

# GRADE 9: FOUNDATIONS FOR AP SCIENCES CHEMISTRY CURRICULUM FRAMEWORKS

## UNIT 1: MEASUREMENT AND MATTER

Big Questions		Formative/ Summative Assessments		
1. What is chemistry? 2. How do chemists measure small quantities? 3. What are physical and chemical properties of matter?		Formative and summative assessments created by teachers/teams  Options include, but are not limited to: - Right vs. Wrong Response Paper - Chapter 2 problems - Bubble Domes Lab - Determining Lab - Thickness of Aluminum Foil Lab - Properties of Matter Lab - Sugar Content of Beverages Lab - Unit Test		
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
<u>Substrand:</u> The Practice of Science <u>Standard:</u> Understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.	Understand that scientists conduct investigations for a variety of reasons, including: to discover new aspects of the natural world, to explain observed phenomena, to test the conclusions of prior investigations, or to test the predictions of current theories. <i>(Standard NSE: 9.1.1.1.2)</i>	None		Textbook: <a href="#"><u>Introductory Chemistry: A Foundation</u></a> (Houghton Mifflin)  Video: "World of Chemistry" (University of Maryland and the Educational Film Center-1990)
<u>Substrand:</u> The Practice of Science <u>Standard:</u> Understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.	Explain how the traditions and norms of science define the bounds of professional scientific practice and reveal instances of scientific error or misconduct. (For example: The use of peer review, publications and presentations.) <i>(Standard NSE: 9.1.1.1.3)</i>	<ul style="list-style-type: none"> <li>Items will NOT require students to make ethical decisions.</li> </ul>		<a href="#"><u>First You Build a Cloud</u></a> (KC Cole)
<u>Substrand:</u> The Practice of Science <u>Standard:</u> Understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.	Identify sources of bias and explain how bias might influence the direction of research and the interpretation of data. (For example: How funding of research can influence questions studied, procedures used, analysis of data, and communication of results.) <i>(Standard NSE: 9.1.1.1.5)</i>	<ul style="list-style-type: none"> <li>Items will NOT require students to make ethical decisions.</li> <li>Sources of bias may include gender bias, misconception, cultural bias, funding bias, procedural bias, individual bias based on prior experience with the subject and political bias.</li> </ul>		

# GRADE 9: FOUNDATIONS FOR AP SCIENCES CHEMISTRY CURRICULUM FRAMEWORKS

## UNIT 1: MEASUREMENT AND MATTER (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
<p><u>Substrand:</u> The Practice of Science <u>Standard:</u> Understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.</p>	<p>Describe how changes in scientific knowledge generally occur in incremental steps that include and build on earlier knowledge. (<i>Standard NSE: 9.1.1.1.6</i>)</p>	<ul style="list-style-type: none"> <li>• Items may require students to show how one scientific understanding leads to another (e.g., show how new evidence or analysis led to further development of the theory of evolution, germ theory or theory of inheritance).</li> <li>• Items assessing this benchmark may also assess benchmarks 9.1.3.2.1 and 9.4.4.1.3.</li> </ul>		<p>Textbook: <a href="#">Introductory Chemistry: A Foundation</a> (Houghton Mifflin)</p> <p>Video: “World of Chemistry” (University of Maryland and the Educational Film Center-1990)</p>
<p><u>Substrand:</u> The Practice of Science <u>Standard:</u> Understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.</p>	<p>Explain how scientific and technological innovations-as well as new evidence-can challenge portions of, or entire accepted theories and models including, but not limited to: cell theory, atomic theory, theory of evolution, plate tectonic theory, term theory of disease, and the big bang theory. (<i>Standard NSE: 9.1.1.1.7</i>)</p>	<ul style="list-style-type: none"> <li>• Items will address theories, models and the validity of scientific knowledge in the context of life science.</li> <li>• Technological innovations may include microscopy, global positioning system (GPS), genetic engineering and molecular engineering.</li> </ul>		<p><a href="#">First You Build a Cloud</a> (KC Cole)</p>
<p><u>Substrand:</u> The Practice of Science <u>Standard:</u> Understand that scientific inquiry uses multiple interrelated processes to investigate and explain the natural world.</p>	<p>Formulate a testable hypothesis, design and conduct an experiment to test the hypothesis, analyze the data, consider alternative explanations, and draw conclusions supported by evidence from the investigation. (<i>Standard NSE: 9.1.1.2.1</i>)</p>	<ul style="list-style-type: none"> <li>• Context of items should demonstrate all appropriate safety considerations.</li> <li>• Items may address part or all of the benchmark.</li> <li>• Hypothesis is defined as “a testable statement about the natural world that can be used to build more complex inferences and explanations” (National Academy of Sciences, Teaching About Evolution and the Nature of Science, [National Academy Press, 1988], 5).</li> <li>• Items will NOT require students to define the term hypothesis.</li> <li>• Items may require students to evaluate or draw an accurate conclusion based on presented evidence.</li> <li>• Items may require students to identify which variables were changed, kept the same and measured in a given experiment.</li> <li>• Items will NOT use the terms independent variable, dependent variable, manipulated variable or responding variables.</li> </ul>		

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## UNIT 1: MEASUREMENT AND MATTER (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
<p><u>Substrand:</u> The Practice of Science <u>Standard:</u> Understand that scientific inquiry uses multiple interrelated processes to investigate and explain the natural world.</p>	<p>Evaluate the explanations proposed by others by examining and comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the scientifically acceptable evidence, and suggesting alternative scientific explanations. <i>(Standard NSE: 9.1.1.2.2)</i></p>	<ul style="list-style-type: none"> <li>Items may require students to evaluate a set of data to formulate possible conclusions.</li> </ul>		<p>Textbook: <u>Introductory Chemistry: A Foundation</u> (Houghton Mifflin)</p> <p>Video: “World of Chemistry” (University of Maryland and the Educational Film Center-1990)</p>
<p><u>Substrand:</u> The Practice of Science <u>Standard:</u> Understand that scientific inquiry uses multiple interrelated processes to investigate and explain the natural world.</p>	<p>Identify the critical assumptions and logic used in a line of reasoning to judge the validity of a claim. <i>(Standard NSE: 9.1.1.2.3)</i></p>	<ul style="list-style-type: none"> <li>Items may include product claims, pseudoscience and unsupported conclusions.</li> </ul>		<p><u>First You Build a Cloud</u> (KC Cole)</p>
<p><u>Substrand:</u> The Practice of Science <u>Standard:</u> Understand that scientific inquiry uses multiple interrelated processes to investigate and explain the natural world.</p>	<p>Use primary sources or scientific writings to identify and explain how different types of questions and their associated methodologies are used by scientists for investigations in different disciplines. <i>(Standard NSE: 9.1.1.2.4)</i></p>	<ul style="list-style-type: none"> <li>Disciplines are limited to zoology, botany, microbiology, evolutionary biology, ecology, genetics, cell biology, anatomy and physiology.</li> <li>Methodologies may include observation, gathering data, organizing information, analysis, experimentation and computer modeling.</li> </ul>		

# GRADE 9: FOUNDATIONS FOR AP SCIENCES CHEMISTRY CURRICULUM FRAMEWORKS

## UNIT 2: ATOMIC THEORY

Big Questions		Formative/ Summative Assessments		
1. How does the structure of an atom determine property? 2. What is the result of chemical reactions? 3. How is energy transformed in chemical reactions?		Formative and summative assessments created by teachers/teams  Options include, but are not limited to: - Element Quiz (names and symbols) - Alchemy Lab - Spectral Analysis Lab - Half Life of Radioactive Isotope Lab - Unit Test		
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
<u>Substrand:</u> Matter <u>Standard:</u> Understand that the structure of the atom determines chemical properties of elements.	Describe the relative charges, masses, and locations of the protons, neutrons, and electrons in an atom of an element. <i>(Standard PS: 9.2.1.1.1)</i>	None		Textbook: <u>Introductory Chemistry: A Foundation</u> (Houghton Mifflin)  Periodic Table of Elements
<u>Substrand:</u> Matter <u>Standard:</u> Understand that the structure of the atom determines chemical properties of elements.	Describe how experimental evidence led Dalton, Rutherford, Thompson, Chadwick and Bohr to develop increasingly accurate models of the atom. <i>(Standard PS: 9.2.1.1.2)</i>	None		Video: "World of Chemistry" (University of Maryland and the Educational Film Center-1990)
<u>Substrand:</u> Matter <u>Standard:</u> Understand that the structure of the atom determines chemical properties of elements.	Explain the arrangements of the elements on the Periodic Table, including the relationships among elements in a given column or row. <i>(Standard PS: 9.2.1.1.3)</i>	None		
<u>Substrand:</u> Matter <u>Standard:</u> Understand that the structure of the atom determines chemical properties of elements.	Explain that isotopes of an element have different numbers of neutrons and that some are unstable and emit particles and/or radiation. (For example: Some rock formations and building materials emit radioactive radon gas; the predictable rate of decay of radioactive isotopes makes it possible to estimate the age of some materials, and makes them useful in some medical procedures.) <i>(Standard PS: 9.2.1.1.4)</i>	None		

## GRADE 9: FOUNDATIONS FOR AP SCIENCES CHEMISTRY CURRICULUM FRAMEWORKS

### UNIT 2: ATOMIC THEORY (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
<p><b>Substrand:</b> Matter <b>Standard:</b> Understand that chemical reactions involve the rearrangement of atoms as chemical bonds are broken and formed through transferring or sharing of electrons and the absorption or release of energy.</p>	<p>Describe the role of valence electrons in the formation of chemical bonds. (<i>Standard PS: 9.2.1.2.1</i>)</p>	None		<p>Textbook: <a href="#"><u>Introductory Chemistry: A Foundation</u></a> (Houghton Mifflin)</p> <p>Periodic Table of Elements</p> <p>Video: “World of Chemistry” (University of Maryland and the Educational Film Center-1990)</p>
<p><b>Substrand:</b> Matter <b>Standard:</b> Understand that chemical reactions involve the rearrangement of atoms as chemical bonds are broken and formed through transferring or sharing of electrons and the absorption or release of energy.</p>	<p>Explain how the rearrangement of atoms in a chemical reaction illustrates the law of conservation of mass. (<i>Standard PS: 9.2.1.2.2</i>)</p>	None		
<p><b>Substrand:</b> Matter <b>Standard:</b> Understand that chemical reactions involve the rearrangement of atoms as chemical bonds are broken and formed through transferring or sharing of electrons and the absorption or release of energy.</p>	<p>Describe a chemical reaction using words and symbolic equations. (For example: The reaction of hydrogen gas with oxygen gas can be written – <math>2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}</math>.) (<i>Standard PS: 9.2.1.2.3</i>)</p>	None		
<p><b>Substrand:</b> Matter <b>Standard:</b> Understand that chemical reactions involve the rearrangement of atoms as chemical bonds are broken and formed through transferring or sharing of electrons and the absorption or release of energy.</p>	<p>Relate exothermic and endothermic chemical reactions to temperature and energy changes. (<i>Standard PS: 9.2.1.2.4</i>)</p>	None		

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### UNIT 2: ATOMIC THEORY (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
<p><u>Substrand:</u> Energy</p> <p><u>Standard:</u> Understand that energy can be transformed within a system or transferred to other systems or the environment, but is always conserved.</p>	<p>Compare fission and fusion in terms of the reactants, the products and the conversion from matter into energy. (For example: The fusion of hydrogen produces energy in the sun; the use of chain reactions in nuclear reactors.)</p> <p><i>(Standard PS: 9.2.3.2.6)</i></p>	None		<p>Textbook: <u>Introductory Chemistry: A Foundation</u> (Houghton Mifflin)</p> <p>Periodic Table of Elements</p>
<p><u>Substrand:</u> Earth Structure and Processes</p> <p><u>Standard:</u> Understand that by observing rock sequences and using fossils to correlate the sequences at various locations, geologic events can be inferred and geologic time can be estimated.</p>	<p>Use relative dating techniques to explain how the structures of the earth and life on Earth have changed over short and long periods of time.</p> <p><i>(Standard ESS: 9.3.1.3.1)</i></p>	None		<p>Video: “World of Chemistry” (University of Maryland and the Educational Film Center-1990)</p>
<p><u>Substrand:</u> Interdependence Within the Earth System</p> <p><u>Standard:</u> The Earth system has internal and external sources of energy, which produce heat and drive the motion of material in the oceans, atmosphere and solid earth.</p>	<p>Compare and contrast the energy sources of the Earth, including the sun, the decay of radioactive isotopes and gravitational energy.</p> <p><i>(Standard ESS: 9.3.2.1.1)</i></p>	None		

# GRADE 9: FOUNDATIONS FOR AP SCIENCES CHEMISTRY CURRICULUM FRAMEWORKS

## UNIT 3: STOICHIOMETRY

### Big Questions

1. How is matter conserved in chemical reactions?
2. How are chemists able to determine chemical composition?

### Formative/ Summative Assessments

Formative and summative assessments created by teachers/teams

- Options include, but are not limited to:
- Identifying Chemical Reactions Lab
  - Empirical Formula Lab
  - Unit Test

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
<p><u>Substrand:</u> Matter <u>Standard:</u> Understand that chemical reactions involve the rearrangement of atoms as chemical bonds are broken and formed through transferring or sharing of electrons and the absorption or release of energy.</p>	<p>Describe the role of valence electrons in the formation of chemical bonds. (<i>Standard PS: 9.2.1.2.1</i>)</p>	None		<p>Textbook: <a href="#"><u>Introductory Chemistry: A Foundation</u></a> (Houghton Mifflin)</p> <p>Periodic Table of Elements</p> <p>Stoichiometry Packet</p>
<p><u>Substrand:</u> Matter <u>Standard:</u> Understand that chemical reactions involve the rearrangement of atoms as chemical bonds are broken and formed through transferring or sharing of electrons and the absorption or release of energy.</p>	<p>Explain how the rearrangement of atoms in a chemical reaction illustrates the law of conservation of mass. (<i>Standard PS: 9.2.1.2.2</i>)</p>	None		
<p><u>Substrand:</u> Matter <u>Standard:</u> Understand that chemical reactions involve the rearrangement of atoms as chemical bonds are broken and formed through transferring or sharing of electrons and the absorption or release of energy.</p>	<p>Describe a chemical reaction using words and symbolic equations. (For example: The reaction of hydrogen gas with oxygen gas can be written – <math>2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}</math>.) (<i>Standard PS: 9.2.1.2.3</i>)</p>	None		