Course Syllabus

CHEM 1405; CHEM 1405L – Introductory Chemistry I

Catalog Description: An introductory course in inorganic chemistry that relates the principles and concepts of chemistry to man and his environment. This course is a basic introduction to chemistry, with chemical calculations, making it appropriate for health science students. (Lab Fee)

Prerequisites: none

Semester Credit Hours: 4
Lecture Hours per Week: 3
Laboratory Hours per Week: 3
Contact Hours per Semester: 90
State Approval Code: 4005015103

Course Subject/Catalog Number: CHEM 1405
Course Title: Introductory Chemistry 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 1405 is the first semester of a two semester introductory course in chemistry for non-science majors. The first part of the course includes mastery of topics in measurement, dimensional analysis, classification of matter, chemical structure, chemical formula and equation writing, and stoichiometry. The remainder of the semester is spent in a survey of physical applications to chemical systems including gas laws, kinetic theory, solutions, equilibrium, and electrochemistry with emphasis on health science applications. Chemistry 1405 has a required laboratory component that forms an important portion of this study. Most of the experiments for the lab will be selected from the manual that accompanies the text. Experiment results will be reported in forms found in the lab manual.

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. Describe the scientific method.
2. Describe good laboratory behavior.
3. Describe the safety criteria and safety features of your lab.
4. Identify from the lab drawer any specific item of glassware and its proper use and function.
5. Describe the proper use of an analytical balance.
6. Define and distinguish between the terms precision, uncertainty, and accuracy.
7. Make and record measurements to the proper instrument precision.
8. Give the metric units for mass, length, and volume.
9. Perform American to metric conversion equivalents for mass, length, and volume.

10. Give the exponential numerical equivalents for the metric prefixes:
    nano, micro, milli, centi, deci, deca, hecta, kilo, and mega
11. Distinguish between mass and weight.
12. Distinguish between heat and temperature.

13. Use the unit analysis(factor-label) method in good written form to perform conversion calculations.
14. Define, distinguish, and correctly classify examples of:
    a. Physical and chemical properties of matter
    b. elements, compounds, and mixtures
    c. metals, nonmetals, and metalloids
    d. solid, liquid, and gaseous phases of matter
    e. atoms, ions, and molecules
    f. homogeneous and heterogeneous materials
15. Write the names and symbols for common chemical elements. See list.
16. Give the correct symbols for the seven common elements that exist as diatomic molecules.
17. Identify the purpose and broad organization of the chemical periodic table.
18. Write the symbols for the common monoatomic ions, recognizing the ion charge from the periodic chart.
19. Explain the use of the formula E = m x sp.ht. x Dt. Clearly define the quantity represented by each symbol and the proper units of measurement for the quantity. Use the formula to compute information from a calorimetry experiment.
20. Write a thorough description of the development of thought shaping early theory of atomic structure.
21. Describe the present day simple electron-proton-neutron model for a many-electron atom.
22. Explain how an atom acquires a net charge to become an ion.
23. Define: isotope, atomic number, atomic mass (weight), and atomic mass unit.
24. Give the name, symbol, and charge for some common polyatomic ions. See list.
25. Write the correct formulas for compounds, given the names; write the correct names for compounds, given the formulas.
26. Define and distinguish between:
    a. Binary and ternary compounds
    b. common and systematic chemical names
27. Describe the energy level nature for the electrons in many-electron atoms.
28. Describe the historical discovery of electron energy levels and give an overview of the theoretical development, Define atomic orbital.
29. Write electron configurations (spdf) for the first twenty elements of the periodic chart.
30. Relate the electron configurations of elements to their position in the periodic chart (row and column).

31. Draw Lewis dot diagrams for representative elements.
32. Define ionization potential, electron affinity, and electronegativity.
33. Describe the periodic trends in the properties of elements in the periodic chart.
34. Define and give examples of ionic and covalent bonds. Identify compounds as ionic or covalent.
35. Draw Lewis structures for simple molecules.
36. Define: atomic mass, formula mass, molar mass, empirical formula molecular formula, Avogadro's number.
37. Given the formula for a substance, determine its percent composition by mass for each element in the formula.
38. Given the composition of a pure substance by mass or percent weight, determine its empirical formula.
39. Given the empirical formula and the molecular weight, determine the molecular formula for a given compound.
40. Use the unit analysis method to convert between grams, molecules, atoms, and moles of a substance.
41. Describe what a "chemical equation" is and explain why it is an important tool in the study of chemistry.
42. Explain what we mean by each of the following: reactants, products, coefficients, balanced equation, word equation, skeleton equation.
43. Name and describe four types of chemical reactions.
44. Explain what is meant by a "combustion reaction". Explain why we say that hydrogen is combustible but will not *support* combustion. Cite experimental evidence.
45. Calculate related amounts in chemical reactions from balanced chemical equations
    a. Given reactant moles, find product mass or moles.
    b. Given reactant mass, find product mass or moles.
    c. Given one reactant or product amount, find related reactant or product amount.
    d. Given two or more reactant amounts, determine and correctly use limiting reactant information.

    e. Given percent yield, determine related reactant or product amount.

46. State and solve problems using Boyle's Law, Charles Law, Guy-Lussac's Law, Avogadro's Law and the Combined Gas Law. .
47. State and apply Graham's Law for rates of diffusion.
48. State and apply Dalton's Law of Partial Pressures.
49. State and solve problems using the Ideal Gas Law
50. Recognize the values for STP and molar volume at STP.
51. Solve stoichiometry problems involving gas volumes.
52. Compare ideal gases and real gases.
53. Using the Kinetic Molecular Theory distinguish among gases, liquids, and solids.
54. Define: evaporation, vapor pressure, surface tension, boiling point, freezing point, and melting point.
55. Describe the importance of hydrogen bonding.
56. Distinguish between hygroscopic, deliquescent, and efflorescent substances.

57. List important sources of air and water pollution.
58. Describe the operation of a typical municipal water purification system.
59. Define solubility and describe the solvation process; define saturated and unsaturated.
60. Define molarity; solve problems computing moles, mass, and concentrations of solutions.
61. Solve stoichiometry problems for reacting solutions.
62. Define equivalence and normality; be able to relate molarities and normalities.
63. Given appropriate constants, calculate boiling and freezing point changes due to colligative properties.
64. Define acids and bases. Give typical reactions, especially neutralization reactions.
65. Describe the titration process.
66. Given concentration of acids or bases, calculate the pH and the pOH.
67. Distinguish between spontaneous and nonspontaneous reactions.
68. Use the collision theory to explain how the rate of a chemical reaction is influenced by temperature, catalyst, concentration, and particle size of reactants.
69. Define chemical equilibrium in terms of a reversible reaction and predict the equilibrium position of a reaction from a given K_{eq} value.
70. State LeChatelier's principle and use it to predict changes in the equilibrium position due to changes in concentration and temperature.
71. Describe how buffer solutions control pH in biological systems.
72. Define oxidation and reduction reactions; describe an oxidizing agent and a reducing agent.
73. Predict reactivity of ionic compounds by comparing metal cations' activity .
74. Balance redox equations.
75. Describe alpha, beta, and gamma rays.
76. Differentiate between fission and fusion.
77. Describe the biological effects of radioactive substances.

Course Content:

Students will be required to participate in and complete the following:

1. Students will participate in lecture activities including discussions, quizzes and in class assignments
2. Students will turn in assigned homework problems and questions
3. Students may turn in additional homework problems and questions for extra credit
4. Students may participate in optional cooperative learning groups
5. Students will participate in laboratory experiments and turn in laboratory reports
6. Students will complete five unit exams and one comprehensive final exam

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. Homework- completion of assigned reading and problems from the textbook
2. Lecture Activities – participation in classroom discussions and practice problems, completion of quizzes
3. Laboratory Experiments – Laboratory experiments are to be completed each week during the laboratory period. Participation in the experiment is worth 40 points. A quiz about each experiment is given at the beginning of the lab period each week and is worth 10 points. Laboratory reports are due by the end of the lab period and are worth 50 points.
4. Unit Exams – Five unit exams are given throughout the semester that are worth 100 points each. No one coming in late may start an exam after the first person has left. One unit exam may be made up at the end of the semester at a time designated by the instructor.
5. Final Exam – completion of a comprehensive test at the end of the semester
6. Extra Credit- completion of additional homework problems from the textbook, participation in cooperative learning groups, attendance at relative scientific presentations

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

1. Homework 10%
2. Lecture Activities 10%
3. Labs 25%
4. Unit Exams 40%
5. Final Exam 15%

Textbook:

1. *Introduction to General, Organic, and Biochemistry 8th ed. By Hein, Best, Pattison & Arena.*
2. *Introduction to General, Organic, and Biochemistry in the Laboratory 8th ed. By Hein, Peisen and Ritchey.*

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