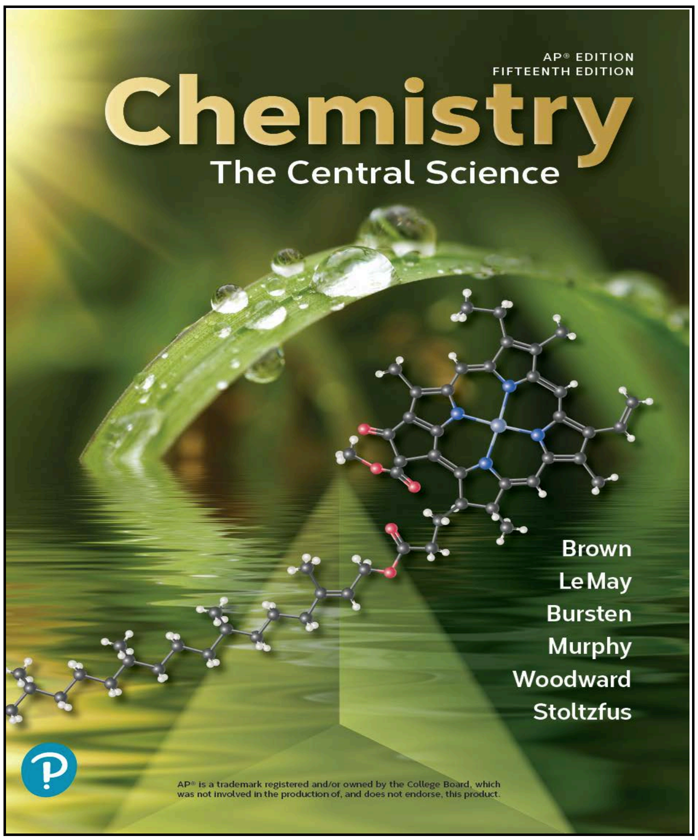
SAVVAS
LEARNING COMPANY

Savvas is proud to partner with Pearson to offer the best in AP, honors, and electives products.

A Correlation of

Chemistry: The Central Science

15th Edition, AP® Edition © 2023



To the

AP® Chemistry
Course and Exam Description

Dated Fall 2020

A Correlation of Chemistry: The Central Science, 15e, AP® Edition, ©2023
to the College Board AP® Chemistry Course and Exam Description
Dated Fall 2020

Upon publication, this text was correlated to the College Board's AP® Chemistry Course and Exam Description dated Fall 2020. We continually monitor the College Board's AP® Course and Exam Descriptions for updates.
For the most current correlation for this textbook, visit Savvas.com/AdvancedCorrelations.

Table of Contents

Big Ideas in Chemistry.......... 2

Content Unit and Chapter Correlation.......... 3

Unit 1: Atomic Structure and Properties (8 Topics) 4

Unit 2: Molecular and Ionic Compound Structure and Properties (7 Topics) 6

Unit 3: Intermolecular Forces and Properties (12 Topics) 8

Unit 4: Chemical Reactions (9 Topics).......... 11

Unit 5: Kinetics (11 Topics).......... 14

Unit 6: Thermodynamics (10 Topics) 16

Unit 7: Equilibrium (14 Topics) 18

Unit 8: Acids and Bases (10 Topics) 21

Unit 9: Applications of Thermodynamics (10 Topics) 23

The units above reflect the College Board's AP® Chemistry Course and Exam Description.

Big Ideas in Chemistry

BIG IDEA 1: SCALE, PROPORTION, AND QUANTITY (SPQ)

Quantities in chemistry are expressed at both the macroscopic and atomic scale. Explanations, predictions, and other forms of argumentation in chemistry require understanding the meaning of these quantities, and the relationship between quantities at the same scale and across scales.

BIG IDEA 2: STRUCTURE AND PROPERTIES (SAP)

Properties of substances observable at the macroscopic scale emerge from the structures of atoms and molecules and the interactions between them. Chemical reasoning moves in both directions across these scales. Properties are predicted from known aspects of the structures and interactions at the atomic scale. Observed properties are used to infer aspects of the structures and interactions.

BIG IDEA 3: TRANSFORMATIONS (TRA)

At its heart, chemistry is about the rearrangement of matter. Understanding the details of these transformations requires reasoning at many levels as one must quantify what is occurring both macroscopically and at the atomic level during the process. This reasoning can be as simple as monitoring amounts of products made or as complex as visualizing the intermolecular forces among the species in a mixture. The rate of a transformation is also of interest, as particles must move and collide to initiate reaction events.

BIG IDEA 4: ENERGY (ENE)

Energy has two important roles in characterizing and controlling chemical systems. The first is accounting for the distribution of energy among the components of a system and the ways that heat exchanges, chemical reactions, and phase transitions redistribute this energy. The second is in considering the enthalpic and entropic driving forces for a chemical process. These are closely related to the dynamic equilibrium present in many chemical systems and the ways in which changes in experimental conditions alter the positions of these equilibria.

Correlation of the AP® Chemistry Content Units with *Chemistry: The Central Science*

The AP® Chemistry Course and Exam Description (CED) outlines the course content around nine Content Units, four Big Ideas, and 91 Learning Objectives. The chapters listed under each of the following content units identify where in this book you can find the explanations and practice you need to master the corresponding chemistry content. The approximate exam weight in percent is given for each content unit.

Unit 1: Atomic Structure and Properties 7–9%
- Chapter 1: Introduction: Matter, Energy and Measurement
- Chapter 2: Atoms, Molecules and Ions
- Chapter 6: Electronic Structure of Atoms
- Chapter 7: Periodic Properties of the Elements

Unit 2: Molecular and Ionic Compound Structure and Properties 7–9%
- Chapter 8: Basic Concepts of Chemical Bonding
- Chapter 9: Molecular Geometry and Bonding Theories

Unit 3: Intermolecular Forces and Properties 18–22%
- Chapter 10: Gases
- Chapter 11: Liquids and Intermolecular Forces
- Chapter 12: Solids and Modern Materials
- Chapter 13: Properties of Solutions

Unit 4: Chemical Reactions 7–9%
- Chapter 3: Chemical Reactions and Reaction Stoichiometry
- Chapter 4: Reactions in Aqueous Solution

Unit 5: Kinetics 7–9%
- Chapter 14: Chemical Kinetics

Unit 6: Thermodynamics 7–9%
- Chapter 5: Thermochemistry

Unit 7: Equilibrium 7–9%
- Chapter 15: Chemical Equilibrium

Unit 8: Acids and Bases 11–15%
- Chapter 16: Acid-Base Equilibria
- Chapter 17: Aqueous Equilibria: Buffers, Titrations, and Solubility

Unit 9: Applications of Thermodynamics 7–9%
- Chapter 19: Chemical Thermodynamics
- Chapter 20: Electrochemistry

The following tables provide a detailed analysis of how the Big Ideas, Enduring Understandings and Learning Objectives of the AP® Chemistry Course and Exam Description (CED) correlate to the requisite content in Chemistry the Central Science. The content required to master each Learning Objective is found in the indicated sections of Chemistry the Central Science.

Unit 1: Atomic Structure and Properties (8 Topics)
AP® Chemistry Course and Exam Description

Big Ideas	Enduring Understandings	Learning Objectives	Chemistry: the Central Science Sections
Scale, Proportion, and Quantity (SPQ)	SPQ-1 The mole allows different units to be compared.	SPQ-1.A. Calculate quantities of a substance or its relative number of particles using dimensional analysis and the mole concept.	1.7. Dimensional Analysis 2.4. Atomic Weights 3.4. Avogadro's number and the Mole
		SPQ-1.B. Explain the quantitative relationship between the mass spectrum of an element and the masses of the element's isotopes.	2.3. The Modern View of Atomic Structure 2.4. Atomic Weights
	SPQ-1 The mole allows different units to be compared.	SPQ-2.A Explain the quantitative relationship between the elemental composition by mass and the empirical formula of a pure substance.	3.4. Avogadro's number and the Mole 3.5. Empirical Formulas from Analysis
		SPQ-2.B Explain the quantitative relationship between the elemental composition by mass and the composition of substances in a mixture.	1.2. Classification of Matter 3.5. Empirical Formulas from Analysis

Structure and Properties (SAP)	SAP-1 Atoms and molecules can be identified by their electron distribution and energy.	SAP-1.A Represent the electron configuration of an element or ions of an element using the Aufbau principle.	6.8. Electron Configurations 6.9. Electron Configurations and the Periodic Table 7.2. Effective Nuclear Charge 7.4. Ionization Energy and Electron Affinity
		SAP-1.B Explain the relationship between the photoelectron spectrum of an atom or ion and: a. The electron configuration of the species. b. The interactions between the electrons and the nucleus.	6.9 TPWB: 6.9. Electron Configurations and the Periodic Table: Photoelectron Spectroscopy (PES)
	SAP-2 The periodic table shows patterns in electronic structure and trends in atomic properties .	SAP-2.A Explain the relationship between trends in atomic properties of elements and electronic structure and periodicity.	7.1. The Development of the Periodic Table 7.3. Sizes of Atoms and Ions 7.4. Ionization Energy and Electron Affinity 8.4 Bond Polarity and Electronegativity

		SAP-2.B Explain the relationship between trends in the reactivity of elements and periodicity.	TPWB: 2.8. Naming Inorganic Compounds 6.9. Electron Configurations and the Periodic Table 7.6. Trends for Group 1A and Group 2A Metals 7.7. Trends for Selected Nonmetals 8.1. Lewis Symbols and the Octet Rule
		TPWB = Test Prep Work Book	

Unit 2: Molecular and Ionic Compound Structure and Properties (7 Topics)
AP® Chemistry Course and Exam Description

Big Ideas	Enduring Understandings	Learning Objectives	Chemistry: the Central Science Sections
Structure and Properties (SAP)	SAP-3 Atoms or ions bond due to interactions between them, forming molecules.	SAP-3.A Explain the relationship between the type of bonding and the properties of the elements participating in the bond.	8.2. Ionic Bonding 8.3. Covalent Bonding 8.4. Bond Polarity and Electronegativity 12.3. Metallic Solids
		SAP-3.B Represent the relationship between potential energy and distance between atoms, based on factors that influence the interaction strength.	8.2. Ionic Bonding 8.4. Bond Polarity and Electronegativity

		SAP-3.C Represent an ionic solid with a particulate model that is consistent with Coulomb's law and the properties of the constituent ions.	12.4. Ionic Solids TPWB: 8.2. Ionic Bonding
		SAP-3.D Represent a metallic solid and/or alloy using a model to show essential characteristics of the structure and interactions present in the substance.	12.2. Metallic Solids TPWB: 12.4. Metalic Bonding
	SAP-4 Molecular compounds are arranged based on Lewis diagrams and Valence Shell Electron Pair Repulsion (VSEPR) theory.	SAP-4.A Represent a molecule with a Lewis diagram.	8.5. Drawing Lewis Structures
		SAP-4.B Represent a molecule with a Lewis diagram that accounts for resonance between equivalent structures or that uses formal charge to select between nonequivalent structures.	8.6. Resonance Structures

		SAP-4.C Based on the relationship between Lewis diagrams, VSEPR theory, bond orders, and bond polarities: a. Explain structural properties of molecules. b. Explain electron properties of molecules.	9.1 Molecular Shapes 9.2.The VSEPR Model 9.3. Molecular Shape and Molecular Polarity 9.5. Hybrid Orbitals

Unit 3: Intermolecular Forces and Properties (12 Topics)
AP® Chemistry Course and Exam Description

Big Ideas	Enduring Understandings	Learning Objectives	Chemistry: the Central Science Sections
Structure and Properties (SAP)	SAP-5 Intermolecular forces can explain the physical properties of a material.	SAP-5.A Explain the relationship between the chemical structures of molecules and the relative strength of their intermolecular forces when: a. The molecules are of the same chemical species. b. The molecules are of two different chemical species.	11.2. Intermolecular Forces 11.3. Select Properties of Liquids

		SAP-5.B Explain the relationship among the macroscopic properties of a substance, the particulate-level structure of the substance, and the interactions between these particles.	12.1. Classification and Structures of Solids 12.3. Metallic Bonding 12.4. Ionic Solids 12.5. Molecular and Covalent-Network Solids 13.1. The Solution Process
	SAP-6 Matter exists in three states: solid, liquid, and gas, and their differences are influenced by variances in spacing and motion of the molecules.	SAP-6.A Represent the differences between solid, liquid, and gas phases using a particulate-level model.	10.1. Physical Characteristics of Gases 11.1. A Molecular Comparison of Gases, Liquids, and Solids
	SAP-7 Gas properties are explained macroscopically—using the relationships among pressure, volume, temperature, moles, gas constant—and molecularly by the motion of the gas.	SAP-7.A Explain the relationship between the macroscopic properties of a sample of gas or mixture of gases using the ideal gas law.	10.2. The Gas Laws 10.3. The Ideal Gas Equation 10.4. Gas Mixtures and Partial Pressures
		SAP-7.B Explain the relationship between the motion of particles and the macroscopic properties of gases with: a. The kinetic molecular theory (KMT) b. A particulate model. c. A graphical representation	10.5. The Kinetic Molecular Theory of Gases 10.6. Molecular Speeds, Effusion, and Diffusion

		SAP-7.C Explain the relationship among non-ideal behaviors of gases, interparticle forces, and/or volumes.	10.7. Real Gases: Deviation from Ideal Behavior
Scale, Proportion, and Quantity (SPQ)	SPQ-3 Interactions between intermolecular forces influence the solubility and separation of mixtures.	SPQ-3.A Calculate the number of solute particles, volume, or molarity of solutions.	13.1. The Solution Process 13.4. Expressing Solution Concentration
		SPQ-3.B Using particulate models for mixtures: a. Represent interactions between components. b. Represent concentrations of components.	13.1. The Solution Process
		SPQ-3.C Explain the relationship between the solubility of ionic and molecular compounds in aqueous and nonaqueous solvents, and the intermolecular interactions between particles.	1.3. Properties of Matter 13.3. Factors Affecting Solubility TPWB: 13.3. Factors Affecting Solubility: Chromatography
Structure and Properties (SAP)	SAP-8 Spectroscopy can determine the structure and concentration in a mixture of a chemical species.	SAP-8.A Explain the relationship between a region of the electromagnetic spectrum and the types of molecular or electronic transitions associated with that region.	6.1. The Wave Nature of Light TPWB: 6.9. Electron Configurations and the Periodic Table: Spectroscopy

		SAP-8.B Explain the properties of an absorbed or emitted photon in relationship to an electronic transition in an atom or molecule.	6.2. Quantized Energy and Photons 6.3. Line Spectra and the Bohr Model
		SAP-8.C Explain the amount of light absorbed by a solution of molecules or ions in relationship to the concentration, path length, and molar absorptivity.	14.2. Rate Laws and Rate Constants: The Method of Initial Rates TPWB: 6.9. Electron Configurations and the Periodic Table, Spectroscopy

Unit 4: Chemical Reactions (9 Topics)
AP® Chemistry Course and Exam Description

Big Ideas	Enduring Understandings	Learning Objectives	Chemistry: the Central Science Sections
Transformations (TRA)	TRA-1 A substance that changes its properties, or that changes	TRA-1.A Identify evidence of chemical and physical changes in matter.	3.1. Chemical Equations 3.2. Simple Patterns of Reactivity

	into a different substance, can be represented by chemical equations.	TRA-1.B Represent changes in matter with a balanced chemical or net ionic equation: a. For physical changes. b. For given information about the identity of the reactants and/or product. c. For ions in a given chemical reaction.	3.1. Chemical Equations 3.2. Simple Patterns of Reactivity TPWB: 4.2. Precipitation Reactions: Net Ionic Equations
		TRA-1.C Represent a given chemical reaction or physical process with a consistent particulate model.	3.1. Chemical Equations
		TRA-1.D Explain the relationship between macroscopic characteristics and bond interactions for: a. Chemical processes. b. Physical processes.	4.1. General Properties of Aqueous Solutions 13.1. The Solution Process
Scale, Proportion, and Quantity (SPQ)	SPQ-4 When a substance changes into a new substance, or when its properties change, no mass is lost or gained.	SPQ-4.A Explain changes in the amounts of reactants and products based on the balanced reaction equation for a chemical process.	3.1. Chemical Equations 3.6. Quantitative Information from Balanced Equations 10.3. The Ideal Gas Equation

		SPQ-4.B Identify the equivalence point in a titration based on the amounts of the titrant and analyte, assuming the titration reaction goes to completion.	4.5. Concentrations of Solutions 4.6. Solution Stoichiometry and Chemical Analysis
Transformations (TRA)	TRA-2 A substance can change into another substance through different processes, and the change itself can be classified by the sort of processes that produced it.	TRA-2.A Identify a reaction as acid-base, oxidation-reduction, or precipitation.	4.2. Precipitation Reactions 4.3 Acids, Bases, and Neutralization Reactions 4.4. Oxidation-Reduction Reactions
		TRA-2.B Identify species as Brønsted-Lowry acids, bases, and/or conjugate acid-base pairs, based on proton-transfer involving those species.	16.2. Conjugate Acid-Base Pairs 16.3. The Autoionization of Water 16.6. Weak Acids 16.7. Weak Bases
		TRA-2.C Represent a balanced redox reaction equation using half-reactions.	20.1. Oxidation States and Oxidation-Reduction Reactions 20.2. Balancing Redox Equations

Unit 5: Kinetics (11 Topics)
AP® Chemistry Course and Exam Description

Big Ideas	Enduring Understandings	Learning Objectives	Chemistry: the Central Science Sections
Transformations (TRA)	TRA-3 Some reactions happen quickly, while others happen more slowly and depend on reactant concentrations and temperature.	TRA-3.A Explain the relationship between the rate of a chemical reaction and experimental parameters.	14.1. Reaction Rates
		TRA-3.B Represent experimental data with a consistent rate law expression.	14.2. Rate Laws and Rate Constants: The Method of Initial Rates 14.3. Integrated Rate Laws
		TRA-3.C Identify the rate law expression of a chemical reaction using data that show how the concentrations of reaction species change over time.	14.2. Rate Laws and Rate Constants: The Method of Initial Rates 14.3. Integrated Rate Laws
	TRA-4 There is a relationship between the speed of a reaction and the collision frequency of particle collisions.	TRA-4.A Represent an elementary reaction as a rate law expression using stoichiometry.	14.5. Reaction Mechanisms
		TRA-4.B Explain the relationship between the rate of an elementary reaction and the frequency, energy, and orientation of molecular collisions.	14.4. Temperature and Rate: Activation Energy and the Arrhenius Equation

		TRA-4.C Represent the activation energy and overall energy change in an elementary reaction using a reaction energy profile.	14.4. Temperature and Rate: Activation Energy and the Arrhenius Equation
	TRA-5 Many chemical reactions occur through a series of elementary reactions. These elementary reactions when combined form a chemical equation.	TRA-5.A Identify the components of a reaction mechanism.	14.5. Reaction Mechanisms
		TRA-5.B Identify the rate law for a reaction from a mechanism in which the first step is rate limiting.	14.5. Reaction Mechanisms
		TRA-5.C Identify the rate law for a reaction from a mechanism in which the first step is not rate limiting.	14.5 Reaction Mechanisms
		TRA-5.D Represent the activation energy and overall energy change in a multistep reaction with a reaction energy profile.	14.5. Reaction Mechanisms
Energy (ENE)	ENE-1 The speed at which a reaction occurs can be influenced by a catalyst.	ENE-1.A Explain the relationship between the effect of a catalyst on a reaction and changes in the reaction mechanism.	14.7. Catalysis

Unit 6: Thermodynamics (10 Topics)
AP® Chemistry Course and Exam Description

Big Ideas	Enduring Understandings	Learning Objectives	Chemistry: the Central Science Sections
Energy (ENE)	ENE-2 Changes in a substance's properties or change into a different substance requires an exchange of energy.	ENE-2.A Explain the relationship between experimental observations and energy changes associated with a chemical or physical transformation.	5.1. The Nature of Chemical Energy 5.2. The First Law of Thermodynamics 5.3. Enthalpy 13.1. The Solution Process
		ENE-2.B Represent a chemical or physical transformation with an energy diagram.	5.1. The Nature of Chemical Energy 5.2. The First Law of Thermodynamics
		ENE-2.C Explain the relationship between the transfer of thermal energy and molecular collisions.	1.4. The Nature of Energy 5.1. The Nature of Chemical Energy
		ENE-2.D Calculate the heat q absorbed or released by a system undergoing heating/cooling based on the amount of the substance, the heat capacity, and the change in temperature.	5.4. Enthalpies of Reaction 5.5. Calorimetry

		ENE-2.E Explain changes in the heat q absorbed or released by a system undergoing a phase transition based on the amount of the substance in moles and the molar enthalpy of the phase transition.	5.3. Enthalpy 5.6. Hess's Law 5.7. Enthalpies of Formation
		ENE-2.F Calculate the heat q absorbed or released by a system undergoing a chemical reaction in relationship to the amount of the reacting substance in moles and the molar enthalpy of reaction.	5.6. Hess's Law
	ENE-3 The energy exchanged in a chemical transformation is required to break and form bonds.	ENE-3.A Calculate the enthalpy change of a reaction based on the average bond energies of bonds broken and formed in the reaction.	5.8. Bond Enthalpies
		ENE-3.B Calculate the enthalpy change for a chemical or physical process based on the standard enthalpies of formation.	5.7. Enthalpies of Formation
		ENE-3.C Represent a chemical or physical process as a sequence of steps.	5.6. Hess's Law 5.7. Enthalpies of Formation

		ENE-3.D Explain the relationship between the enthalpy of a chemical or physical process and the sum of the enthalpies of the individual steps.	5.6. Hess's Law

Unit 7: Equilibrium (14 Topics)
AP® Chemistry Course and Exam Description

Big Ideas	Enduring Understandings	Learning Objectives	Chemistry: the Central Science Sections
Transformations (TRA)	TRA-6 Some reactions can occur in both forward and reverse directions, sometimes proceeding in each direction simultaneously.	TRA-6.A Explain the relationship between the occurrence of a reversible chemical or physical process, and the establishment of equilibrium, to experimental observations.	15.1. The Concept of Equilibrium
		TRA-6.B Explain the relationship between the direction in which a reversible reaction proceeds and the relative rates of the forward and reverse reactions.	15.2. The Equilibrium Constant 15.3. Using Equilibrium Constants

	TRA-7 A system at equilibrium depends on the relationships between concentrations, partial pressures of chemical species, and equilibrium constant K.	TRA-7.A Represent the reaction quotient Q_c or Q_p, for a reversible reaction, and the corresponding equilibrium expressions $K_c = Q_c$ or $K_p = Q_p$.	15.6. Some Applications of Equilibrium Constants
		TRA-7.B Calculate K_c or K_p based on experimental observations of concentrations or pressures at equilibrium.	15.5. Calculating Equilibrium Constants
		TRA-7.C Explain the relationship between very large or very small values of K and the relative concentrations of chemical species at equilibrium.	15.3. Using Equilibrium Constants 15.6. Some Applications of Equilibrium Constants
		TRA-7.D Represent a multistep process with an overall equilibrium expression, using the constituent K expressions for each individual reaction.	15.3. Using Equilibrium Constants
		TRA-7.E Identify the concentrations or partial pressures of chemical species at equilibrium based on the initial conditions and the equilibrium constant.	15.6. Some Applications of Equilibrium Constants

		TRA-7.F Represent a system undergoing a reversible reaction with particulate model.	15.3. Using Equilibrium Constants
	TRA-8 Systems at equilibrium respond to external stresses to offset the effect of the stress.	TRA-8.A Identify the response of a system at equilibrium to an external stress, using Le Châtelier's principle.	15.7. Le Châtelier's Principle
		TRA-8.B Explain the relationships between Q, K, and the direction in which a reversible reaction will proceed to reach equilibrium.	15.6. Some Applications of Equilibrium Constants 15.7. Le Châtelier's Principle
Scale, Proportion and Quantity (SPQ)	SPQ-5 The dissolution of a salt is a reversible process that can be influenced by environmental factors such as pH or other dissolved ions.	SPQ-5.A Calculate the solubility of a salt based on the value of K_{sp} for the salt.	17.4. Solubility Equilibria
		SPQ-5.B Identify the solubility of a salt, and/or the value of K_{sp} for the salt, based on the concentration of a common ion already present in solution.	17.5. Factors that Affect Solubility
		SPQ-5.C Identify the qualitative effect of changes in pH on the solubility of a salt.	17.5. Factors that Affect Solubility

		SPQ-5.D Explain the relationship between the solubility of a salt and changes in the enthalpy and entropy that occur in the dissolution process.	13.1. The Solution Process

Unit 8: Acids and Bases (10 Topics)
AP® Chemistry Course and Exam Description

Big Ideas	Enduring Understandings	Learning Objectives	Chemistry: the Central Science Sections
Structure and Properties (SAP)	SAP-9 The chemistry of acids and bases involves reversible proton-transfer reactions, with equilibrium concentrations being related to the strength of the acids and bases involved.	SAP-9.A Calculate the values of pH and pOH, based on K_w and the concentration of all species present in a neutral solution of water.	16.3. The Autoionization of Water 16.4. The pH Scale
		SAP-9.B Calculate pH and pOH based on concentrations of all species in a solution of a strong acid or a strong base.	16.5. Strong Acids and Bases
		SAP-9.C Explain the relationship among pH, pOH, and concentrations of all species in a solution of a monoprotic weak acid or weak base.	16.2. Conjugate Acid-Base Pairs 16.6. Weak Acids 16.7. Weak Bases

		SAP-9.D Explain the relationship among the concentrations of major species in a mixture of weak and strong acids and bases.	16.8. Relationship between K_a and K_b 16.9. Acid-Base Properties of Salt Solutions 17.1. The Common-Ion Effect 17.2. Buffers
		SAP-9.E Explain results from the titration of a mono- or polyprotic acid or base solution, in relation to the properties of the solution and its components.	17.3. Acid-Base Titrations
		SAP-9.F Explain the relationship between the strength of an acid or base and the structure of the molecule or ion.	16.9. Acid-Base Properties of Salt Solutions 16.10. Acid-Base Behavior and Chemical Structure
	SAP-10 A buffered solution resists changes to its pH when small amounts of acid or base are added.	SAP-10.A Explain the relationship between the predominant form of a weak acid or base in solution at a given pH and the pKa of the conjugate acid or the pK_b of the conjugate base.	16.9. Acid-Base Properties of Salt Solutions 17.2. Buffers 17.3. Acid-Base Titrations
		SAP-10.B Explain the relationship between the ability of a buffer to stabilize pH and the reactions that occur when an acid or a base is added to a buffered solution.	17.2. Buffers

		SAP-10.C Identify the pH of a buffer solution based on the identity and concentrations of the conjugate acid-base pair used to create the buffer.	17.2. Buffers
		SAP-10.D Explain the relationship between the buffer capacity of a solution and the relative concentrations of the conjugate acid and conjugate base components of the solution.	17.2. Buffers

Unit 9: Applications of Thermodynamics (10 Topics)
AP® Chemistry Course and Exam Description

Big Ideas	Enduring Understandings	Learning Objectives	Chemistry: the Central Science Sections
Energy (ENE)	ENE-4 Some chemical or physical processes cannot occur without intervention.	ENE-4.A Identify the sign and relative magnitude of the entropy change associated with chemical or physical processes.	19.2. Entropy and the Second Law of Thermodynamics 19.3. The Molecular Interpretation of Entropy and the Third Law of Thermodynamics
		ENE-4.B Calculate the entropy change for a chemical or physical process based on the absolute entropies of the species involved in the process.	19.4. Entropy Changes in Chemical Reactions

		ENE-4.C Explain whether a physical or chemical process is thermodynamically favored based on an evaluation of ΔG^o.	19.5. Gibbs Free Energy
		ENE-4.D Explain, in terms of kinetics, why a thermodynamically favored reaction might not occur at a measurable rate.	19.6. Free Energy and Temperature
	ENE-5 The relationship between $\Delta G°$ and K can be used to determine favorability of a chemical or physical transformation.	ENE-5.A Explain whether a process is thermodynamically favored using the relationships between K, ΔG^o, and T	19.7. Free Energy and the Equilibrium Constant
		ENE-5.B Explain the relationship between external sources of energy or coupled reactions and their ability to drive thermodynamically unfavorable processes.	19.7. Free Energy and the Equilibrium Constant

	ENE-6 Electrical energy can be generated by chemical reactions.	ENE-6.A Explain the relationship between the physical components of an electrochemical cell and the overall operational principles of the cell.	20.3. Voltaic Cells
		ENE-6.B Explain whether an electrochemical cell is thermodynamically favored, based on its standard cell potential and the constituent half-reactions within the cell.	20.4. Cell Potentials under Standard Conditions 20.5. Free Energy and Redox Reactions
		ENE-6.C Explain the relationship between deviations from standard cell conditions and changes in the cell potential.	20.6. Cell Potentials under Nonstandard Conditions
		ENE-6.D Calculate the amount of charge flow based on changes in the amounts of reactants and products in an electrochemical cell.	20.9. Electrolysis