Course Syllabus

CHEM 1407; CHEM 1407L – Introductory Chemistry I 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: CHEM 1405

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 1407
Course Title: Introductory 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 1407 is the second semester of a two semester introductory course in chemistry for non-science majors. This course is the continuation of fundamental concepts in chemical language and applications. The material for this course assumes a background in chemical nomenclature, equation writing, and simple stoichiometric calculations involving reacting masses, moles and gas volumes as related by balancing chemical equations. Familiarity with molecular structure and typical descriptive chemistry is desirable. This second semester includes extensive units on organic and biochemical nomenclature and applications. Chemistry 1407 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. Draw electron dot structures of simple alkanes to illustrate that carbon forms four covalent bonds.
2. Recognize structural, condensed, and molecular formulas of the continuous chain hydrocarbons containing up to twelve carbon atoms.
3. Given the structural formula of an alkane, name it according to IUPAC rules.
4. Given the IUPAC name of an alkane, draw its structural formula.
5. Name and draw structural isomers of hydrocarbons.
6. Name and draw structural formulas of cycloalkanes.
7. Tell whether a hydrocarbon is saturated or unsaturated.
8. Identify cis and trans geometric isomers.
9. Describe the bonding, chemical properties, and structure of benzene.

10. Name and draw structures of simple aromatic compounds.
11. Define a functional group.
12. Name and draw structures of simple halocarbons.
13. Contrast an addition reaction of an alkene to a substitution reaction with benzene.

14. Name and draw structures of alcohols, glycols, and phenols.
15. Identify an alcohol as being primary, secondary, or tertiary.
16. Identify the uses of some common alcohols and illustrate the synthesis of alcohols by addition and displacement reactions.
17. Explain the behavior of alcohols and phenols as weak acids.
18. Name and draw structures of ethers and illustrate the synthesis of an ether from a halocarbon and an alkoxide ion.
19. Relate trends in boiling point and solubility to the molecular structure of hydrocarbons, halocarbons, alcohols, and ethers.
20. Identify names, structures, and uses of some common thiols, thioethers, and disulfides.
21. Define a polyfunctional molecule and recognize the functional groups on a given polyfunctional molecule.
22. Name and draw structures of simple aldehydes and ketones.
23. Describe the carbon-oxygen bond of the carbonyl group of aldehydes and ketones.
24. Explain how the intermolecular interactions of the carbonyl group affect the boiling point and water solubility of aldehydes and ketones.
25. Relate the energy content of a molecule to its degree of oxidation or reduction.
26. Describe the process of oxidation and reduction in organic chemistry in the terms of the loss or gain of oxygen, hydrogen, or electrons.
27. Write structures for the products (if any) of the oxidation of primary, secondary, and tertiary alcohols.
28. Describe the results of Tollens' or Benedict's test on an aldehyde, a ketone, and an alpha-hydroxy ketone.
29. Illustrate with equations the formations of a hydrate, a hemiacetal and an acetal, and a hemiketal and a ketal.
30. State the names and uses of some important aldehydes and ketones.
31. Name and draw structures of simple aldehydes and ketones.
32. Describe the carbon-oxygen bond of the carbonyl group of aldehydes and ketones.
33. Explain how the intermolecular interactions of the carbonyl group affect the boiling point and water solubility of aldehydes and ketones.
34. Relate the energy content of a molecule to its degree of oxidation or reduction.
35. Describe the process of oxidation and reduction in organic chemistry in the terms of the loss or gain of oxygen, hydrogen, or electrons.
36. Write structures for the products (if any) of the oxidation of primary, secondary, and tertiary alcohols.
37. Describe the results of Tollens' or Benedict's test on an aldehyde, a ketone,

and an alpha-hydroxy ketone.

38. Illustrate with equations the formations of a hydrate, a hemiacetal and an acetal, and a hemiketal and a ketal.
39. State the names and uses of some important aldehydes and ketones.
40. Name and draw the structures of simple aliphatic and aromatic amines.
41. Classify an amine as primary, secondary, or tertiary.
42. Name and draw the structures of common aliphatic and aromatic heterocyclic amines.
43. Show, with equations, how amines act as weak bases.
44. Name and draw the structures of a quaternary ammonium salt.
45. Name and draw the structures of simple amides.
46. Write equations for the preparation of amides from ammonium salts and carboxylic acid derivatives.
47. Predict the products of the hydrolysis of an amide.
48. Define the terms: analgesic, antihistamine, antipyretic, decongestant, hallucinogen, hypnotic, opiate, sedative.
49. Recognize compounds of biochemical significance, including catecholamines, alkaloids, and barbiturates.
50. Classify a carbohydrate as a monosaccharide, disaccharide, or polysaccharide; as a triose, tetrose, pentose, or hexose; as an aldose or a ketose. Also, give the name and structures of common structures.
51. Use the term asymmetric carbon and steriosomer to explain what is meant by the handedness of a molecule.
52. Interpret two-dimensional Fischer projection formulas of sugars as three dimensional structures.
53. State whether a sugar is in the D or L form by looking at its Fischer projection formula.
54. Draw Haworth projections of common simple sugar.
55. Classify simple sugars as an alpha or beta anomer; as a pyranose or a furanose and as a hemiacetal or a hemiketal.
56. Explain the interconversion of closed-chain forms of sugars.
57. Describe the formation of glycosidic bonds and the products of their hydrolysis.
58. List the structure, sources, and uses of these polysaccharides: starch, amylose, amylopectin, glycogen, and cellulose.
59. Draw the structures and list the sources and uses of these disaccharides: maltose, cellobiose, sucrose, and lactose.
60. Predict, on the basis of molecular structure, whether a carbohydrate is reducing or nonreducing.
61. Characterize these lipids by source, structure, and use: waxes, triglycerides, fats, and oils.
62. Describe the production of soap by saponification.
63. Recognize the general structures of these three types of lipid molecules: phosphoglycerides, sphingomyelins, and glycolipids.
64. Sketch sections of the liposomal bilayer in water, labeling the polar end of the lipid molecules.

65. Draw the fundamental chemical structure of all steroid molecules.
66. State the source and at least one function of each of these steroids or classes of steroids (most of which are hormones): cholesterol, cortisone, prednisone, aldosterone, androgens, estrogens, testosterone, progesterone and digitoxin.
67. Recognize prostaglandins and state several of their biologic effects.
68. Classify the 20 common amino acids according to their side-chain structures.
69. Describe the formation of zwitterions and their effect on the properties of amino acids.
70. List at least four functions of proteins.
71. Distinguish between simple and conjugated proteins and between fibrous and globular proteins.
72. Describe the forces that help determine the chain conformation of proteins and distinguish between fibrous and globular proteins.
73. State three ways to denature proteins.
74. Discuss the mechanism of oxygen transport by hemoglobin.
75. Explain the molecular basis for sickle cell anemia and the chemical basis for carbon monoxide poisoning.
76. State three properties of enzymes which show that they are catalysts.
77. Describe the function of coenzymes.
78. Give the names and one-letter symbols for the five major nitrogen bases found in nucleic acids.
79. State two differences between the molecular composition of DNA and RNA.
80. Name and draw structures of nucleosides and nucleotides, and describe the bonding that joins nucleotides together in nucleic acids.
81. Discuss the significance of A = T and G = C as it relates to the formation of the I double-helical structure of DNA.
82. Outline the process of replication and transcription.
83. List five essential needs of the human body.
84. Name the type of chemical reaction which is common to the digestion of carbohydrates, proteins, lipids, and nucleic acids.
85. Name the trace elements found in the body, and state some of their possible functions.
86. Define homeostasis and cite some examples of homeostatic control in the body.
87. Describe the distribution of body water, and compare the electrolyte compositions of blood plasma, interstitial fluid, and intracellular fluid.
88. List the functions of blood, the formed elements of blood and the plasma proteins, and distinguish between blood serum and blood plasma.
89. Name the major blood buffer systems and describe how each maintains a constant blood pH.
90. State two important functions of the kidneys.
91. Describe how the pH of urine is controlled.
92. Differentiate among metabolism, catabolism, and anabolism.
93. Briefly describe what happens in photosynthesis and the energy and carbon cycle.

94. Name the energy-transmitting molecule in nature and list its hydrolysis products.
95. Explain why ATP could not be a very high-energy compound and still fulfill its- role in cellular energetics.
96. Outline the production of ATP in aerobic cells, showing the relationship between oxidation reactions, formation of reducing power, cellular respiration, and oxidative phosphorylation.
97. Outline the three stages of aerobic catabolism of glucose, indicating where in the cell the stages takes place and the entry points of sugars, fatty acids and amino acids.
98. List the steps in the aerobic glycolysis of one molecule of glucose.

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