

NGSS UNIT OVERVIEW

CHEMISTRY OF MATERIALS

Performance Expectation MS-PS1-1: Develop models to describe the atomic composition of simple molecules and extended structures.

Performance Expectation MS-PS1-3: Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

Performance Expectation MS-PS1-4: Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
<p>1. Talking it Over: Exploring Materials</p> <p>Students begin to gather and synthesize information about the physical and chemical properties of three materials— glass, aluminum, and plastic. They assess how this information might be used as evidence for making a decision about which material to use for a drink container in relation to the structure and function of that object.</p>	MS-PS1.A	Obtaining, Evaluating, and Communicating Information Asking Questions and Defining Problems Analyzing and Interpreting Data	Structure and Function Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World	ELA/Literacy: WHST.6-8.1
<p>2. Laboratory: Investigating Elements</p> <p>Students carry out an investigation of the physical and chemical properties of a set of elements. They analyze and interpret the data they have collected on these elements, and begin to explore how this data can help identify pure substances. Finally, students synthesize what they have learned to further assess how this data can be used as evidence to determine if aluminum is a good choice for making a drink container.</p>	MS-PS1.A	Obtaining, Evaluating, and Communicating Information Planning and Carrying Out Investigations Analyzing and Interpreting Data	Structure and Function Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World	ELA/Literacy: RST.6-8.3

CHEMISTRY OF MATERIALS (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
3. Laboratory: Physical and Chemical Properties of Materials Students are introduced to compounds as well as chemical properties of materials. They conduct an investigation with several materials and use the data to determine how properties of a specific material would determine the use of the material, in particular, focusing on structure and function.	MS-PS1.A MS-PS1.B	Planning and Carrying Out Investigations Analyzing and Interpreting Data	Structure and Function Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology	ELA/Literacy: RST.6-8.3
4. Laboratory: Determining Density Students conduct an investigation to collect, analyze, and interpret data on density for several materials—aluminum, glass, and four types of plastics. Students connect their analysis of the densities of these materials to their possible uses, focusing on the crosscutting concept of structure and function.	MS-PS1.A	Planning and Carrying Out Investigations Analyzing and Interpreting Data Using Mathematics and Computational Thinking	Structure and Function Scale, Proportion, and Quantity	Mathematics: 7.RP.A.2
5. Talking it Over: Evaluating Properties of Materials Students read and synthesize information from multiple sources describing the use of materials and their potential impact on society. Students assess the credibility and possible bias of those sources. Students use this and additional information to inform a debate on which material would be best in terms of the structure and function of its intended purpose (as a reusable drink container) and in terms of impact on society.	MS-PS1.A	Obtaining, Evaluating, and Communicating Information	Structure and Function Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World	
6. Modeling: Modeling Molecules Students are introduced to the practice of modeling as a tool to investigate phenomena at a molecular scale. Students use models to investigate the atomic composition of simple molecules and compounds.	MS-PS1.A	Developing and Using Models	Scale, Proportion, and Quantity	

CHEMISTRY OF MATERIALS (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
<p>7. Reading: Structure and Properties of Materials Students obtain information from text and diagrams of structural models to elaborate on what students observed when they developed models of molecules and extended structures in the previous activity. This activity emphasizes the crosscutting concept of scale, quantity, and proportion as students observe the varieties of particles that make up substances. The activity also focuses on structure and function, building the concept that the particle structure of a substance determines its bulk properties and the ways that the substance can be used.</p>	MS-PS1.A	Developing and Using Models Obtaining, Evaluating, and Communicating Information	Scale, Proportion, and Quantity Structure and Function	ELA/Literacy: RST.6-8.2 RST.6-8.7
<p>8. Talking it Over: What's in a State? Students begin their investigations about the three states of matter. Students make observations and construct explanations about how the behavior of the particles in each state causes the observable properties of solids, liquids, and gases. Students then use a computer simulation to gather more information to begin developing models of the particles in solids, liquids, and gases.</p>	MS-PS1.A	Developing and Using Models Constructing Explanations and Designing Solutions	Cause and Effect	
<p>9. Laboratory: Energy and Particle Movement Students carry out investigations to collect data about how temperature and kinetic energy relate to gas particles. Students investigate cause-and-effect relationships between adding and removing thermal energy to raise or lower temperature and the movement of gas particles. They use their new understandings to further refine their models about particles in different states to include kinetic energy.</p>	MS-PS1.A MS-PS3.A	Developing and Using Models Planning and Carrying Out Investigations Engaging in Argument from Evidence	Cause and Effect	
<p>10. Laboratory: Modeling State Changes Students carry out an investigation to collect data about the relationships between temperature and state changes. They analyze and interpret these data in order to construct explanations about what is happening to particles during state changes. Students further develop their models that depict particle movement, temperature, and state, including the role of thermal energy. This activity provides an opportunity to assess Performance Expectation MS-PS1-4.</p>	MS-PS1.A MS-PS3.A	Developing and Using Models Planning and Carrying Out Investigations Analyzing and Interpreting Data Constructing Explanations and Designing Solutions	Cause and Effect	ELA/Literacy: RST.6-8.3

CHEMISTRY OF MATERIALS (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
11. Laboratory: Making Polymers Students conduct an investigation in which they cross-link a polymer and analyze the results by comparing the starting and final substances. This reinforces the characteristic properties of each pure substance while introducing chemical change. The crosscutting concepts of structure and function, and connections to engineering, technology, and applications of science are related to the design and impact of engineered products.	MS-PS1.A MS-PS1.B	Planning and Carrying Out Investigations Analyzing and Interpreting Data Obtaining, Evaluating, and Communicating Information	Structure and Function Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World	ELA/Literacy: RST.6-8.3
12. Modeling: Modeling Polymers Students use structural models at various scales explain and predict the properties of plastics. This activity draws together the core ideas related to structure and properties of matter and the crosscutting concepts of structure and function, and scale, proportion, and quantity through the practice of modeling. The activity provides an opportunity to assess Performance Expectation MS-PS1-1.	MS-PS1.A MS-PS1.B	Developing and Using Models	Structure and Function Scale, Proportion, and Quantity Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World	ELA/Literacy: WHST.6-8.9

CHEMISTRY OF MATERIALS (continued)

Activity Description	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts	Common Core State Standards
<p>13. Talking it Over: The Impact of Plastics on Society</p> <p>Students gather, read, and synthesize information from text and diagrams about four types of polymers (Teflon, Kevlar, compostable polymers, and polyester). Students apply this information to an analysis of the impact of these materials on society, focusing on the crosscutting concepts of structure and function and connections to engineering, technology, and applications of science. This activity provides an opportunity to assess Performance Expectation MS-PS1-3.</p>	MS-PS1.A	Obtaining, Evaluating, and Communicating Information Constructing Explanations and Designing Solutions	Structure and Function Connections to Engineering, Technology, and Applications of Science	ELA/Literacy: RST.6-8.7 WHST.6-8.1 WHST.6-8.9