Course: Concepts of Chemistry / CHE 111

Credits: 4 hrs. credit (3hours of lectures and 3hours of lab each week)

Text(s): Fundamentals of Chemistry, Ralph A. Burns, 4th edition, Prentice Hall Inc. Publisher
Other Required Materials: Chemical safe goggles, Calculator, and Three-hole folder w/ pockets.

Description of the Course:

A) Catalogue Description: A brief and comprehensive survey of the important theories and some of the applications of chemistry. Topics to be covered will include: the physical states of matter and their characteristics, measurements in chemistry, atomic structure, chemical bonding, chemical reactions and reaction rates, stoichiometry, gases and the gas laws, theories of solutions, and basic organic and biochemical concepts. **Course Design**: CHE 111 is intended for students with little or no background in chemistry, who need this course as a prerequisite for General College Chemistry (CHE 121) or Higher, or as a pre-admission requirement for nursing or other allied health programs, or to the meet the lab science requirement for Technical or LAS programs of study. **Prerequisites**: Successful completion of ENG 100 with a C grade or higher, **Or** placement score indicating eligibility to take English 101 and successful completion of Math 137 Intermediate Algebra with a (C grade or better).

B) General Course Objectives:

1) To aid the student in developing an understanding of the basic concepts of chemistry.

2) To encourage increase awareness as to how chemistry affects our lives daily.

3) To provide a useful body of knowledge for students studying chemistry, biology, fire science, environmental science, nursing and other allied health science areas.

Class Attendance Policy:

Attendance of all class activities in lecture and laboratory is required. Absences are counted from the first meeting of class. More than four consecutive or more than six accumulative absences could result in a student receiving a "F" grade in this course. An explanation of the cause of all absences should be given to your instructor.

Academic and Classroom Misconduct:

The instructor has primary responsibility for control over classroom and/or laboratory behavior and maintenance of academic integrity, and can request the temporary removal or exclusion from the classroom or laboratory of any student engaged in conduct that violates the general rules and regulations of the institution. Or any student engaged in conduct deemed hazardous in the laboratory. Extended or permanent exclusion from lecture or laboratory activities or further disciplinary action can only be effected through appropriate procedures of the institution.
Plagiarism, cheating on quizzes or tests, or any form of academic dishonesty is strictly prohibited. Students quilty of academic dishonesty directly or indirectly will receive a zero for the exercise or quiz or test and may receive a "F" grade for the course in addition to other possible disciplinary sanctions which maybe imposed through the regular institutional procedures. Any student that believes that he or she has been erroneously accused may appeal the case through the appropriate institutional procedures if their grade was affected.

Procedure for Dropping the Course:

*** College's Withdrawal Policy***

Any student who finds it necessary to discontinue this course **MUST** complete a withdrawal form in the Registrar's Office at the time of the withdrawal. If you can not withdraw in person you may call the Registrar's Office and provide them with the appropriate information. Students may withdraw from the course anytime during the first *14th weeks of class, **without** written authorization from the instructor or their academic advisor. (*Deadline date will be announced.)
Once you withdraw from class you are no longer eligible to continue attending class and/or take any remaining quizzes or test. Students who do not withdraw, but stop attending will be assigned an "F" grade in this course. Verbal withdraws **CANNOT** be accepted.

Tests:

There will be nine scheduled quizzes (additional pop quizzes may also be given), all quizzes are given during the first ten minutes of class. (No make-ups for quizzes). Three-unit test, two labs tests and a comprehensive final exam will also be given. Unit tests are scheduled in advance and will be reviewed before the final exam is given.

Grade Determination:

½ of the semester's average, ¼ of the lab grade, ¼ of the score on the comprehensive final exam will determine the final course grade.
EXAMPLE:

(Semester's Average)	½	(90)	=	45
(Lab Grade)	¼	(92)	=	23
(Final Exam Score)	¼	(96)	=	24
				92

The best seven quiz scores will be added together and divided by seven to determine the quiz average. The quiz average and the three unit tests scores will be added together and divided by four to determine the semester's average. The lab grade will be determined by averaging the two lab test scores plus points for laboratory reports. The comprehensive final exam consist of two hundred questions x 0.5 point, total possible points 100.

Grade Scale: There will be NO grading on the normal distribution curve.

100.00 - 93.50 = A
93.49 - 90.00 = A-
89.99 - 87.50 = B+
87.49 - 84.50 = B
84.49 - 79.50 = B-
79.49 - 77.50 = C+
77.49 - 73.50 = C
72.49 - 69.50 = C-
69.49 - 63.50 = D+
63.49 - 59.50 = D
59.49 - 00.00 = F

Exemption Policy:

The instructor will determine who is to be exempted from taking the final exam, not the student. Exemption is an earned privilege not an inherited right. Any student that is exempted from taking the final exam will be notified in writing. Students being considered for exemption MUST meet all of the following requirements: (No exceptions for any reason!)

1) Good classroom conduct.
2) Only 1 absence from lecture or laboratory (excused or non-excused).
3) No more than three tardies during course of the semester in lecture or laboratory.
4) All unit tests and lab tests must be taken when scheduled (no make-ups).
5) No unit test score lower than 88.
6) No lab test score lower than 90.
7) The average of the best seven quizzes cannot be lower than 90.
8) Must have an overall semester's average of 95 or higher. (No rounding off)
9) Must have a semester's lab test average of 95 or higher. (No rounding off) Points for lab reports will NOT be used to meet eligibility requirements for exemption.
10) Intangibles.

Make-ups:

Any assignment missed can be obtained from the instructor. Lab work ***cannot*** be made up. Quizzes, scheduled or pop, cannot be made up for any reason. Unit tests can only be made up by special arrangement with the instructor. Makeup tests will be granted on an individual basis only following a conference with the instructor; where the reason(s) for missing the test must be determined mitigating circumstances beyond the control of the student such as, illness, death in the family, or change in condition of employment. All make-up tests will be scheduled during the week of the final exams. If two unit tests are missed during the semester and/or if the final exam is missed the student will receive a "F"grade if he or she is failing other parts of the course or an "I" if the student is passing all other parts of the course.

Revisions to the Syllabus:

Students are responsible for learning all of the objectives and all of the items in the course outline whether they are discussed in lecture and/or laboratory or not. The instructor reserves the right to revise the objectives, topical outline, or academic schedule contained in this syllabus without notice. However, if the revisions affect scheduled unit tests a 48-hour notice will be given for the new test date.

Cellular phones and/or beepers:

Cellular phones and beepers are only allowed in class or lab if they are turned off or in silent mode. Under no circumstances are phones to be answered in class. When there are extenuating circumstances that require that a student be available by phone or beeper, that student must speak to the instructor prior to class, so that together they can arrive at an agreement.

Course Outcomes (Objectives): Chemistry 111 – Concepts of Chemistry

1. The student will develop "critical thinking skills" and will learn to derive sound scientific conclusions by analyzing scientific data.

2. The student will demonstrate knowledge of the scientific method through examples.

3. The student will be able to define science.

4. The student will be able to define chemistry, list and describe the various branches of chemistry.

5. The student will be able to define matter.

6. The student will be able to identify the three physical states of matter and describe their basic characteristics.

7. The student will be able to distinguish between homogenous and heterogeneous matter.

8. The student will be able to explain the difference between pure substances, solutions, homogeneous mixtures, and heterogeneous mixtures.

9. The student will learn the laws of conservation of energy and mass, and explain the interrelationship between these two laws.

10. The student will learn the division of elements into metals and non-metals and will be able to describe their chemical and physical properties.

11. The student will learn the rules for identifying significant digits.

12. The student will learn the correct use of significant digits in basic mathematical operations.

13. The student will learn the metric system of measurements and its application in science.

14. The student will be able to make conversions within the metric system.

15. The student will be able to covert metric units to English units and vice versa.

16. The student will learn the basic measures of matter.

17. The student will learn the correct procedures for measuring mass (weight).

18. The student will learn the correct procedures for measuring volume.

19. The student will be able to define and/or describe the distinguishing characteristics of the following terms: mass, weight, energy, calorie, joule, Newton of force, specific heat, density, and specific gravity.

20. The student will be able to define the term atom, describe the structure of an atom and give the general characteristics of atoms.

21. The student will be able to name the subatomic particles, explain their unique characteristics, and describe the arrangement of these particles in an atom.

22. The student will be able to define the term isotope and explain how isotopes differ from each other.

23. The student will be able to describe the unique characteristics of natural radioactive isotopes.

24. The student will be able to understand the principle energy levels and their electron capacities in relationship to the Quantum Mathematical Model.

25. The student will be able to demonstrate the arrangement of electrons in the principle energy levels, the arrangement of electrons in the sub-levels and the arrangement of electrons in the suborbitals.

26. The student will be able to explain what is meant by valence electrons.

27. The student will be able to explain ionic charge, valence, and oxidation numbers.

28. The student will be able to explain electron arrangement as it relates to chemical bonding (ionic and covalent).

29. The student will be able to define terms, ions (cation and anion), molecules and compounds.

30. The student will learn to write chemical formulas for compounds.

31. The student will be able to understand the structure of some representative compounds.

32. The student will learn the general characteristics of the series and groups of elements in the periodic table.

33. The student will learn how to use the periodic table of elements as one of the tools for studying chemistry.

34. The student will learn the scientific methods for naming inorganic compounds.

35. The student will learn to calculate formula weights of elements, ions, molecules and compounds.

36. The student will learn to calculate the molar masses of elements, ions, molecules and compounds.

37. The student will learn to calculate the percent composition of each element in a compound.

38. The student will learn to calculate the empirical formula for compounds.

39. The student will learn the basic concepts of chemical equations.

40. The student will learn the terms and symbols used in writing a chemical equation, as well as their meanings.

41. The student will learn the guidelines for balancing chemical equations.

42. The student will be able to write and balance chemical equations.

43. The student will be able to do simple calculations involving chemical equations (Stoichiometry).

44. The student will be able to demonstrate knowledge of the unique characteristics of gases and the gas laws.

45. The student will be able to perform calculations involving the gas laws.

46. The student will demonstrate knowledge of the characteristics of water and other liquids.

47. The student will demonstrate knowledge of the characteristics of solids.

48. The student will be able to define the term solution, identify and give the characteristics of different types of solutions.

49. The student will be able to explain solubility and list factors that affect solubility, as well as, factors that affect the rate of solubility.

50. The student will be able to explain the difference between saturated, unsaturated and supersaturated solutions.

51. The student will be able perform calculations involving solutions (percent mass, molal, molar, normal).

52. The student will be able to give various definitions of acids and bases, and explain their properties.

53. The student will be able to define pH.

54. The student will be able to define the term buffer and explain the process of neutralization.

55. The student will be able to distinguish between electrolytes and non-electrolytes.

56. The student will be able to understand oxidation-reduction reactions and balance Redox equations.

57. The student will be able to understand reaction rates and chemical equilibrium.

58. The student will be able to define organic chemistry.

59. The student will be able to give the chemical composition and the basic characteristics of carbohydrates, lipids, proteins, nucleic acids and vitamins.

60. The student will be able to define the following terms: metabolism, anabolism and catabolism.

61. The student will learn the basic biochemical mechanisms of photosynthesis, DNA and RNA synthesis, protein synthesis, and cellular respiration.

62. The student will learn the characteristics and classification of the major groups of hydrocarbons.

63. The student will learn the IUPAC system for naming hydrocarbons.

64. The student will learn the chemical composition of some of the derivatives of the hydrocarbons.

Chemistry 111 – Laboratory Outcomes (Objectives):

1. The student will be able to identify, describe the location and name all permanent and portable safety equipment and devices in the laboratory and explain the appropriate use of each device.

2. The student will be able to identify and describe the proper use of common devices and equipment used in the chemistry lab for performing experiments.

3. The student will be able to describe the proper use of a centigrade quad-beam balance and an electronic balance in lab.

4. The student will be able to demonstrate the proper weighing techniques for both the quad-beam and electronic balance.

5. The student will be able to demonstrate the proper techniques for using graduate cylinders, pipettes, burettes and other devices that are used for measuring volumes.

6. The student will be able to demonstrate the proper procedures for setting up and carrying out laboratory experiments both accurately and safely.

7. The student will demonstrate the ability to choose the appropriate "Personal Safety Equipment" when performing various laboratory experiments.

8. The student will be able to calculate the theoretical yield for the products for the experiments on Percentages and Stoichiometry and compare the experimental yields with the theoretical yields.

9. The student will be able to collect and interpret data resulting for various experiments.

10. The student will be able to demonstrate the ability to write a lab report on various experiments.

Course Outline: Chemistry 111 - Concepts of Chemistry
UNIT I

I) Introduction
- A) What is Science?
- B) The Scientific Method
- C) Chemistry
- D) Branches of Chemistry
  1. Inorganic
  2. Organic
  3. Analytical
  4. Physical
  5. Biochemistry

II) Matter and Energy
- A) Definition of Matter
- B) Physical States of Matter
  1. Solids
  2. Liquids
  3. Gases
- C) Divisions of Matter
  1. Homogeneous matter
     a) pure substance
     b) solution
     c) homogeneous mixture
  2. Heterogeneous matter (mixture)
- D) Definition of Energy
- E) Forms of Energy
  1. Potential
  2. Kinetic
- F) Types or Kinds of Energy
  1. Solar or light
  2. Radiation
  3. Electrical
  4. Chemical
  5. Mechanical
  6. Heat
     a) endothermal
     b) exothermal
- G) Law of Conservation of Energy
- H) Law of Conservation of Mass
- I) Energy – Mass Relationship
- J) Elements
  1. Definition
  2. Composition
  3. Division of the elements (metals and nonmetals)
     a) physical properties
     b) chemical properties

III) Measurements

- A) Significant Digits
- B) Mathematical Operations Involving Measurements and Significant Digits
- C) Mass and Weight
  1. Definitions
  2. Measurements
- D) Quantitative Measurements of Matter
  1. Mass (Weight)
  2. Volume
  3. Linear (Area)
- E) Metric System
  1. Standard units
     a) Gram for Mass
     b) Liter for Volume
     c) Meter for Length
  2. Prefixes and their meanings
     a) mega
     b) kilo
     c) hecto
     d) deca
     e) deci
     f) centi
     g) milli
     h) micro
  3. Conversions within the metric system
  4. English to Metric conversions and Metric to English conversions.
  5. Energy
  6. Heat Energy(Temperature measurements)
     a) calorie
     b) joule
  7. Temperature scales
     a) Fahrenheit scale - ^{o}F
     b) Celsius scale - ^{o}C
     c) Kelvin scale - ^{o}K
  8. Conversions within the temperature scales
     a) Fahrenheit to Celsius
     b) Celsius to Fahrenheit
     c) Celsius to Kelvin
     d) Kelvin to Celsius
- F) Specific Heat
- G) Density
- H) Specific Gravity

IV) The Atom

- A) Definition
- B) Atomic Theories – from Dalton to Rutherford to Bohr to de Broglie to Schrodinger et. al.

C) Subatomic Particles
   1. Electrons
   2. Protons
   3. Neutrons
D) Atomic Number
E) Atomic Mass or Atomic Weight
F) Isotopes
   1. Definition
   2. Natural radioactivity particles
      a) Alpha
      b) Beta
      c) Gamma
G) Electron Configuration and Distribution
   1. Principle energy levels and their capacities
   2. Sublevels and their capacities
   3. Suborbitals and their capacities
   4. The arrangements of electrons in the principle energy levels and sublevels
   5. The arrangement of electrons in the suborbitals – the order of filling
   6. The electron dot method
H) Electron Arrangement versus Reactivity
   1. Ions – cations, anions, - ionic charge and valence
   2. Oxidation Numbers
   3. Chemical Bonding
      a) Ionic or electrovalent bonds
      b) Covalent bonds
         1) polar
         2) non-polar
   4. Molecules and Compounds
   5. Writing Chemical Formulas
      a) Rules for writing chemical formulas
      b) Chemical symbols and subscripts

UNIT II

I) The Periodic Classification of the Elements
   A) The Periodic Law
   B) The Periodic Table of Elements
      1. Periods or series
      2. Groups or families
      3. Metals
      4. Nonmetals
   C) General Characteristics of the Groups
   D) General Characteristics of the Periods
   E) The use of the Periodic Table

II) Chemical Nomenclature of Inorganic Compounds
- A) Systemic Chemicals Names
  1. Binary Compounds
     - a) inorganic compounds combining metals with a **fixed** oxidation number with a nonmetal
     - b) inorganic compounds combining metals with ***variable*** oxidation numbers with a nonmetal
     - c) inorganic compounds combining two nonmetals
       1) Greek prefixes and their meanings
          a. mono
          b. di or bi
          c. tri
          d. tetra
          e. penta
          f. hexa
          g. hepta
          h. octa
          i. ennea
          j. deca
  2. Ternary and Higher Compounds
     - a) polyatomic ions
     - b) oxyanions (ate or ite endings)
  3. Naming bases
  4. Naming acids
     - a) binary acids
     - b) ternary acids
- B) Common Names of Some Compounds

III) Calculation Involving Elements and Compounds
- A) Calculation of Formula Weights
  1. Formula Mass
  2. Molecular Mass
- B) Avogadro's Number
- C) The Mole
- D) Calculating Molar Masses
- E) Conversions From Moles to Grams and Grams to Moles
- F) Molar Volume of Gasses
- G) Conversions From Moles to Liters and Liters to Moles
- H) Simple Calculations – Percent Composition of Compounds
- I) Calculation of Empirical and Molecular Formulas

IV) Chemical Equations
- A) What is a Chemical Equation?
- B) Definition of Terms
  1. Reactants
  2. Products
  3. Catalyst

C) Symbols and Their Meanings
   1. Single arrow pointing from left to right
   2. Double arrows pointing in opposite directions
   3. Equal sign
   4. Arrow pointing upward
   5. Arrow pointing downward
   6. Plus (+) sign
   7. Delta sign above or below the directional arrow
   8. Chemical symbol(s) above or below the directional arrow
   9. g, l, s, aq.

D) Rules for Balancing Chemical Equations

E) Balancing Chemical Equations
   1. Composition reactions
   2. Decomposition reactions
   3. Single or double replacement reactions

F) Predicting the Product(s) and Balancing the Chemical Equation

G) Writing and Balancing Word Equations

V) Stoichiometry – Calculation involving Chemical Equations

A) Three Basic Steps for Solving Stoichiometry Problems the Mole Method

B) Types of Stoichiometry Problems
   1. Mass – Mass
   2. Mass – Volume / Volume – Mass
   3. Volume – Volume

VI) Gases

A) Basic Characteristics of Gases

B) The Kinetic Theory

C) The Gas Laws
   1. Boyle's law
   2. Charles' law
   3. Gay-Lussac's law
   4. The combined gas law
   5. The ideal gas law
   6. Dalton's law of the partial pressure of gases
   7. Henry's law
   8. Problem solving related to the gas laws

VII) Water and Other Liquids

A) Water
   1. Basic characteristics
   2. Chemical properties
   3. Physical properties
   4. Hydrates
   5. Hydrogen peroxide

B) Liquids
   1. Basic characteristics
   2. Evaporation
   3. Vapor pressure
   4. Boiling points
   5. Distillation

VIII) Solids
- A) Basic Characteristics
- B) Structural Forms
  1. Crystalline solids
  2. Amorphous solids
- C) Melting or Freezing Points
- D) Boiling Points
- E) Sublimation

UNIT III

I) Solutions
- A) Definition
- B) Components of a Solution
- C) Solubility and Factors Affecting Solubility
  1. Chemical properties of the solute and the solvent
  2. Temperature
  3. Pressure
- D) Factors Affecting the Rate of Solubility
  1. Temperature
  2. Stirring
  3. Particle size
- E) Concentrations of the Solute in Solutions
  1. Saturated
  2. Unsaturated
  3. Supersaturated
- F) Types of Solutions and Their Basic Characteristics
  1. True solution
  2. Emulsion
  3. Suspension
  4. Colloidal
- G) Calculations Involving Solutions
  1. Percent by mass
  2. Molality
  3. Molarity
  4. Normality

II) Acids, Bases and Ionic Equations
- A) Definition(s) of Acids
- B) The Properties of Acids

C) Definition(s) of Bases
D) The Properties of Bases
E) pH and pH Values
F) Buffers and Neutralization
G) Methods of Neutralization – Titration
H) Ionization
I) Electrolytes and Non-electrolytes
J) Writing Compounds in Ionic Form
K) Rules for Writing Ionic Equations

III) Oxidation and Reduction
A) Definitions
B) Oxidizing and Reducing Agents
C) Energy Cells
1. Electrolytic
2. Voltaic (Galvanic)
3. Practical
a) dry cells
D) Writing and Balancing Oxidation – Reduction Equations
1. The Oxidation Number Method
2. The Ion Electron Method

IV) Reaction Rates and Chemical Equilibrium
A) The Law of Mass Action
B) Factors Affecting Reaction Rates
1. The nature of the reactants
2. The concentration of the reactants
3. Temperature
4. Catalyst
C) Chemical Equilibrium
1. Irreversible reactions
2. Reversible reactions
D) Principles of Chemical Equilibrium
1. LeChatelier's principle
2. Weak electrolyte equilibrium principle
3. Solubility product equilibrium principle

V) Concepts of Organic and Biochemistry
A) Definitions and Basic Characteristics
B) The Major Classes of Organic Compounds in Living Systems, Their Composition and Their Biological Usage's
1. Carbohydrates
2. Lipids
3. Proteins
4. Nucleic acids
a) DNA
b) RNA
5. Vitamins

C) Metabolism
   1. Anabolism
   2. Catabolism

D) Enzymes

E) Biosynthesis
   1. Photosynthesis
   2. Cellular respiration
      a) glycolysis
      b) kreb's cycle
      c) the electron transport system
   3. Anaerobic metabolism – fermentation
   4. DNA synthesis
   5. Protein synthesis
      a) transcription
      b) translation

F) Hydrocarbon
   1. Chemical composition
   2. Divisions of hydrocarbons
   3. Classification and unique characteristics of the aliphatic hydrocarbons
      a) alkanes
      b) alkenes
      c) alkynes
   4. The IUPAC system for naming the aliphatic hydrocarbons
   5. Aromatic hydrocarbons
   6. Derivatives of hydrocarbons
      a) alcohols
      b) phenols
      c) ethers
      d) esters
      e) ketones
      f) carboxylic acids
      g) aldehydes
      h) amides
      i) amines
      j) organic halides