
4. Determine, using the collision model, the effect of temperature on rates of reactions.
5. Define reaction mechanisms.
6. Describe elementary reactions.
7. Describe and give examples of 2 types of catalysts.
8. Describe equilibrium in terms of LeChatelier’s principle.
9. Write equilibrium constant expressions.

10. Calculate equilibrium constants.
11. Compare and contrast the 3 acid – base models.
12. Perform pH calculations.
13. Distinguish between strong and weak acids and bases.
14. Show the mathematical relationship between K_a and K
15. Using the common-ion effect, calculate the concentrations of ions in buffer solutions.
16. List the factors that affect solubility.
17. Describe a qualitative analysis scheme suitable for separating a selected list of metal ions.
18. Describe the atmosphere and problems that the atmosphere is experiencing in chemical terms.$_b$
19. List current freshwater challenges.
20. Provide evidence of the importance of green chemistry.
21. List the 2^{nd} and 3^{rd} laws of Thermodynamics.
22. Compare entropy and enthalpy.
23. Solve problems using the Gibbs Free Energy relationships.
24. Balance redox equations.
25. Distinguish between voltaic and electrolytic cells.
26. Calculate cell EMF under specified conditions.
27. Compare types of batteries.
28. Describe the effects of electrolysis and methods to control electrolysis.
29. Describe nuclear reactions.
30. Track nuclear transmutations from starting radioactive atom to stable atom.
31. Describe biological effects of radiation.
32. List the periodic properties of metals and nonmetals.
33. Name coordination compounds and write their formulas.
34. Explain the chemical source of color in vision.
35. Use crystal fiels theory to explain molecular phenomena that other bonding theories do not explain.
36. List the IUPAC nomenclature for common classes of organic compounds.
37. Draw the structures for common classes of organic compounds.

Course Content: The philosophy of this course is that an introduction to chemistry is a core discipline for a college education, a course central to a science, engineering, or health science education, especially in view of the rapidly exploding impact of technology developments in routine daily endeavors.

Recognizing a broad range of interests, preparations, and future needs among chemistry students, this course is designed to allow each student to individually select a range of content and an individualized grading scheme.

Further, students may contract in advance for a guaranteed grade in the course, within each scheme. For example, a nursing student may choose to emphasize biochem applications in preparation for nursing practicals while an engineering major may be interested in applications of chemistry, or a future secondary teacher may be more interested in critical reading skills and creative explanation of observables.

For this course, broad "strands" involving different learning strategies are identified which rely heavily on certain characteristic skills and concepts that can be developed through the study of chemistry, including problem solving, critical reading, verbal description, and working within a team. The student with a strong math background would contract for Strand I, where problem solving and traditional exams form the emphasis. The nursing major would probably contract for Strand II, where investigations are emphasized; the education major may choose Strand III, stressing verbal expression. There is also the option to accept the standard grading scheme, based on grade percentages selected for the elements of the course by the instructor. Each would then decide on the level of commitment and contract for a grade of A, B, or C within that strand, or, if the traditional grade system is chosen, accept the average of all course components at the end of the course. The contracted grade is guaranteed when the student has satisfied the terms of the contract. The traditional grade is determined at the end of the semester. Failure to satisfy a grade contract will require a conference with the instructor to renegotiate a grade.

Methods of Instruction/Course Format/Delivery: Lecture, class discussion, reading and homework problem assignments and laboratory experimentation

Assessment: The following components will be used to calculate a final grade for each student:

1. Multiple approaches to problem solving
    a. Traditional end-of-chapter problems from the text - reinforcing methods that strengthen algebraic methods of problem solving.
    b. Describe and Defend (D&D) problems - where a student describes and defends the applicable chemistry in an event or situation. A good response to such an item includes a verbal description of the chemical principles involved, a description of the behavior of the system in the immediate and foreseeable future, and a verbal defense of predictions citing appropriate chemical laws and logical arguments.
    c. Event Frame Representation (EFR) - this approach involves a series of sketches showing the system in progressive states as it changes, e.g., the student may draw a "cartoon strip" picturing the action in successive frames.
    d. Interdisciplinary Applications (IA)- connections between chemistry and other studies, couched in a rich context of events from history, works of literature, political impact, and government policy, among others. The student may be asked to analyze chemistry or develop the context for other applications.

2. Investigations
    a. Experiments in the lab
    b. Internet and library searches
    c. Projects
    d. Research papers

3. Collaborative learning

a. Group problem solving - Teams of students will be presented with a problem. The team will submit a single report on the resolution to the problem incorporating at least three approaches to problem solving (i.e., algebraic, D&D, EFR, IA, etc.)

b. Class discussion - the success of this method depends on the willingness of each student to relax the instinctive guard against having someone else know what we think. Many times learning chemistry requires identifying what our misconceptions are.

4. Personal Journal - this is an option for students who may choose to maintain a log of thoughts and observations about chemical phenomena and chemical ideas. Such a journal should be kept in a bound notebook with dated entries. The progress through the journal should clearly show how a developing consciousness of chemical principles impacts the way we sense and interpret the world around us.

5. Exams - these will also be varied in style, incorporating all the learning styles used in other facets of the course. For example, a group problem will be available on exams, if requested, valued at 20% of the exam, except for Strand I and the traditional grading system.

Selecting a Strand

The following table is a guideline for selecting a strand and deciding on an emphasis for your grade partition. The main categories of activities for the course are listed in the first column and the suggested percentage of the grade composition for each category is listed for each strand. Each student should decide which learning style most suits them and then specify percentages for each category so that the total is 100%. You MUST assign percentages to Homework, Quizzes, Study Group, Tests, and Final Exam. You MUST select at least one from Research Project, Research Paper, or Journal. You may select more than one from the last three activities. Tests and Final Exam MUST be no less than 30% of your grade. Study Group can be no more than 10% of your grade. If you select strand IV, you may choose from the last 3 activities.

CATEGORY	STRAND I	STRAND II	STRAND III	STRAND IV
Homework	5%	10%	5%	10%
Quizzes	5%	10%	5%	5%
Study Gp.	6%	6%	6%	5%
Lab	20%	20%	15%	25%
Tests	34%	24%	20%	25%
Final Exam	20%	10%	10%	15%
Res. Project	10%	14%	14%	15%
Res. Paper		6%	10%	
Journal			15%	

Course Grade: The final grade will be determined as follows:

For an A:

* attendance at all class and lab periods

* good quality written work on all assignments,
* active participation in class discussion and group work
* a minimum of 80% on every exam
* a *demonstrated* enthusiasm for the material of the course

For a B:

* no more than two absences
* quality written work on all assignments
* participation in class discussion/responsibility in groups
* a minimum of 65% on every exam
* some evidence of creativity in activities

For a C:

* no more than four absences
* all assignments submitted
* participation in activities
* a minimum of 60% on every exam

STRAND IV Grade determined at end of semester

Textbook:

1. *Chemistry: The Central Science 10th ed. by Brown, LeMay and Bursten*
2. *Laboratory Experiments Chemistry: The Central Science 10th ed. By Brown, LeMay and Bursten*

Other:

- For current texts and materials, use the following link to access bookstore listings: http://www.panola.edu/collegestore.htm
- For testing services, use the following link: http://www.panola.edu/instruction/dl/testing.htm