Advanced Placement Chemistry (one year)
High School
Standards, Supporting Skills, Assessments, and Resources

Indicator 1: Describe structures and properties of, and changes in, matter.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Analysis)	**9-12.P.1.1A. Students are able to distinguish between the changing models of the atom using the historical experimental evidence.** **Examples**: Dalton, Thompson, Rutherford, Bohr, wave-mechanical models	**Unit 2: Atoms, Molecules, and Ions** ▪ Early History of chemistry ▪ Fundamental of chemical Laws ▪ Dalton's Atomic Law ▪ Early experiments to characterize the atom ▪ Modern view of atomic structure	**Homework** **Exams/quizzes** **Labs** **Activities**	Chemistry, Steven S. Zumdahl Chapter 2 1.5 weeks
(Synthesis)	**9-12.P.1.2A. Students are able to predict electron configuration, ion formation, reactivity, compound formation, periodic trends, and types of compounds formed based on location on the Periodic Table.**	**Unit 6: Atomic Structure Periodicity** ▪ Electromagnetic Radiation ▪ Nature of Matter ▪ Atomic Spectra ▪ Bohr's Model ▪ Quantum Model ▪ Quantum Numbers ▪ Orbital shapes and Energies ▪ Electron Spin and Pauli Exclusion Principle ▪ History of Periodic Table ▪ Periodic and group trends Atomic size, ionic size, electronegativity, electron affinity, ionization energies, oxidation states ▪ Experiment Flame test for metals	**Homework** **Exams/quizzes** **Labs** **Activities**	Chemistry, Steven S. Zumdahl Chapter 7 2 weeks

(Synthesis)	**9-12.P.1.3A. Students are able to identify five basic types of chemical reactions and predict the products.**	**Unit 3: Stoichiometry** ▪ Review of chem math ▪ Balancing Chem Equation Emphasis predicting/writing complete net ionic equation ▪ Review Stoichiometric calculations from adv chem **Unit 13: Acid and Bases** • Strong vs. Weak Acid/base: pH, pOH, $[OH^-]$, $[H^+]$ • Reactions pf salts in water • Reactions of acid/bse in water (titration) • Acid/base titration curves, pH at endpoint, acid/base theories • Ka, Kb, and determination from pH and % dissociation • Determination of $[H^+]$, pH for weak acid with/without quadratic formula • Polyprotic acid analysis • Buffer problem • Weak base/acid ionization • Acid/base indicator principles • Rules for multiple equilbria • Common ion effect • Determination of pH in salt solutions	**Homework** **Exams/quizzes** **Labs** UNIT 3 Experiments *Empirical formula of copper iodide *Synthesis of aspirin *Net ionic reactions using microscale UNIT 14 Experiments *Titration of a solid acid to find its molecular weight *Titration of diprotic acid **Activities**	Chemistry, Steven S. Zumdahl Chapter 3 and 4 2.5 weeks Chemistry, Steven S. Zumdahl Chapter 14 and 15 2.5 weeks

(Synthesis)	**9-12.P.1.4A. Students are able to describe factors that affect solution interactions.**	**Unit 9: Solutions** • Types of solutions and factors affecting solubility • Henry's Law • Methods of expressing concentration (The use of normalities is not tested.) • Raoult's law and colligative properties (nonvolatile solutes); osmosis • Non-ideal behavior (qualitative aspects)	**Homework** **Exams/quizzes** **Labs** UNIT 9 Experiment Molecular Mass detemination by freezing point depression **Activities**	Chemistry, Steven S. Zumdahl Chapter 11 2.0 weeks
(Application)	**9-12.P.1.5A. Students are able to examine energy transfer as matter changes.** **Examples**:	**Unit 5: Thermochemistry** ▪ Nature of Energy ▪ Enthalpy and Calorimetry ▪ Hess's Law ▪ Standard Enthalpies of Formation ▪ Bond Energies ▪ Heats of Reactions **Unit 10: Chemical Thermodynamics** • State functions • Review 1^{ST} law: enthalpy; heat of formation; heat of reaction; Hess's law; heats of vaporization/fusion; calorimetry • 2^{ND} law: entropy; free energy of formation; free energy of reaction; dependence energy on enthalpy and entropy changes • Relationship of change in free energy to equilibrium constants and electrode potentials	**Homework** **Exams/quizzes** **Labs** UNIT 5 Experiment Calorimetry **Activities**	Chemistry, Steven S. Zumdahl Chapter 6 2.0 weeks Chemistry, Steven S. Zumdahl Chapter 16 2.5 weeks

(Application)	**9-12.P.1.6A. Students are able to perform stoichiometric calculations.**	**Unit 1: Calculateions and uncertainty** ▪ Nature of science and scientific method ▪ Experiment design ▪ Data measurement and manipulation ○ ***Review exponential notation, SI units, dimensional analysis, graphing, and algebraic operations.*** ▪ Uncertainty in Measurements ○ ***Learn about the measurements chemists make in the laboratory and how to express the accuracy and precision of these measurements.*** ▪ Significant Figures and calculations ▪ Lab safety and techniques **Unit 3: Stoichiometry** • Review of chem math from adv chem ○ Mole, molar mass , percent composition, determining empirical/molecular formula ▪ Review Balancing Chemical Equations ○ Emphasis on predicting and writing complete net ionic equation	**Homework** **Exams/quizzes** **Labs** UNIT 1 Experiments *Safety in lab *How to use a balance *How to use equipment UNIT 3 Experiments *Empirical formula of copper iodide *Synthesis of aspirin *Net ionic reactions using microscale **Activities** *Lab safety and techniques*	Chemistry, Steven S. Zumdahl Chapter 1 1.0 weeks Chemistry, Steven S. Zumdahl Chapter 3 and 4 2.5 weeks

		▪ Review Stoichiometric calculations from adv chem ○ Emphasis on limiting/excessive reactant problems and percent yield		
(Application)	**9-12.P.1.7A. Students are able to apply the kinetic molecular theory to solve quantitative problems involving pressure, volume, temperature, and number of moles of gas.**	**Unit 4: Gases** ▪ Pressure ▪ Gas Laws ○ Charles, Boyles, Gay-Lussac, Avogadro ▪ Gas Stoichiometry ▪ Dalton's Law of partial Pressure ▪ Laws of ideal gases ○ Equation of state for an ideal gas ▪ Kinetic-molecular theory ○ Interpretation of ideal gas laws on the basis of this theory the ○ Dependence of kinetic energy of molecules on temperature ○ Deviations from ideal gas laws ▪ Diffusion vs. Effusion ▪ Real vs. Ideal gases	**Homework** **Exams/quizzes** **Labs** UNIT 4 Experiment Molecular Mass of a volatile liquid **Activities**	Chemistry, Steven S. Zumdahl Chapter 5 2.0 weeks

(Synthesis)	**9-12.P.1.8A. Students are able to use models to make predictions about molecular structure, chemical bonds, chemical reactivity, and polarity of molecules.**	**Unit 7: Chemical Bonding** ▪ Binding forces o Types: ionic, covalent, metallic, hydrogen bonding, van der Waals • Relationships to states, structure, and properties of matter o Polarity of bonds, electronegativities • Molecular models o Lewis structures, VSEPR o Valence bond: hybridization of orbitals, resonance, sigma and pi bonds • Geometry of molecules and ions, structural isomerism of simple organic molecules and coordination complexes; dipole moments of molecules; relation of properties to structure • Nuclear chemistry: nuclear equations, half-lives, and radioactivity; chemical applications	**Homework** **Exams/quizzes** **Labs** UNIT 7 Experiment VSEPR model building **Activities**	Chemistry, Steven S. Zumdahl Chapter 8 and 9 3.0 weeks
(Analysis)	**9-12.P.1.9A. Students are able to describe the characteristics of equilibria.** •	**Unit 12: Equilibrium** ▪ Concept of dynamic equilibrium, physical and chemical • Le Chatelier's principle • Equilibrium constants for gaseous reactions: *Kp*, *Kc* • Equilibrium constants for reactions in solution	**Homework** **Exams/quizzes** **Labs** UNIT 12 Experiment Determination of the equilibrium constant	Chemistry, Steven S. Zumdahl Chapter 13 2.0 weeks

		• Constants for acids and bases; pK; pH • Law of Mass Action • Solubility product constants and their application to precipitation and the dissolution of slightly soluble compounds • Common ion effect • Buffers ○ Calculation of pH, effects of adding limiting amount of strong acid/base • Hydrolysis	**Activities**	

Indicator 2: Analyze forces, their forms, and their effects on motions.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Synthesis)	**9-12.P.2.1A. Students are able to solve vector problems graphically and analytically.**			
(Analysis)	**9-12.P.2.2A. Students are able to relate gravitational or centripetal force to projectile or uniform circular motion.**			

Indicator 3: Analyze interactions of energy and matter.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Synthesis)	**9-12.P.3.1A. Students are able to explain wave behavior in the fundamental processes of reflection, refraction, diffraction, interference, resonance, and image formation.**			
(Application)	**9-12.P.3.2A. Students are able to describe the relationship between charged particles, static electricity, and electric fields.**			
(Analysis)	**9-12.P.3.3A. Students are able to describe the relationship between changing magnetic and electric fields.**			

Additional Concepts to Cover

Blooms Taxonomy Level	Standard/Objective	Supporting Skills	Assessments	Resources
		Unit 8: Liquids and Solids ▪ Liquids and solids from the kinetic-molecular viewpoint • Phase diagrams of one-component systems • Clausius-Clapeyron Equation • Changes of state, including critical points and triple points • Structure of solids; lattice energies • Crystal Structures (simple cubic, face-centered cubic, body-centered cubic) ▪ Types of solids, metallic bonding, network solids, amorphous	**Homework** **Exams/quizzes** **Labs** **Activities**	Chemistry, Steven S. Zumdahl Chapter 10 1.5 weeks
		Unit 11: Kinetics • Concept of rate of reaction • Use of experimental data and graphical analysis to determine reactant order, rate constants, and reaction rate laws • Effect of temp change on rates • Energy of activation; the role of catalysts • The relationship between the rate-determining step and a mechanism	**Homework** **Exams/quizzes** **Labs** UNIT 11Experiment Kinetics of thiosulfate decomposition **Activities**	Chemistry, Steven S. Zumdahl Chapter 12 2.5 weeks

		Unit 14: Electochemistry Oxidation/reduction half-cells and equations • Voltaic cells, EMF, Standard cell potentials of half reactions; cell potentials, electroltic cells, relationship to oxidation and reduction • Cell potentials, spontaneity, equlibrium constants and free energy relationships • EMF and concentration – Nernst Equation • Electrolysis reaction and Faraday's law of electrolysis ○ **Unit 15: Nuclear Chemistry** ▪ Nuclear equations • Half lives • Nuclear particle emission • Fission vs. fusion • Nuclear reactors	**Homework** **Exams/quizzes** **Labs** <u>UNIT 14 Experiments</u> *Electrolysis of water * Identifying electrodes *Writing half reaction **Activities** **Homework** **Exams/quizzes** **Labs** **Activities**	Chemistry, Steven S. Zumdahl Chapter 17 1.5 weeks Chemistry, Steven S. Zumdahl Chapter 18 0.5 weeks