AP Chemistry
Course Syllabus

A. Course Description

The AP Chemistry course is designed to be the equivalent of the general chemistry course usually taken during the first year of college. Students in this course will attain a depth of understanding of fundamentals and a reasonable competence in dealing with chemical problems. The student will develop the ability to think scientifically and express their ideas, orally and in writing, with clarity and logic.

In addition to the course content, students will be required to maintain a high level of competence in the laboratory. Students will be required to maintain a laboratory manual in which they will record all data and write complete laboratory reports. Students will be working in the laboratory approximately once every 1 to 1 ½ weeks. In addition to the labs completed in class, students will be required to complete a particularly long lab either during a scheduled evening session or a Saturday morning session.

B. Required Materials

Brown, Theodore L.; LeMay, Eugene H., Jr.; Bursten, Bruce E., Chemistry – The Central Science AP Edition. 10th Edition. Pearson Education, Inc. Upper Saddle River, NJ. 2006.

Spain, James D.; Peters, Harold J. ChemSkill Builder 3000+. Electronic Homework Systems, Inc. 2006.

2 Composition Notebooks to be used for all laboratory work.

Scientific Calculator (Preferably a graphing calculator)

Reference Materials

Brown, Theodore L.; LeMay, Eugene H., Jr.; Bursten, Bruce E., Chemistry – The Central Science Laboratory Experiments. 10th Edition. Pearson Education, Inc. Upper Saddle River, NJ. 2006.

Vonderbrink, Sally Ann, Ph.D. Laboratory Experiments for Advanced Placement Chemistry. 2nd Edition. Flinn Scientific, Inc. 2006.

Kotz, John C.; Treichel, Paul; Harman, Patrick. Chemistry & Chemical Reactivity. 5th Edition. Thomson Learning, Inc. 2003.

Zumdahl, Steven; Zumdahl, Susan. Chemistry. 6th Edition. Houghton Mifflin Company. 2003.

C. Course Assessments

Tests

Tests in AP Chemistry are formatted very similar to the AP Chemistry Exam. Each test will include multiple choice questions, free response questions, and net ionic equations. The multiple choice section will be taken first and is timed separately – approximately 10 minutes. Once this timed section is finished, it is turned in and you do not go back to it. The free response and net ionic equation sections will be taken second and timed separately – approximately 30-35 minutes. Tests will count 50% of the final grade.

Homework

Students in AP Chemistry will be expected to complete rigorous homework assignments, both in written format and electronically. If students do not have a computer at home, they have access to many computers at school and the public library to complete their electronic homework assignments.

It is expected of the student to turn in their homework assignments on time. Students will lose ½ credit for assignments turned in one day late and no credit more than one day late. If a student is absent, it is the student's responsibility to obtain any missed assignments, notes, or to make up any lab work that was completed. Students have one day for each day missed.

Students are expected to come in for help when they do not understand. Do not wait until the last minute for help – you will fall behind. Homework and laboratory work will count 30% of the final grade.

Laboratory and Laboratory Safety

All laboratory work will be **hands-on** assignments. Explanations before and discussions after each laboratory will be conducted by the teacher. Students will be working and collaborating in groups before beginning the laboratory and while

working in the laboratory. Students will also collaborate with their groups outside of class on their laboratory reports.

Students will be required to maintain a laboratory manual in which they will record all data and write complete and detailed laboratory reports. Students will be working in the laboratory approximately once every 1 to 1½ weeks. Each laboratory experiment will require two class periods to complete. Each class period is 55 minutes. Under certain circumstances, students may be required to finish a laboratory after school for the third or even fourth period. The qualitative and quantitative analysis laboratory experiments will require more time in which the students will be allowed several days to come in after class hours to complete the experiment.

ALL laboratory safety guidelines will be followed for every laboratory conducted. Chemical splash goggles and chemical resistant lab aprons are required laboratory attire for every lab. Students will be made aware of all safety equipment locations and MSDS catalogs. A safety review of chemicals used in each experiment will be conducted prior to the laboratory day.

Nine Week Exams

The nine week exams will count as 20% of the final grade. Students will be expected to complete a nine weeks test similar to their daily tests – timed and sectioned by multiple choice and free response.

Attendance

Students are expected to be in class. Should a student be absent from class, it is the responsibility of the student to make up any class work missed and schedule any laboratory time before or after school.

D. Course Topics

Chapters 1 and 2
Time Allocation: 1 week

Because both of these chapters have been covered in a first year chemistry course required to be taken before AP Chemistry, a small amount of time will be spent on reviewing the fundamental concepts.

Chapter 1 – Introduction: Matter and Measurement

Objectives:

- Classify materials, distinguishing between pure substances and mixtures and noting that there are two different kinds of pure substances: elements and compounds.
- Identify different properties that we use to characterize, identify, and separate substances.
- Relate the metric system to how properties rely on quantitative measurements.
- Express quantitative measurements in correct significant figures and correct units of measurement.

Chapter 2 – Atoms, Molecules, and Ions

Objectives:

- Give evidence for the atomic theory.
- Determination of atomic masses by chemical and physical means.
- Identify atomic number, mass number, and isotopes.
- Review calculations of empirical and molecular formulas.
- Review basic nomenclature of ionic substances, covalent substances, and introduce basic nomenclature of organic compounds and functional groups.

Lab Assignment:

Determination of the Empirical Formula of Silver Oxide

(*AP Requirement: Determination of the Formula of a Compound)*

Experiment Overview: The percent composition and empirical formula of silver oxide will be calculated, based on the combining ratios of silver and oxygen in the reaction.

Homework Assignments:

End of Chapter Problems
ChemSkill 3000+

Unit 1 Introduction to Chemistry

Section 1.1 Introduction to Chemistry
Section 1.2 Chemical Reactions/Physical Processes
Section 1.3 Three Phases of Matter
Section 1.4 Names/Symbols of Elements I
Section 1.5 Chemical Compounds
Section 1.6 Temperature Conversions

Unit 2 Units and Measurements

Section 2.1 Scientific Notation
Section 2.2 Significant Figures
Section 2.3 Measurement and Interpolation
Section 2.4 Metric Prefixes
Section 2.5 Dimensional Analysis/Unit Conversion
Section 2.6 Density and Volume Problems

Unit 3 Chemical Nomenclature

Section 3.1 Names/Symbols of Elements II
Section 3.2 Molecules/Ions
Section 3.3 Cations and Anions
Section 3.4 Ionic Compounds
Section 3.5 Acids, Bases, and Salts
Section 3.6 Elements, Compounds, and Mixtures

Chapters 3 and 4
Time Allocation: 2.5 weeks

Chapter 3 – Stoichiometry: Calculations with Chemical Formulas and Equations

Objectives:

- Use chemical formulas to write equations that represent chemical reactions.
- Identify and predict the products of the basic types of equations.

- Use quantitative information in chemical formulas and equations together with the mole concept to predict amounts of substances consumed and/or produced in chemical reactions, including limiting reactants.

Chapter 4 – Aqueous Reactions and Solution Stoichiometry

Objectives:

- Understand the various concepts of properties of aqueous solutions.
- Identify and apply solubility rules for the writing and balancing of net ionic equations.
- Explain the process of an oxidation-reduction reaction.
- Balance equations including those for oxidation-reduction reactions.
- Identify and complete acid-base reactions.
- Explain the various methods of expressing concentration and perform calculations using these methods.

Lab Assignments:

Analysis of Alum, $AlK(SO_4)_2 \cdot 12H_2O$

(AP Requirement: Determination of the Percentage of water in a hydrate)

Experiment Overview: Analyze alum by using two techniques in order to verify its identity. The following properties will be determined – melting point and the mole ratio of hydrated water to anhydrous aluminum potassium sulfate. Each of these properties will be compared to the literature or calculated values for alum.

Finding the Ratio of Moles of Reactants in a Chemical Reaction

(AP Requirement: Determination of mass and mole relationship in a chemical reaction)

Experiment Overview: Determine the mole ratio of two reactants. The change in temperature is the property to be measured. The reactions are all exothermic, so the heat produced will be directly proportional to the amount of reaction that occurs. Since the experiment is designed so that the total volume of solutions is constant for all measurements, the temperature change will also be proportional to the total extent that the reaction occurs.

Homework Assignments:

End of Chapter Problems

ChemSkill 3000+

Unit 4 Stoichiometry

Section 4.1 The Mole Concept
Section 4.2 Mass/Mole Calculations
Section 4.3 Molar Conversion Factors
Section 4.4 Limiting Reactants and Yield
Section 4.5 Percent Composition
Section 4.6 Empirical Formulas

Unit 5 Chemical Reactions

Section 5.1 Solubility Rules
Section 5.2 Products of Metathesis Reactions
Section 5.3 Ionic/Net Ionic Equations
Section 5.4 Balancing Equations
Section 5.5 Predicting Products of Reactions
Section 5.6 Single Displacement/Activity Series

Chapter 5 – Thermochemistry
Time Allocation: 1.5 weeks

Objectives:

- Explain the nature of energy and the forms it takes.
- Explain state functions.
- Explore the first law of thermodynamics.
- Calculate change in enthalpy; heat of formation; heat of reaction; Hess's law; heats of vaporization and fusion.
- Using calorimetry, measure heat changes in chemical processes.

Lab Assignments:

Thermodynamics – Enthalpy of Reaction and Hess's Law

(AP Requirement: Determination of enthalpy change association with a reaction)

Experiment Overview: Verify Hess's Law. Three acid-base reactions, chosen so that the third reaction equals the first reaction equation minus the second, are measured for temperature change by calorimetry. The values of heat change and enthalpy of reaction are calculated for each reaction. The measured value for the third reaction is then compared to the value calculated by subtracting the enthalpy of reaction for reaction two from the enthalpy of reaction of reaction one.

Homework Assignments:

End of Chapter Problems
ChemSkill 3000+

Unit 8 Thermochemistry

Section 8.1 Heat Capacity Problems
Section 8.2 Phase Changes and Heat
Section 8.3 Calorimetry Problems
Section 8.4 Internal Energy and Work
Section 8.5 Exothermic and Endothermic Processes
Section 8.6 Enthalpy Change Problems

Chapter 6 – Electronic Structure of Atoms
Time Allocation: 1.5 week

Objectives:

- Study electron energy levels: atomic spectra, quantum numbers, atomic orbitals.

Lab Assignment:

Analysis of Silver in an Alloy

(AP Requirement: Analytical gravimetric determination)

Experiment Overview: Analyze an alloy of silver to determine the content of silver. The silver-copper alloy will be dissolved in nitric acid, the silver will be precipitated as silver chloride, and the silver chloride will be filtered, washed, dried, and its mass determined. From the mass of the silver chloride formed and the mass of the original sample, the percent of silver in the alloy is calculated.

Homework Assignments:

End of Chapter Problems
ChemSkill 3000+

Unit 9 Atomic Structure

Section 9.1 Elementary Particles and Isotopes
Section 9.2 Light, Energy, and Electron Transitions
Section 9.3 Orbital Box Model of Electrons
Section 9.4 Electron Configuration I
Section 9.5 Electron Configuration II
Section 9.6 Quantum Numbers

Chapter 7 – Periodic Properties
Time Allocation: 1.5 weeks

Objectives:

- Discuss a brief history of the periodic table of elements.
- Identify periodic relationships including atomic radii, ionization energies, electron affinities, effective nuclear charge, oxidation states, and electronegativities.
- Identify relationships within groups and periods on the periodic table, including diagonal trends.
- Identify relationships of periodicity of chemical reactivities of elements and compounds.

Lab Assignment:

Separation and Qualitative Determination of Cations and Anions

(AP Requirement: separation and qualitative analysis of cations and anions)

Experiment Overview: Students will analyze a solution that can contain any combination of six different cations and a solution that can contain any combination of six different anions. The students will analyze a cation and an anion solution that are known to contain all of the ions to learn the techniques for the analysis. They will then analyze an unknown solution to determine which ions are present and which are absent.

An Activity Series

Estimated Time for Completion:

(AP Requirement: Determination of electrochemical series)

Experiment Overview: Determine the activity series for five metals and for three halogens. The first part of this experiment derives an activity series for metals. The second part derives an activity series for halogens. This lab makes use of a solvent extraction technique.

Homework Assignments:

End of Chapter Problems

ChemSkill 3000+

Unit 11 Periodic Properties

Section 11.1 Size of Atoms and Ions

Section 11.2 Ionization Energy and Electron Affinity

Section 11.3 Metals, Nonmetals, and Families
Section 11.4 Valence Electrons and Charge of Ions
Section 11.5 Acidity and Basicity

Chapters 8 and 9
Time Allocation: 3 weeks

Chapter 8 – Basic Concepts of Chemical Bonding

Objectives:

- Identify chemical bonding; ionic, covalent, and metallic.
- Understand the concept of bond polarity.
- Construct Lewis structures and use formal charges to identify the best structure.
- Construct Resonance structures.
- Understand the exceptions to the octet rule.
- Calculate bond enthalpy.

Chapter 9 – Molecular Geometry and Bonding Theories

Objectives:

- Predict molecular geometries using the VSEPR, valence-shell electron-pair repulsion.
- Explain the valence bond theory and hybridization of orbitals.
- Identify sigma and pi bonds.

Lab Assignments:

Lewis Structures and Molecular Geometry
Experiment Overview: Practice drawing Lewis structures of molecules and to use these structures to predict molecular geometry.

Molecular Models
Estimated Time for Completion:
Experiment Overview: Students will check out molecular model sets and learn to identify molecular structures by visual recognition.

Homework Assignments:

End of Chapter Problems

ChemSkill 3000+

Unit 12 Polyatomic Structures

Section 12.1 Electronegativity and Bond Polarity
Section 12.2 Lewis Dot Diagrams
Section 12.3 Shapes of Ions and Molecules
Section 12.4 Resonance and Formal Charge
Section 12.5 Review of Molecular Shapes

Unit 13 Covalent Bonding

Section 13.1 Orbital Shapes in Molecules
Section 13.2 Orbital Hybridization
Section 13.3 Bonding in Organic Structures
Section 13.4 Polarity of Molecules
Section 13.5 Molecular Orbital Theory

Chapter 10 – Gases

Time Allocation: 2 weeks

Objectives:

- Distinguish the characteristics of gases with those of liquids and solids.
- Explain gas pressure, how it is measured, and the units used to measure it.
- Relate the variables of volume, pressure, temperature, and quantity of gas using the ideal gas equation.
- Perform calculations using the ideal gas equation to determine relationships involving the physical properties of gases (i.e. density, molar mass).
- Relate gas mixtures and partial pressures.
- Understand the physical properties of gases and what happens to the gas particles as experimental conditions change using the kinetic molecular theory.
- Understand the deviations from the ideal gas equation for real gases.

Lab Assignments:

Determining the Molar Volume of a Gas

(AP Requirement: Determination of the molar volume of a gas)

Experiment Overview: Determine the volume of one mole of hydrogen gas at STP. Hydrogen will be generated by the reaction of a known mass of magnesium with excess

hydrochloric acid in an inverted gas measuring tube filled with water. The volume of hydrogen collected by water displacement will be measured and correct for differences in temperature and pressure in order to calculate the molar volume of hydrogen at STP.

Determination of the Molar Mass of Volatile Liquids

Estimated Time for Completion:

(AP Requirement: Determination of molar mass by vapor density)

Experiment Overview: Determine the molar masses of various volatile liquids. The liquids are volatilized and condensed in a fixed volume. The condensed vapor is massed and the liquid's molar mass is calculated from the experimental data.

Homework Assignments:

End of Chapter Problems

ChemSkill 3000+

Unit 7 Properties of Gases

Section 7.1 Intuitive Behavior of Gases
Section 7.2 Gas Law Problems
Section 7.3 Ideal Gas Equation
Section 7.4 Mixture of Gases
Section 7.5 Kinetic Theory of Gases

Chapter 11 – Intermolecular Forces, Liquids, and Solids

Time Allocation: 2 weeks

Objectives:

- Compare solids, liquids, and gases from a molecular perspective.
- Identify the intermolecular forces that occur within and between substances: ion-dipole forces, dipole-dipole forces, London dispersion forces, and hydrogen bonding.
- Relate intermolecular forces between molecules to the properties of liquids.
- Identify phase changes and the energy changes that accompany phase changes.
- Examine the structure of solids and the attractive forces between their component atoms, molecules, or ions: molecular solids, covalent-network solids, ionic solids, and metallic solids.

Lab Assignment:

Chemical Reactions and Qualitative Analysis

(AP Requirement: separation and qualitative analysis of cations and anions)

Experiment Overview: Design and carry out a sequence of chemical reactions for the separation and identification of iron(III), silver, and zinc ions in water.

Homework Assignments:

End of Chapter Problems

ChemSkill 3000+

Unit 14 Liquids and Solids

Section 14.1 Changes of Physical State
Section 14.2 Types of Bonding in Solids
Section 14.3 Crystalline Solids
Section 14.4 Intermolecular Forces in Liquids
Section 14.5 Vapor Pressure
Section 14.6 Phase Diagrams

Chapter 13 – Properties of Solutions

Time Allocation: 2 weeks

Objectives:

- Identify the role of intermolecular forces at the molecular level of substances being dissolved.
- Examine the changes in energy and the changes in how particles are distributed in space that accompany the solution process.
- Identify the types of solutions and the factors affecting solubility.
- Examine colligative properties: lowering vapor pressure, boiling point elevation, freezing point depression, and osmotic pressure.

Lab Assignment:

Molar Mass by Freezing Point Depression

(AP Requirement: Determination of molar mass by freezing point depression)

Experiment Overview: Determine the molar mass of an unknown substance by measuring the freezing point depression of a solution of the unknown substance and BHT. The freezing

point of the BHT is first determined. A known amount of cetyl alcohol is then added to a measured quantity of BHT. The freezing point depression of this solution is found and the freezing point depression constant (k_{fp}) is then calculated. The unknown is added to BHT, the freezing point depression of this solution is measured, and the molar mass of the unknown is then determined.

Homework Assignments:

End of Chapter Problems
ChemSkill 3000+

Unit 15 Properties of Solutions

Section 15.1 Solvents and Solutions
Section 15.2 Concentration Calculations
` Section 15.3 Pressure and Temperature Effects
Section 15.4 Vapor Pressure of Solutions
Section 15.5 Freezing Point Lowering and Boiling Point Raising

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Chapter 14 – Chemical Kinetics
Time Allocation: 1.5 weeks

Objectives:

- Understand the concept of rate of reaction.
- Explain the variables that affect reaction rates.
- Use experimental data and graphical analysis to determine reaction order, rate constants, and reaction rate laws.
- Explain activation energy and the role of catalysts in chemical reactions.
- Distinguish the relationship between the rate-determining step and a mechanism.

Lab Assignment:

Kinetics of a Reaction

(AP Requirement: Determination of the rate of a reaction and its order)

Experiment Overview: Determine the total rate law for the oxidation of iodide ions by bromate ions in the presence of acid. The order for each of the reactants is found by varying the concentration of each reactant individually. Once the orders are known, the rate constant is calculated. The activation energy is found by repeating the experiment at several different

temperatures, measuring the rate, and calculating the rate constants at the different temperatures. A graph of the reciprocal of absolute temperature versus the natural logarithm of the rate constant allows the calculation of the activation energy. A catalyst is then added and the change in reaction is observed.

Homework Assignments:

End of Chapter Problems
ChemSkill 3000+
Unit 16 Chemical Kinetics
Section 16.1 Reaction Rates from Chemical Data
Section 16.2 Rate Law Equations
Section 16.3 Experimental Kinetics
Section 16.4 First Order Rate Problems
Section 16.5 Reaction Mechanisms
Section 16.6 Temperature and Rate

Chapter 15 – Chemical Equilibrium
Time Allocation: 1.5 weeks

Objectives:
- Examine the concept of dynamic equilibrium; physical and chemical.
- Define the equilibrium constant.
- Write equilibrium constant expressions for homogeneous and heterogeneous reactions.
- Interpret the size of the equilibrium constant and how the value is affected when the reaction is changed in some manner.
- Use the equilibrium constant to predict the equilibrium concentrations of reactants and products and determine the direction a reaction must proceed in order to reach equilibrium.
- Using Le Châtelier's principle, predict how a system at equilibrium responds to changes in concentration, volume, pressure, and temperature.

Lab Assignment:

The Determination of K_{eq} for $FeSCN^{2+}$
(AP Requirement: Determination of the equilibrium constant for a chemical reaction)

(AP Requirement: Colorimetric or spectrophotometric analysis)

Experiment Overview: Calculate the equilibrium constant for the reaction of iron (III) ions with thiocyanate ions. The reaction will be tested under different conditions to determine if the equilibrium constant always has the same numerical value. In Part 1 of the experiment, a series of reference solutions and test solutions are prepared. The reference solutions are prepared by mixing a large excess of Fe^{3+} ions with known amounts of SCN^- ions. The large excess of Fe^{3+} ions should convert all of the SCN^- ions to the blood-red $FeSCN^{2+}$ complex ions. The test solutions are prepared by mixing a constant amount of Fe^{3+} ions with different amounts of SCN^- ions. These solutions contain unknown concentrations of $FeSCN^{2+}$ ions at equilibrium. In Part 2 of the experiment, the absorbances of both the reference solutions and the test solutions are measured by colorimetry. A calibration curve is constructed from the absorption values of the reference solutions. The unknown concentrations of $FeSCN^{2+}$ in the test solutions are calculated by comparing their absorbance readings to the absorbance values of the calibration curve. These values are used to determine the equilibrium concentrations and the equilibrium constant for the reaction.

Equilibrium and LeChâtelier's Principle

(AP Requirement: Determination of the equilibrium constant for a chemical reaction)

(AP Requirement: Colorimetric or spectrophotometric analysis)

Experiment Overview: Form several equilibrium systems, put different stresses on the systems, and observe how equilibrium systems react to the stresses.

Homework Assignments:

End of Chapter Problems

ChemSkill 3000+

Unit 17 Chemical Equilibria

Section 17.1 Equilibrium Law and K_c
Section 17.2 Gas Equilibria and K_p
Section 17.3 Heterogeneous Equilibria
Section 17.4 Equilibrium Calculations
Section 17.5 La Châtelier's Principle

Chapter 16 – Acid-Base Equilibria

Time Allocation: 2 weeks

Objectives:

- Identify and explain an Arrhenius acid and base.

- Identify and explain a Bronsted-Lowry acid and base as well as the conjugate acid and base.
- Identify, explain, and perform calculations using the equilibrium constant for the autoionization of water: K_w.
- Identify, explain, and perform calculations using the equilibrium constants for gaseous reaction: K_c and K_p.
- Perform calculations of pH using pOH, K_a, and K_b.
- Understand the relationship between K_a and K_b.
- Identify and explain a Lewis acid and base.

Lab Assignments:

Determination of K_a of Weak Acids

(AP Requirement: Determination of the equilibrium constant for a chemical reaction)

Experiment Overview: Determine the pK_a values for ionization of two unknown weak acids. Solutions containing equal molar amounts of the weak acids and their conjugate bases are prepared by half-neutralization of the acid. Their pH values are measured and used to calculate the pK_a value for the unknowns and thus determine their identities.

Selecting Indicators for Acid-Base Titrations

(AP Requirement: Determination of appropriate indicators for various acid-base titrations)

Experiment Overview: The appropriate indicators will be selected for two titrations – a weak acid solution with a strong base and a weak base solution titrated with a strong acid solution. Titration curves of pH versus volume of titrant will be generated and used to verify the appropriateness of the selected indicators.

Acid-Base Titrations

(AP Requirement: Standardization of a solution using a primary standard)
(AP Requirement: Determination of concentration by acid-base titration, including a weak acid or weak base)

Experiment Overview: Standardize a sodium hydroxide solution and use the stand solution to titrate an unknown solid acid. The equivalent mass of the solid acid will be determined from the volume of sodium hydroxide added at the equivalence point. The equilibrium constant, K_a, of the solid acid will be calculated from the titration curve obtained by plotting the pH of the solution versus the volume of sodium hydroxide added.

Homework Assignments:

End of Chapter Problems

ChemSkill 3000+

Unit 18 Acid – Base Equilibria

Section 18.1 Acid/Base Reactions
Section 18.2 K_w and pH Calculations
Section 18.3 pH Meter Simulation
Section 18.4 Strong Acids and Bases
Section 18.5 Weak Acids and Bases

Chapter 17 – Additional Aspects of Aqueous Equilibria
Time Allocation: 2 weeks

Objectives:

- Identify, explain, and perform calculations using the concept of the common-ion effect.
- Distinguish how buffered solutions, or buffers, resist pH change upon the addition of small amounts of strong acid or strong base.
- Determine pH at any point in an acid-base titration.
- Use the solubility-product constants to determine what extent a soluble salt will dissolve in water.
- Identify methods of selectively precipitating ions using the concepts of solubility equilibria.

Lab Assignments:

Oxidation-Reduction Titration

(AP Requirement: Determination of concentration by oxidation-reduction titration)

Experiment Overview: Standardize a solution of potassium permanganate by redox titration with a standard solution of iron (II) ions. A solution of oxalic acid will be titrated with the permanganate solution to determine the exact concentration of oxalic acid.

Preparation and Properties of Buffer Solutions

(AP Requirement: Preparation and properties of buffer solutions)

Experiment Overview: The pH of water and a number of solutions will be measured, and then acids and bases will be added to see how the pH is affected. Several buffer solutions of different pH values will be prepared and tested for their ability to resist change of pH.

Determination of the Solubility Product of an Ionic Compound

(AP Requirement: Determination of the equilibrium constant for a chemical reaction)

Experiment Overview: The solubility product for calcium hydroxide ions will be calculated from the solution concentration.

Homework Assignments:

End of Chapter Problems

ChemSkill 3000+

Unit 6 Molarity of Solutions

Section 6.1 Molar Concentration
Section 6.2 Titrations
Section 6.3 Volumetric Analysis
Section 6.4 Molarity of Ions
Section 6.5 Redox Titrations

Unit 19 Buffers and Hydrolysis

Section 19.1 Salt Hydrolysis
Section 19.2 Common Ion Effect
Section 19.3 Buffers
Section 19.4 Titration Calculations
Section 19.5 Titration Curves

Unit 20 Solubility Equilibria

Section 20.1 Solubility Product Equation
Section 20.2 Solubility Calculations
Section 20.3 Common Ion Effect
Section 20.4 Simultaneous Equilibria

Chapter 19 – Chemical Thermodynamics

Time Allocation: 1.5 weeks

Objectives:

- Explore the spontaneity of reactions.

- Examine the second law of thermodynamics.
- Examine the third law of thermodynamics.
- Using Gibbs free energy to determine how far removed a system is from equilibrium.
- Using the relationship among free-energy change, enthalpy change, and entropy change, determine how temperature affects the spontaneity of a process.
- Using the standard free-energy change for a chemical reaction, calculate the equilibrium constant.

Lab Assignment:

Electrochemical Cells and Thermodynamics

(AP Requirement: Determination of electrochemical cells)
(AP Requirement: Measurements using electrochemical cells and electroplating)

Experiment Overview: Become familiar with fundamentals of electrochemistry, including the Nernst equation, by constructing electrochemical cells and measuring their potentials at various temperatures. The quantities ΔG, ΔH, and ΔS will be calculated from the temperature variation of the measured emf.

Homework Assignments:

End of Chapter Problems
ChemSkill 3000+

Unit 21 Thermodynamics

Section 21.1 Enthalpy Change
Section 21.2 Entropy Change
Section 21.3 Free Energy Changes
Section 21.4 Spontaneity of Reactions
Section 21.5 Free Energy and Concentration

Chapter 20 - Electrochemistry
Time Allocation: 1 week

Objectives:

- Review oxidation-reduction reactions.
- Gain an understanding of an electrolytic and galvanic cell.

- Using electrode potentials, determine the strengths of oxidizing agents and reducing agents, and predict the spontaneity of oxidation-reduction reactions.
- Relate Gibbs free energy to the emf of an electrochemical cell.
- Calculate the voltage of cells under nonstandard conditions using standard voltages and the Nernst equation.

Lab Assignment:

Electrochemical Cells

(AP Requirement: Measurements using electrochemical cells and electroplating)

Experiment Overview: Construct a "standard" table listing the reduction potentials of a series of metal ions in order of ease of reduction and applying the Nernst equation to the voltage measurement of a cell with nonstandard copper ion concentration. In the final section of the experiment, the solubility product constant of silver chloride is determined from the Nernst equation and the voltage of a cell in which the zinc half-cell is connected to a solution containing a trace of silver ions in a 1.0 M solution of sodium chloride.

Homework Assignments:

End of Chapter Problems

ChemSkill 3000+

Unit 22 Electrochemistry

Section 22.1 Using Redox Potentials
Section 22.2 Voltaic Cells
Section 22.3 Electrolytic Cells
Section 22.4 Faraday's Law Problems
Section 22.5 Nernst Equation Problems

Chapter 21 – Nuclear Chemistry
Time Allocation: 1 week

Objectives:

- Describe nuclear reactions by equations.
- Determine the radioactive decay: alpha, beta, or gamma radiations.
- Determine rates of radioactive decay.

Homework Assignments:

End of Chapter Problems
ChemSkill 3000+
Unit 23 Nuclear Chemistry
Section 23.1 Properties of Radiation
Section 23.2 Balancing Nuclear Reactions

Chapter 22 – Organic Chemistry
Time Allocation: 1 week

Objectives:

- Introduce the structure and reactivity of organic compounds.
- Introduce hydrocarbons and the different classes of hydrocarbons.
- Explore isomers and functional groups.

Homework Assignments:

End of Chapter Problems
ChemSkill 3000+
Unit 24 Organic Chemistry
Section 24.1 Hydrocarbon Structure and Nomenclature
Section 24.2 Functional Group Nomenclature
Section 24.3 Addition and Substitution Reactions
Section 24.4 Oxidation and Reduction Reactions

The remaining weeks before the AP Chemistry exam will be used for intense studying, reviewing, practice exams, and discussions.

- Previous Free Response AP Chemistry exam questions will be assigned as homework.
- Previous Free Response AP Chemistry exam questions will be worked and discussed in class.
- Practice AP Chemistry exams will be taken.
- AP Chemistry style multiple choice questions will be assigned as homework and then discussed in class.
