CHEM 1412
General Chemistry II

Western Texas College

I. Basic Course Information
   A. Lecture—Chemical equilibrium; phase diagrams and spectrometry; acid-base concepts; thermodynamics; kinetics; electrochemistry; nuclear chemistry; an introduction to organic chemistry and descriptive inorganic chemistry.
   B. Lab— the required laboratory activities will reinforce the lecture material; introduction of the scientific method, experimental design, data collection and analysis, and preparation of laboratory reports.
   C. Any required prerequisites: Need a C or higher in CHEM 1411.
   D. Required grade for enrolling in the next course in this sequence: None

II. Student Learning Outcomes
   A. Lecture
   B. State the characteristics of liquids and solids, including phase diagrams and spectrometry.
   C. Articulate the importance of intermolecular interactions and predict trends in physical properties.
   D. Identify the characteristics of acids, bases, and salts, and solve problems based on their quantitative relationships.
   E. Identify and balance oxidation-reduction equations, and solve redox titration problems.
   F. Determine the rate of reaction and its dependence on concentration, time, and temperature.
   G. Apply the principles of equilibrium to aqueous systems using LeChâtelier's Principle to predict the effects of concentration, pressure, and temperature changes on equilibrium mixtures.
   H. Analyze and perform calculations with the thermodynamic functions, enthalpy, entropy, and free energy.
   I. Discuss the construction and operation of galvanic and electrolytic electrochemical cells, and determine standard and non-standard cell potentials.
   J. Define nuclear decay processes.
   K. Describe basic principles of organic chemistry and descriptive inorganic chemistry.

III. Lab
   A. Use basic apparatus and apply experimental methodologies used in the chemistry laboratory.
   B. Demonstrate safe and proper handling of laboratory equipment and chemicals.
   C. Conduct basic laboratory experiments with proper laboratory techniques.
   D. Make careful and accurate experimental observations.
   E. Relate physical observations and measurements to theoretical principles.

F. Interpret laboratory results and experimental data, and reach logical conclusions.
G. Record experimental work completely and accurately in laboratory notebooks and communicate experimental results clearly in written reports.
H. Design fundamental experiments involving principles of chemistry and chemical instrumentation.
I. Identify appropriate sources of information for conduction laboratory experiments involving principles of chemistry.

IV. Testing Requirements
A. Campus
1. Students are not allowed to use their book or notes of any kind while taking their proctored tests and exams. A periodic table will be provided.
2. Students are allowed to use a calculator.
B. Online
1. The midterm and final exam must be proctored by an approved testing organization. (Ask your instructor for more details.)
2. Students are not allowed to use their book or notes of any kind while taking their proctored tests and exams. A periodic table will be provided.
3. Students are allowed to use a calculator.

V. Course Requirements
A. Campus/Online

- Lecture: homework assignments; weekly quizzes; midterm and final exam
- Lab: lab reports, lab quizzes; final exam
- Quizzes and exams are timed.

VI. Information on Books and Other Course Materials
A. Required Book: Chemistry: A Molecular Approach, 5th Edition. Tro, Nivaldo J. 2020. Pearson. (ISBN: 9780134874371)
B. Required Access Code: MasteringChemistry access code is bundled with book.
C. Required Lab Kit (ONLINE ONLY): General Chemistry 2. Hands- On Learning. (SKU: Kit SP-3006-CK-02). ***Please contact the WTC bookstore to purchase the kit.***
D. Required Calculators: scientific calculator
E. Recommended: Quick Study Academic: Chemistry. Jackson, Mark. D. (ISBN: 978-142321859-3)
F. Recommended: Quick Study Academic: Chemistry 2. Gardner, Jane. P. (ISBN: 978-142323304-6)
G. Recommended: Quick Study Academic: Chemistry Equations & Answers. Jackson, Mark. D. (ISBN: 978-142320189-2)

VII. Grading Breakdown
A. Campus/Online

Lecture Homework	10%
Lecture Quizzes	10%
Lecture Midterm	25%
Lecture Final Exam	25%
Lab Reports	15%
Lab Final Exam	15%

B. A final semester grade will be based as follows:

A = 89.5% and above
B = 79.5 – 89.49
C = 69.5 – 79.49
D = 59.5 – 69.49
F = 59.49% and below
I = Incomplete (failure to complete the requirements of the course)

VIII. Other Policies, Procedures and important dates. Please refer to the WTC Catalog for the following:

B. Campus Calendar
C. Final exam schedule
D. How to drop a class
E. Withdrawal information
F. Student Conduct/Academic Integrity
G. Students with disabilities

VIII. Course Content

Chapter 7: Thermochemistry	Chemical Hand Warmers The Nature of Energy: Key Definitions The Frist Law of Thermodynamics: There is No Free Lunch Quantifying Heat and Work Measuring DE for Chemical Reactions: Constant-Volume Calorimetry Enthalpy: The Heat Evolved in a Chemical Reaction at Constant Pressure Constant- Pressure Calorimetry: Measuring DHrxn Relationships Involving DHrxn Determining Enthalpies of Reaction from Standard Enthalpies of Formation Energy Use and Environment
Chapter 12: Liquids, Solids, and Intermolecular Forces	Water, No Gravity Solids, Liquids, and Gases: A molecular Comparison Intermolecular Forces: The Force that Hold Condensed States Together

	Intermolecular Forces in Action: Surface Tension, Viscosity, and Capillary Action Vaporization and Vapor Pressure Sublimation and Fusion Heating Curve for Water Phase Diagrams Water: An Extraordinary Substance
Chapter 13: Solids and Modern Materials	Friday Night Experiments: The Discovery of Graphene X-Ray Crystallography Unit Cells and Basic Structures The Fundamental Types of Crystalline Solids The Structures of Ionic Solids Network Covalent Atomic Solids: Carbon and Silicates Ceramics, Cement, and Glass Semiconductors and Band Theory Polymers and Plastics
Chapter 14: Solutions	Thirsty Solutions: Why You Shouldn't Drink Seawater Types of Solutions and Solubility Energetics of Solution Formation Solution Equilibrium and Factors Affecting Solubility Expressing Solution Concentration Colligative Properties: Vapor Pressure Lowering, Freezing Point Depression, Boiling Point Elevation, and Osmotic Pressure Colligative Properties of Strong Electrolyte Solutions Colloids
Chapter 15: Chemical Kinetics	Catching Lizards The Rate of a Chemical Reaction he Rate Law: The Effect of Concentration on Reaction Rate The Integrated Rate Law: The Dependence of Concentration on TimeThe Effect of Temperature on Reaction Rate Reaction Mechanisms Catalysis
Chapter 16: Chemical Equilibrium	Fetal Hemoglobin and Equilibrium The Concept of Dynamic Equilibrium The Equilibrium Constant (K) Expressing the Equilibrium Constant in Terms of Pressure Heterogeneous Equilibria: Reaction Involving Solids and Liquids Calculating the Equilibrium Constant from Measured Equilibrium Concentrations

	The Reaction Quotient: Predicting the Directions of Change Finding Equilibrium Concentrations Le Châtelier's Principle: How a system at Equilibrium Responds to Disturbances
Chapter 17: Acids and Bases	Heartburn The Nature of Acids and Bases Definitions of Acids and Bases Acid Strength and the Acid Ionization Constant (Ka) Autoionization of Water and pH Finding [H3O+] and pH of Strong and Weak Acid Solutions Base Solutions The Acid-Base Proportions oaf Ions and Salts Polyprotic Acids Acid Strength and Molecular Structure Lewis Acids and Bases Acid Rain
Chapter 18: Aqueous Ionic Equilibrium	The Danger of Antifreeze Buffers: solutions that resist pH Change Buffer Effectiveness: Buffer Range and Buffer Capacity Titrations and pH Curves Solubility Equilibria and the Solubility Product Constant Precipitation Qualitative Chemical Analysis Complex Ion Equilibria
Chapter 19: Free Energy and Thermodynamics	Cold Coffee and dead universes Spontaneous and Nonspontaneous Processes Entropy and the Second Law of Thermodynamics Entropy Changes Associated with State Change Heat Transfer and Changes in the Entropy of the Surroundings Gibb's Free Energy Entropy Changes in Chemical Reactions: Calculating DS°rxn Free Energy in Chemical Reactions: Calculating DG°rxn Free Energy Change for Nonstandard States: The relationship between DG°rxn DGrxn Free Energy and Equilibrium: Relating DG°rxn to the Equilibrium Constant (K)
Chapter 20: Electrochemistry	Lightning and Batteries Balancing Oxidation-Reduction Equations Voltaic (or Galvanic) Cells: Generating Electricity form

	Spontaneous Chemical Reactions Standard Electrode Potentials Cell Potential, Free Energy, and the Equilibrium Constant Cell Potential and Concentration Batteries: Using Chemistry to Generate Electricity Electrolysis: Driving Nonspontaneous Chemical Reactions with Electricity Corrosion: Undesirable Redox Reactions
Chapter 21: Radioactivity and Nuclear Chemistry	Diagnosing Appendicitis Discovery of Radioactivity Types of Radioactivity The Valley of stability: Predicting the Type of Radioactivity Detecting Radioactivity The Kinetics of Radioactive Decay and Radiometric Dating The Discovery of Fission: The Atomic Bomb and Nuclear Power Converting Mass to Energy: Mass Defect and Nuclear Binding Energy Nuclear Fusion: The Power of the Sun Nuclear Transmutation and Transuranium Elements The Effects of Radiation on Life Radioactivity in Medicine and Other Applications
Chapter 22: Organic Chemistry	Fragrances and Odors Carbon: Why it is Unique Hydrocarbons: Compounds Containing Only Carbon and Hydrogen Alkanes: Saturated Hydrocarbons Alkenes and Alkynes Hydrocarbons Reactions Aromatic Hydrocarbons Functional Groups Alcohols Aldehydes and Ketones Carboxylic Acids and Esters Ethers Amines