MOORESTOWN TOWNSHIP PUBLIC SCHOOLS
MOORESTOWN, NEW JERSEY

Moorestown High School
Science Department

AP Chemistry
Grades 11 and 12

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Contents

Back to Table of Contents

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Back to Table of Contents

Course Description and Fundamental Concepts

The AP Chemistry course focuses on a model of instruction which promotes enduring conceptual understandings and the content that supports them. This approach enables students to spend less time on factual recall and more time on inquiry-based learning of essential concepts, and it helps them develop the reasoning skills necessary to engage in the science practices used throughout their study of AP Chemistry.

To foster this deeper level of learning, the AP Chemistry content is defined in a way that distinguishes content essential to support the enduring understandings from the many examples or applications that can overburden the course. Content that is outside the scope of the course and exam is also identified. This framework encourages student development of inquiry and reasoning skills, such as designing a plan for collecting data, analyzing data, creating models and representations, applying mathematical routines, developing a scientific argument, and connecting concepts in and across domains.

Big Ideas serve as the foundation of the course and allow students to create meaningful connections among concepts. They are often abstract concepts or themes that become threads that run throughout the course. Revisiting the big ideas and applying them in a variety of contexts allows students to develop deeper conceptual understanding. Below are the big ideas of the course and a brief description of each.

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.

Back to Table of Contents

New Jersey Student Learning Standards (NJSLS)

Subject/Content Standards
Include grade appropriate subject/content standards that will be addressed

Standard #	Standard Description
HS-PS1	
HS-PS1-1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
HS-PS1-3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
HS-PS1-4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
HS-PS1-5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
HS-PS1-6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
HS-PS1-8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
HS-PS2	
HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
HS-PS3	
MS-PS3-1	Construct and interpret graphical displays of data to describe the relationships

Back to Table of Contents

	of kinetic energy to the mass of an object and to the speed of an object.
MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
MS-PS3-4	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample
HS-PS4	
HS-PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
HS-PS4-3	Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.
HS-PS4-4	Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

English Companion Standards

List grade-level appropriate companion standards for History, Social Studies, Science and Technical Subjects (CTE/Arts) 6-12. English Companion Standards are required in these subject/content areas.

Unit Addressed	Standard #	Standard Description
1,2,3,4,8	*RST.9-10.7*	*Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. (HS-PS1-1)*
3	*RST.9-10.8*	*Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-PS4-3),(HS-PS4-4)*
2,4,5,6,7,8	*RST.11-12.1*	*Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3),(HS-PS1-5), (HS-PS2-6), (HS-PS3-4) (HS-PS4-3),(HS-PS4-4)*

Back to Table of Contents

3	*RST.11-12.7*	*Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-PS4-1),(HS-PS4-4)*
3	*RST.11-12.8*	*Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-PS4-3),(HS-PS4-4)*
1,2,3,4,5,6,7,8	*WHST.9-12.2*	*Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1- 2),(HS-PS1-5), (HS-PS2-6)*
1,2,3,4,5,7,8	*WHST.9-12.5*	*Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-PS1-2)*
4,6,7,8	*WHST.9-12.7*	*Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HSPS1-3),(HS-PS1-6), (HS-PS3-4)*
7,8	*WHST.11-12.8*	*Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3), (HS-PS3-4), (HS-PS4-4)*
7,8	*WHST.9-12.9*	*Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS1-3), (HS-PS3-4)*
2,4,5,7	*SL.11-12.5*	*Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-PS1-4), (HS-PS3-1), (HS-PS3-2)*

Back to Table of Contents

21st-Century Skills and Technology Integration (Standard 8)
List appropriate units below for which strands (A through F) will be addressed

Standard 8.1 (K-12)		**Educational Technology:** *All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.*
Unit Addressed	**Strand Letter**	**Standard Description**
	Strand A	**Technology Operations and Concepts:** *Students demonstrate a sound understanding of technology concepts, systems, and operations.*
2,8	**Strand B**	**Creativity and Innovation:** *Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.*
1-8	**Strand C**	**Communication and Collaboration:** *Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.*
	Strand D	**Digital Citizenship:** *Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.*
2-8	**Strand E**	**Research and Information Fluency:** *Students apply digital tools to gather, evaluate, and use information.*
1,8	**Strand F**	**Critical thinking, problem-solving, and decision making:** *Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.*

Career Ready Practices (Standard 9)
List appropriate units below for which CRPs will be addressed

Unit Addressed	Standard #	Standard Description
1	**CRP1**	*Act as a responsible and contributing citizen and employee.*
1-8	**CRP2**	*Apply appropriate academic and technical skills.*

Back to Table of Contents

1	**CRP3**	*Attend to personal health and financial well-being.*
8	**CRP4**	*Communicate clearly and effectively and with reason.*
	CRP5	*Consider the environmental, social and economic impacts of decisions.*
8	**CRP6**	*Demonstrate creativity and innovation.*
8	**CRP7**	*Employ valid and reliable research strategies.*
1-8	**CRP8**	*Utilize critical thinking to make sense of problems and persevere in solving them.*
	CRP9	*Model integrity, ethical leadership, and effective management.*
	CRP10	*Plan education and career paths aligned to personal goals.*
1-8	**CRP11**	*Use technology to enhance productivity.*
	CRP12	*Work productively in teams while using cultural global competence*

Interdisciplinary Connections
List any other content standards addressed as well as appropriate units

Visual & Performing Arts Integration (Standard 1)
List appropriate units below for which standards (1.1 through 1.4) may be addressed

Unit Addressed	Standard #	Standard Description
3	**Standard 1.1**	**The Creative Process:** *All students will demonstrate an understanding of the elements and principles that govern the creation of works of art in dance, music, theatre, and/or visual art.*
	Standard 1.2	**History of the Arts and Culture:** *All students will understand the role, development, and influence of the arts throughout history and across cultures.*
8	**Standard 1.3**	**Performing/Presenting/Producing:** *All students will synthesize those skills, media, methods, and technologies appropriate to creating, performing, and/or presenting works of art in dance, music, theatre, and/or visual art.*
	Standard 1.4	**Aesthetic Responses & Critique Methodologies:** *All students will demonstrate and apply an understanding of arts philosophies, judgment, and analysis to works of art in dance, music, theatre, and/or visual art.*

Back to Table of Contents

Other Interdisciplinary Content Standards *List appropriate units below for any other content/standards that may be addressed*		
Unit Addressed	**Content / Standard #**	**Standard Description**
1,2,3,4,5,6,7,8	*Math / MP.2*	*Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7) , (HS-PS3-1), (HS-PS3-2), (HS-PS3-4) (HS-PS4-1),(HS-PS4-3)*
2,4,7	*Math /MP.4*	*Model with mathematics. (HS-PS1-4),(HS-PS1-8), (HS-PS3-1), (HS-PS3-2), (HS-PS3-4) (HS-PS4-1)*
1,2,3,4,5,6,7,8	*Math / HSN-Q.A.1*	*Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8), (HS-PS2-6), (HS-PS3-1)*
1,2,3,4,5,6,7,8	*Math / HSN-Q.A.2*	*Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),(HS-PS1-7),(HS-PS1-8), (HS-PS2-6), (HS-PS3-1)*
1,2,3,4,5,6,7,8	*Math / HSN-Q.A.3*	*Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2), (HS-PS1-3), (HS-PS1-4), (HS-PS1-5),(HS-PS1- 7),(HS-PS1-8), (HS-PS2-6), (HS-PS3-1)*
3	*Math / HSA-SSE.A.1*	*Interpret expressions that represent a quantity in terms of its context. (HS-PS4-1),(HS-PS4-3)*
3	*Math / HSA-SSE.B.3*	*Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. (HS-PS4-1),(HS-PS4- 3)*
3	*Math / HSA.CED.A.4*	*Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-PS4-1),(HS-PS4-3)*

Back to Table of Contents

Pacing Guide (All Dates are approximate based on the school calendar)

Unit/ Topic	Month (w/Approx number of Teaching Days)
Unit 1 - The Basics Chapter 1: Introduction to matter and measurement Chapter 2: Atoms, Molecules, and Ions Chapter 3: Stoichiometry	**September (~19 days)**
Unit 2 - Solutions and Thermochemistry Chapter 4: Reactions in aqueous solution Chapter 5: Thermochemistry: Energy relationships in chemistry	**October (~19 days)**
Unit 3 - Atomic Structure, Bonding, and the Periodic Table Chapter 6: Electronic structure of the atom Chapter 7: Periodic properties of the elements Chapter 8: Basic concepts of chemical bonding	**November (~16 days)**
Unit 3 - Atomic Structure, Bonding, and the Periodic Table (Cont'd) Chapter 9: Molecular geometry and bonding theories	**December (~15 days)**
Unit 4 - Gases, Liquids, and Solids Chapter 10: Gases Chapter 11: Liquids and intermolecular forces Chapter 13: Properties of Solutions	
Unit 4 - Gases, Liquids, and Solids (Cont'd) Chapter 12: Solids	**January (~18 days)**
Unit 5 - Kinetics and Equilibrium Chapter 14: Chemical kinetics	
Unit 5 - Kinetics and Equilibrium (Cont'd) Chapter 15: Chemical Equilibrium	**February (~18 days)**
Unit 6 - Additional Aspects of Equilibrium Chapter 16: Acid-Base Equilibrium Chapter 17: Additional Aspects of Aqueous Equilibria	**March (~15-20 days)**
Unit 7 - Free Energy & Electrochemistry Chapter 19: Chemical Thermodynamics Chapter 20: Electrochemistry	**April (~15-20 days)**
Unit 8 - Everyday Chemistry **Review AP Chemistry Test** Project – Everyday Chemistry	**May (~18 days)**
Unit 8 Everyday Chemistry Project – Everyday Chemistry	**June (~15 days)**

Back to Table of Contents

Units

Contact the Content Supervisor for unit details.

Back to Table of Contents