GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 1: MATTER AND ENERGY

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What do chemists study and how do they use the scientific method to solve problems? 2. How do chemists distinguish between potential and kinetic energy in chemical systems? 3. What categories and concepts do chemists use to classify matter? 4. How have chemists impacted and improved society with the study of matter and its changes? 5. How is measurement uncertainty expressed in the results of calculations such as density? 6. How is confidence of an experimental result expressed as percent error (accuracy error)? 7. What does the Law of Definite Composition tell us about compounds? 8. How is percent composition of an element in a compound determined?	Options include, but are not limited to: • Textbook problems from end of chapters 1 and 2 • Quiz • Lab reports • Unit 1 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that developments in chemistry affect society and societal concerns affect the field of chemistry.	Explain the political, societal, economic and environmental impact of chemical products and technologies. (For example: Pollution effects, atmospheric changes, petroleum products, material use or waste disposal) *(Standard NSE: 9C.1.3.3.1)*			Textbook: Chemisty: The Central Science (Pearson)
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that physical and mathematical models are used to describe physical systems.	Use significant figures and an understanding of accuracy and precision in scientific measurements to determine and express the uncertainty of a result. *(Standard NSE: 9C.1.3.4.1)*			
Substrand: Matter Standard: Understand that chemical and physical properties of matter result from the ability of atoms to form bonds.	Determine percent composition, empirical formulas and molecular formulas of simple compounds. *(Standard PS: 9C.2.1.2.5)*			

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 1: PERIODIC TABLE

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What are the major families and regions on the periodic table and what is a "family"? 2. How did the modern periodic table evolve from early Laws such as the "Law of Triads"? 3. How is the modern periodic table arranged? What information can we obtain from it? 4. What is the periodic law? 5. How can we determine if a property is periodic?	Options include, but are not limited to: • Textbook problems from end of chapter 2 • Unit 2 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
Substrand: Matter Standard: Understand that the periodic table illustrates how patterns in the physical and chemical properties of elements are related to atomic structure.	Identify and compare trends on the periodic table, including reactivity and relative sizes of atoms and ions; use the trends to explain the properties of subgroups, including metals, non-metals, alkali metals, alkaline earth metals, halogens and noble gases. *(Standard PS: 9C.2.1.1.2)*			Textbook: Chemisty: The Central Science (Pearson)

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 2: STOICHIOMETRY

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How do concepts of valence electrons and Lewis dot symbolism explain ionic bonding? 2. How do ionic compound names derive from their formulas? 3. What are the properties of ionic compounds, and how do they result from the structure of ionic compounds? 4. How do ionic compound formulas derive from their names? 5. How are ionic and covalent bonds different? 6. What are the properties of covalent compounds? 7. How do Lewis dot symbols demonstrate the formation of covalent bonds?	Options include, but are not limited to: • Nomenclature assignments • Textbook problems from end of chapters 2 and 4 • Ionic compounds quiz created by department • Unit 2 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
Substrand: Matter Standard: Understand that chemical and physical properties of matter result from the ability of atoms to form bonds.	Explain how elements combine to form compounds through ionic and covalent bonding. *(Standard PS: 9C.2.1.2.1)*			Textbook: Chemisty: The Central Science (Pearson)
Substrand: Matter Standard: Understand that chemical and physical properties of matter result from the ability of atoms to form bonds.	Use IUPAC (International Union of Pure and Applied Chemistry) nomenclature to write chemical formulas and name molecular and ionic compounds, including those that contain polyatomic ions.) *(Standard PS: 9C.2.1.2.3)*			

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 2: STOICHIOMETRY (continued)

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What is a mole? 2. How are molar masses used to determine molar masses of elements and compounds? 3. How are molar masses and Avogadro's number used to perform simple molar conversions? 4. How are empirical formulas determined and used in combination with molecular masses to determine molecular formulas? 5. How are molar volumes and moles used to determine amounts of gases?	Options include, but are not limited to: • Textbook problems from end of chapter 3 • Lab report • Unit 2 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
Substrand: Matter Standard: Understand that chemical and physical properties of matter result from the ability of atoms to form bonds.	Determine the molar mass of a compound from its chemical formula and a table of atomic masses; convert the mass of a molecular substance to moles, number of particles, or volume of gas at standard temperature and pressure. *(Standard PS: 9C.2.1.2.4)*			Textbook: Chemisty: The Central Science (Pearson)

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 2: STOICHIOMETRY (continued)

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How is a balanced chemical equation and amounts of reactants or products used to determine limiting reactants? 2. How is percent yield calculated from knowledge of limiting reactants? 3. What is meant by concentration of a solution and how is it expressed in terms of molarity, percent concentration, and parts per million? 4. How does concentration and solute size influence a chemical reaction?	Options include, but are not limited to: • Textbook problems from end of chapter 3 • Lab report • Unit 2 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
Substrand: Matter Standard: Understand that chemical and physical properties of matter result from the ability of atoms to form bonds.	Determine the molar mass of a compound from its chemical formula and a table of atomic masses; convert the mass of a molecular substance to moles, number of particles, or volume of gas at standard temperature and pressure. *(Standard PS: 9C.2.1.2.4)*			Textbook: Chemisty: The Central Science (Pearson)

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 2: STOICHIOMETRY (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources**
Substrand: Matter Standard: Understand that chemical and physical properties of matter result from the ability of atoms to form bonds.	Describe the dynamic process by which solutes dissolve in solvents, and calculate concentrations, including percent concentration, molarity and parts per million. *(Standard PS: 9C.2.1.2.6)*			Textbook: Chemisty: The Central Science (Pearson)
Substrand: Matter Standard: Understand that chemical and physical properties of matter result from the ability of atoms to form bonds.	Explain the role of solubility of solids, liquids and gases in natural and designed systems. (For example: The presence of heavy metals in water and the atmosphere; development and use of alloys) *(Standard PS: 9C.2.1.2.7)*			
Substrand: Matter Standard: Understand that chemical reactions describe a chemical change in which one or more reactants are transformed into one or more products.	Use the law of conservation of mass to describe and calculate relationships in a chemical reaction, including molarity, mole/mass relationships, mass/volume relations, limiting reactants and percent yield. *(Standard PS: 9C.2.1.3.5)*			
Substrand: Matter Standard: Understand that chemical reactions describe a chemical change in which one or more reactants are transformed into one or more products.	Describe the factors that affect the rate of a chemical reaction, including temperature, pressure, mixing, concentration, particle size, surface area and catalyst. *(Standard PS: 9C.2.1.3.6)*			

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 3: CHEMICAL REACTIONS

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What types of evidence indicate that a chemical reaction has taken place? 2. How can chemical equations be balanced, including states of matter, and products of reactions predicted? 3. How are chemical reactions classified into the categories of combustion, synthesis, decomposition, single replacement, and double replacement? 4. How is the law of conservation of mass applied in chemical reactions?	Options include, but are not limited to: • Types of chemical reactions assignment • Balancing chemical reactions quiz created by department • Types of chemical reactions quiz created by department • Two lab reports • Unit 6 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
Substrand: Matter Standard: Understand that chemical reactions describe a chemical change in which one or more reactants are transformed into one or more products.	Classify chemical reactions as double replacement, single replacement, synthesis, decomposition or combustion. *(Standard PS: 9C.2.1.3.1)*			Textbook: Chemisty: The Central Science (Pearson)
Substrand: Matter Standard: Understand that chemical reactions describe a chemical change in which one or more reactants are transformed into one or more products.	Use solubility and activity of ions to determine whether a double replacement or single replacement reaction will occur. *(Standard PS: 9C.2.1.3.2)*			
Substrand: Matter Standard: Understand that chemical reactions describe a chemical change in which one or more reactants are transformed into one or more products.	Balance chemical equations by applying the laws of conservation of mass and constant composition. *(Standard PS: 9C.2.1.3.4)*			

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 4: ENTHALPY

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What is the first law of thermodynamics? 2. How are enthalpy problems, standard enthalpy values and stoichiometric relationships related? 3. How is Hess's Law used for problems and lab situations? 4. What is the difference among heat, work, and internal energy?	Options include, but are not limited to: • Textbook problems from end of chapter 5 • Lab report • Unit 4 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
N/A	N/A			Textbook: Chemisty: The Central Science (Pearson)

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 5: ATOMIC THEORY

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How can we describe electromagnetic radiation as a wave and as a particle, and use these concepts to calculate wavelength, frequency, and energy? 2. What is the origin of the atomic theory? 3. How do the Bohr and Schrödinger models of the atom compare and contrast to each other? 4. How do quantum levels explain atomic spectra? 5. How are electron configurations for atoms and ions written? 6. How do electron configurations explain the structure of the periodic table and trends among the elements?	Options include, but are not limited to: • Textbook problems from end of chapter 6 • Quantum numbers and electron configuration assignment • Energies of Electrons lab report • Unit 5 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
Substrand: Matter Standard: Understand that the periodic table illustrates how patterns in the physical and chemical properties of elements are related to atomic structure.	Explain the relationship of an element's position on the periodic table to its atomic number and electron configuration. *(Standard PS: 9C.2.1.1.1)*			Textbook: Chemisty: The Central Science (Pearson)

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 6: PERIODIC TRENDS

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What is ionization energy, atomic and ionic radius and electron affinity and what are the periodic trends based on atomic model and Coulomb's Law? 2. How can general physical properties and specific chemical properties of classes and groups of elements be predicted from the periodic table? 3. How can products of chemical reactions involving groups of families be predicted? 4. How does electron configuration apply to the periodic table and properties?	Options include, but are not limited to: • Textbook problems from end of chapter 7 • Chemical periodicity assignment • Unit 6 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
Substrand: Matter Standard: Understand that the periodic table illustrates how patterns in the physical and chemical properties of elements are related to atomic structure.	Identify and compare trends on the periodic table, including reactivity and relative sizes of atoms and ions; use the trends to explain the properties of subgroups, including metals, non-metals, alkali metals, alkaline earth metals, halogens and noble gases. *(Standard PS: 9C.2.1.1.2)*			Textbook: Chemisty: The Central Science (Pearson)

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNITS 7 AND 9: MOLECULAR STRUCTURE

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How can simple molecules and ions be represented using Lewis structures? 2. How does VSEPR Theory aid in the prediction of molecular shapes? 3. How do Lewis structure and VSEPR Theory help us predict properties of compounds such as molecular polarity? 4. What is the connection between VSEPR Theory and valence-bond theory? 5. How do intermolecular and ionic forces relate to the properties of compounds?	Options include, but are not limited to: • Textbook problems from end of chapters 8 and 9 • Model building assignment • Structure assignment • Lab report • Unit 7 test created by department • Unit 9 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
Substrand: Matter Standard: Understand that chemical and physical properties of matter result from the ability of atoms to form bonds.	Compare and contrast the structure, properties and uses of organic compounds, such as hydrocarbons, alcohols, sugars, fats and proteins. *(Standard PS: 9C.2.1.2.2)*			Textbook: Chemisty: The Central Science (Pearson)
Substrand: Matter Standard: Understand that chemical and physical properties of matter result from the ability of atoms to form bonds.	Describe the dynamic process by which solutes dissolve in solvents, and calculate concentrations, including percent concentration, molarity and parts per million. *(Standard PS: 9C.2.1.2.6)*			
Substrand: Matter Standard: Understand that chemical and physical properties of matter result from the ability of atoms to form bonds.	Explain the role of solubility of solids, liquids and gases in natural and designed systems. (For example: The presence of heavy metals in water and the atmosphere; development and use of alloys) *(Standard PS: 9C.2.1.2.7)*			

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 8: GAS LAWS

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How does the Kinetic Molecular Theory (KMT) aid in the understanding of gas behavior? 2. What is the ideal gas law? 3. How does the ideal gas law apply to a variety of problems involving pressure (P), volume (V), temperature (T), and moles (n)? 4. How is the ideal gas law utilized to determine molar mass of a substance? 5. How is stoichiometry used in combination with the ideal gas law to solve for P, V, T, or n?	Options include, but are not limited to: • Textbook problems from end of chapter 10 • Lab reports • Unit 8 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
Substrand: Matter Standard: Understand that chemical reactions describe a chemical change in which one or more reactants are transformed into one or more products.	Describe the factors that affect the rate of a chemical reaction, including temperature, pressure, mixing, concentration, particle size, surface area and catalyst. *(Standard PS: 9C.2.1.3.6)*			Textbook: Chemisty: The Central Science (Pearson)
Substrand: Matter Standard: Understand that states of matter can be described in terms of motion of molecules. The properties and behavior of gases can be explained using the kinetic molecular theory.	Use kinetic molecular theory to explain how changes in energy content affect the state of matter (solid, liquid and gaseous phases). *Standard PS: 9C.2.1.4.1)*			
Substrand: Matter Standard: Understand that states of matter can be described in terms of motion of molecules. The properties and behavior of gases can be explained using the kinetic molecular theory.	Use the kinetic molecular theory to explain the behavior of gases and the relationship among temperature, pressure, volume and the number of particles. *(Standard PS: 9C.2.1.4.2)*			

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 10: SOLUTIONS

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How can solutions, solubility, and general mixtures be analyzed? 2. What are the quantitative concentration units for solutions? How can they be converted from one to the other? 3. What is Henry's Law? 4. What are colligative properties and how are they analyzed? 5. What is the van't Hoff factor and what is the connection to colligative properties?	Options include, but are not limited to: • Textbook problems from end of chapter 13 • Lab report • Unit 10 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
N/A	N/A			Textbook: Chemisty: The Central Science (Pearson)

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 11: KINETICS

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What is meant by reaction rates and what factors affect rates? 2. How are initial rates, average rates, and instantaneous rates different? 3. How can the Method of Initial rates be used to solve for zero order, first order and second order reactions? 4. How can a reaction mechanism be identified? 5. How do catalysts and other factors affect reaction rates?	Options include, but are not limited to: • Textbook problems from end of chapter 14 • Lab report • Unit 11 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
N/A	N/A			Textbook: Chemisty: The Central Science (Pearson)

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 12: EQUILBRIUM

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How can an equilibrium expression be written for a chemical equation? 2. What is equilibrium constant? 3. How can an ICE table be used to determine equilibrium concentrations? 4. How does the reaction quotient, Q, get used to determine the direction of reaction? 5. How does Le Châtelier's Principle aid in determining equilibrium shifts?	Options include, but are not limited to: • Textbook problems from end of chapter 15 • Unit 12 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
N/A	N/A			Textbook: Chemisty: The Central Science (Pearson)

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 13: ACID-BASE CHEMISTRY

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How do we classify compounds a acids, bases, strong acids and bases, or weak acids and bases? 2. What is meant by pH? 3. Use hydronium ion and hydroxide ion concentrations to determine pH of a solution. 4. How can we predict the products of an acid-base reaction? 5. What is a titration and how is it performed?	Options include, but are not limited to: • Textbook problems from end of chapter 16 • Lab report • Unit 13 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
Substrand: Matter Standard: Understand that chemical reactions describe a chemical change in which one or more reactants are transformed into one or more products.	Relate the properties of acids and bases to the ions they contain and predict the products of an acid-base reaction. *(Standard PS: 9C.2.1.3.3)*			Textbook: Chemisty: The Central Science (Pearson)
Substrand: Matter Standard: Understand that chemical reactions describe a chemical change in which one or more reactants are transformed into one or more products.	Recognize that some chemical reactions are reversible and that not all chemical reactions go to completion. *(Standard PS: 9C.2.1.3.7)*			

GRADES 11-12: AP CHEMISTRY CURRICULUM FRAMEWORKS

UNIT 14: THERMODYNAMICS

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. What is entropy and how does it apply to chemical reactions? 2. How can entropy changes for a chemical equation be calculated? 3. What are the qualitative and quantitative relationships between Gibbs free energy, enthalpy, entropy, and temperature? 4. How does Gibbs free energy relate to chemical equilibrium?	Options include, but are not limited to: • Textbook problems from end of chapter 19 • Lab report • Unit 14 test created by department

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources
N/A	N/A			Textbook: Chemisty: The Central Science (Pearson)