Unit Title: Experimenting With Mixtures, Compounds, and Elements	**Content Area:** Physical Science/General Chemistry	**Grade Level:** 8

Unit Summary: This unit builds upon students' awareness, from previous study, of some of the physical properties of a substance and some of its defining characteristics. In this unit, students investigate how such properties can be used to separate mixtures or how additional energy (in the form of heat or electricity) is needed to separate compounds.
They examine elements and discover that elements can combine to form compounds but cannot be further separated into different components.
Students engage in a series of inquiries designed to develop their understanding of the types of matter.
Each lesson builds on skills, concepts, and experiences from previous lessons. The reading selections within the lessons are an integral part of the learning process for students and will help them appreciate the relevance of their schoolwork to real-life situations, history, and culture.

The Crosscutting concepts indicated in this unit are cause and effect, systems and system models that students will engage in.
Scientific Practices that students will engage in are asking questions, developing models, constructing explanation and designing solutions and obtaining, evaluating and communicating information are exhibited in this unit.

Unit Essential Questions:	**Unit Enduring Understandings:**
• How do the properties of materials determine their use? • How does conservation of mass apply to the interaction of materials in a closed system?	• The structures of materials determine their properties. • When materials interact within a closed system, the total mass of the system remains the same.

Possible Student Misconceptions:

- Students may incorrectly assume that only elements are pure substances with unique properties.
- Students may incorrectly believe that pure substances are transparent, free from additives and safe to ingest.
- They may assume that all mixtures are heterogeneous or homogeneous.
- Students may incorrectly give mixtures properties that are independent of their composition.
- Students may confuse compounds with mixtures or elements.
- Students may fail to recognize that elements combine in fixed ratios to form compounds.
- Students may not have observed the production of a gas, a change in temperature, or color change as an example of a chemical reaction.
- Students may confuse dissolving with a chemical reaction.
- Students may use the terms "atoms," "molecules," and "electrons" freely with little or no understanding of where they come from or what they mean. The notion of developing concepts based on their observation of scientific phenomena and collection of experimental data may be new for many of them.
- Students may incorrectly think that all metals are magnetic.
- Students may incorrectly think that electrical conductivity is a property of metals only.
- Students may incorrectly think that all elements are solids.
- Students may incorrectly think that matter "gets lighter" in chemical reactions in which there is an apparent loss of matter.
- Students may incorrectly think that matter can disappear during a chemical reaction.
- Students may incorrectly equate an apparent loss of mass during a chemical reaction with the destruction of matter.
- Students may incorrectly think that the appearance of products is the result of the creation of new matter rather than of the rearrangement of the bonds between the atoms of the reactants.

NJCCCS: 5.2.8.A.1-2, 5.2.8.B.2, 5.2.8.A.5, 5.2.8.A.3-4, 5.2.8.A.6-7, 5.2.8.B.1

NGSS Performance Expectations: *Students who demonstrate understanding can…*

- MS-PS1-1 Develop models to describe the atomic composition of simple molecules and extended structures. [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.]
- MS-PS1-3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.]
- 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. [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs.]
- MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
- MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.

Primary CCSS ELA/Literacy Connections:
RI.6.1, RI.6.2, RST.6-8.1,RST.6-8.3, RST.6-8.7, W.6.1, W.6.2, WHST.6-8.7, WHST.6-8.8, SL.8.1

Primary CCSS Mathematics Connections: 8.EE.4, 8.EE.5, 8.EE.7, 8.SP.3, 8.SP.4

Lesson Pace & Sequence

Lesson Title/Number: The Nature of Matter Lesson 1

Learning Objective(s): I can determine key characteristic properties of matter.

Lesson Duration: 100 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Students engage in a class discussion on the characteristic properties of matter.	• KWL chart	Asking Questions		
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Students work in small groups to compose a definition of "matter." Groups will present their definitions and the class comes to consensus on a definition.	• Getting Started Activity - Teacher's Guide page 4	Engaging in Argument from Evidence		
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Working with in a group students will engage in a series of 8 inquires with common and familiar objects that will allow them to observe some physical, chemical, magnetic and electrical conducting properties of matter.	• Set-up for Inquiries Teacher's Guide pages 3-A-C • Kit contains materials • Student edition needed for procedure.	Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2) Conduct an investigation	"PS1.A: Structure and Properties of Matter Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size	Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

			and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation. (MS-PS1-6) Analyzing and Interpreting Data Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2) Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)	from two to thousands of atoms. (MS-PS1-1) Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3) Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4) In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4) Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)"	
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Students will reflect one observation and make a connection to a real-life situation on large chart paper. Student will compare and contrast each group's reflect for common threads.	• Reflecting on What you have done p.13(TE)	Engaging in Argument from Evidence		
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Lesson is a formative pre-assessment. Utilize student discussions and written response as a needs assessment.				
Extend: How will students	Independent: Students will				

deepen their conceptual understanding through use in new context?	obtain an article from online or in class resource on any substance they are familiar with to identify characteristics.				
Lesson Title/Number: Pure Substance or Mixture?/ Lesson 2		**Learning Objective(s):** I can determine whether substances are pure or mixtures.			**Lesson Duration:** 200 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Small Group: Students will write their ideas of what it means when a substance is a pure or mixture.	• Student Sheet 2.1 • Student STC text	Asking questions		
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Students will engage in a class discussion on "How can you tell whether something is a pure substance or a mixture?" Create a concept map of student responses from this discussion.	• Large chart paper • Smartboard or newsprint	Engaging in Argument from Evidence	Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3)	
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Small Group: Students engage in observing 8 different samples to determine whether it is pure or mixture. Students will utilize apparatus to devise a technique to make a decision and record their findings.	• Student Sheet 2.1 "Identifying Pure Substances and Mixtures" • Materials from kit as listed on Teacher's Guide page 15	Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2) Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation. (MS-PS1-6) Analyzing and Interpreting Data Analyze and interpret data to determine similarities and	Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3)	Structure and Function Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)

			differences in findings. (MS-PS1-2) Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)		
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Independent or Partner: Students will read "Perfect Teamwork" that describes how the combination of substances can form a new substance such as fiberglass or carbon composites.	• Literacy STC Series *"Experimenting with Mixtures, Compounds and Elements"* pages 18-23	Engaging in Argument from Evidence		
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Students will share the results of the investigation, recording and analyzing the procedure that each group developed. Students will apply the reading selection text connecting the investigation for analysis of pure substance vs. mixture.	• Concept Map from beginning of the lesson	Engaging in argument from evidence		Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Student response to questions on Student Sheet and reflection dialogue	• Student worksheet and journal reflection			
Lesson Title/Number: Separating A Soluble and an Insoluble Substance Lesson 3		**Learning Objective(s)**: I can design an experiment to separate a soluble from an insoluble substance.			**Lesson Duration:** 250 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Students engage in discussion respond to: - Does anyone know what a water filter is? How does the filter work?	• KWL or graphic organizer	Asking questions		
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Independent/Partner: Students will read lesson selection "Separating a Soluble and Insoluble Substance" In small groups students will respond and discuss to "Why is knowledge of separation techniques important to ensure the health of our rivers? Groups can record on large paper response for even later discussion after investigation.	• STC Student Edition Page 22	Asking questions · Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.	Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)	"Structure and Function Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)"

Explore: What hands-on/minds-on common experience(s) will you provide for students?	In small groups students will observe a substance (Copper (II) Sulfate) and describe it. Students will make predictions on what would happen if water is added and then test it. Students will set up an apparatus filtering system following the procedure given. (inquiry 3.1) Inquiry 3.2 - Student groups will design and conduct an inquiry to obtain a clean sample from crushed rock salt building on from Inquiry 3.1. They will then re-dissolve the solid from an evaporated solution.	• Materials from kit for Inquiry 3.1 and 3.2 • STC Student Edition	Constructing Explanations and Designing Solutions Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MS-PS1-6) Planning and carrying out investigations	Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)	Energy and Matter Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5) The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6)
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Small groups: Students will discuss their procedures and reflect on it. Students will read "Separating Solids from Liquids" and observe their final product to respond to questions such as: Are any crystals present?, Are they all the same shape? Students are recording in the science journal section of their notebook.	• STC Student Edition Pages 28-29	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)"	Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)	

Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	In small groups students will discuss other systems in our world will filtration occurs. Students will generate questions on filtration using scientific terms that they group develops.	• Science Journals/ Notebooks • Chart paper • Post-its	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)"	Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)	
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Student response to questions in small groups, student worksheet questions, their procedure in Inquiry 3.2 using correct terminology in their writing.	• Student Worksheet inquiry 3.1 and 3.1	Engaging in Argument from Evidence		
Extend: How will students deepen their conceptual understanding through use in new context?	Students will read "Separating solutions and the Salty Sea" Working with a partner, students can determine commonalities between the two reading selections and the sewage filtration discussion from the beginning of the lesson. Students can demonstrate conceptual understanding with an illustration design.	• STC Student Guide pages 30-31	Analyzing and interpreting	Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)	
Lesson Title/Number: Changing Mixtures/5		**Learning Objective(s):** I can determine the effect of concentration and composition on the melting point of a tin alloy.			**Lesson Duration**: 150 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***

Elicit: How will you access students' prior knowledge?	Students will engage in brainstorming on "What is a mixture?". Discussion includes recording student examples of mixtures. Students will observe illustrations on different mixtures to probe their understanding.	• Smartboard animated examples of mixtures • Chart paper • Illustrations	Asking questions		
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Student will read the introduction selection "changing Mixtures" to focus their thinking on the topic. Students can share their understanding of the reading before beginning the investigation.	• Student guide pg. 42	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)"	The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)	Structure and Function Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Small groups: Students measure the time required to melt three different solders to compare melting points. Inquiry 5.3 Investigating Solid Solutions	• Kit materials for inquiry 5.3, • Student guide pages 48-50	Planning and carrying out investigations Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation. Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)	The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)	Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

Explain: How will you help students connect their exploration to the concept/topic under investigation?	Small groups: Students will discuss the question on Student sheet such as: How do you think the length of time to melt relates to the melting point of these solders? Students are to practice using key vocabulary in their response to questions.	• Student Sheet Inquiry 5.3	Engaging in Argument from Evidence		
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Individual - Student will read "About Alloys" to develop a more sophisticated understanding. Students will lead a class discussion on their results from each group as they review the data.	• Student Guide pg. 51 • Student Sheet Inquiry 5.3 pg. 2	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)"	The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)	Energy and Matter Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Exit Ticket Question for example: Identity one important concept you learned today from the investigation. Student response on student sheet and observations recorded.	• Student Sheet Inquiry 5.3			
Extend: How will students deepen their conceptual understanding through use in new context?	Individual - Student's will read "The Samurai's Sword". Whole class - Discussion of the reading and students will make connections to movies they may have seen where metals were melted to create an object. Small group- Simulation of how a swordsmith modifies a blade using paper created layers.	• Student Guide pages 52-55 • Discussion questions activity page 55			
Lesson Title/Number: Breaking Down a Compound/6		**Learning Objective(s):** I can compare and contrast a compound from an element.			**Lesson Duration:** 90 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Students explain the terms element and compound using a concept map.	• Science notebook • Smartboard or chart paper	Asking questions		
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Students will engage in observing a visual map of water anywhere (ocean, river, bottled water, running water). Students will discuss the questions "What is the composition of water?" This will lead into the introduction of the lesson reading "Breaking Down a Compound". Students can engage in small groups or as a class.	• Graphic organizer - Student Guide page 58	Engaging in Argument from evidence	Chemical Reactions Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2), (MS-PS1-3), (MS-PS1-5) The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5) Some chemical reactions release energy, others store energy. (MS-PS1-6)	Energy and Matter Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)

Explore: What hands-on/minds-on common experience(s) will you provide for students?	Small groups will engage in Inquiry 6.1 - Students will use electrolysis to decompose water into hydrogen and oxygen. Students will compare some of the physical and chemical properties of the reactant and the product.	• Student Sheet 6.1 • Student guide pages 60-64 • Student Notebook	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)"	"PS1.A: Structure and Properties of Matter Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1) Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3) Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4) In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4) Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)"	
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Students will explain their exploration using the questions on student sheet step 11 and 12 What did you see happen	• Student Sheet 6.1 • Student guide pages 60-64 • Student Notebook	***observing, communicating information***		

	after the apparatus was set up? Are new substances being produced?				
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Students will reflect on the investigation by their response to questions on the topic. To assist students in elaboration of the investigation, student illustrations of the electrolysis process is helpful.	• Newsprint or chart paper • Colored pencils, • Student Sheet 6.1	***making models, observing information***		
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Science journal, response to key critical thinking questions on student sheet 6.1, reflections. Student oral explanations can also demonstrate mastery of objective.	• Student Sheet 6.1 • Student Notebook	engaging in argument from evidence		

Extend: How will students deepen their conceptual understanding through use in new context?	Student groups can jigsaw reading selections (the reading can be done for homework and discussion in class. "Hydrogen and Oxygen" "Car Battery and "Chemical Factory". "The Properties of Hydrogen and the Death of an Airship" "Extracting Aluminum" Groups share key points connecting to the investigation and key terms for a conceptual understanding.	• Student Guide pages 66-77		"PS1.A: Structure and Properties of Matter Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1) Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3) Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4) In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4) Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)"	
Lesson Title/Number: Combining Elements/8		**Learning Objective(s):** I can determine how elements can be combined to form compounds.			**Lesson Duration:** 100 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	As students observe a periodic table of elements they can identify familiar elements to foster a discussion on their prior knowledge.	• Visual aid - Periodic Table of Elements (Can be displayed on Smartboard or individual periodic tables for students)			
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Using the periodic table student groups will create a Venn diagram to identify elements classified as a metal or non-metal. Student will also discuss the following questions in their groups: What properties (criteria) would you use to decide which elements go into which group? What are some elements that you would place into each group?	• Student Sheet 7.1 (Periodic Table) • Student Sheet 8.1	Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)		

Explore: What hands-on/minds-on common experience(s) will you provide for students?	Students will continue the engagement activity building upon it with an apparatus setup that they will observe the chemical properties of metal and non-metal in groups.	• Kit materials • Student Guide pages 92-95 • Inquiry 8.1 and 8.2 • Student Sheet 8.1 and 8.2	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)" Developing and Using Models • Develop a model to predict and/or describe phenomena. (MS-PS1-1), (MS-PS1-4) • Develop a model to describe unobservable mechanisms. (MS-PS1-5)	Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2),(MS-PS1-3),(MS-PS1-5)	Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Students will explain the connection with steel wool that is possibly used at home. Students can also reference other similar products made from some type of metal.		Analyzing and Interpreting Data Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2)		Structure and Function Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Students will engage in a reading selection "Synthesizing Materials" within their groups or independently to connect how combinations of elements were involved in the invention of common household items.	• Student guide pages 96-99	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)"		

Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Student journals, response to questions and their explanation of how they grouped the elements.	• Science journals • Student Sheet 8.1. and 8.2			
Lesson Title/Number: Exploration Activity/9 This lesson can be done at the end of the unit as an Extension.		**Learning Objective(s):** I can research the composition, use and history of a common compound.			**Lesson Duration:** 500 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	As students observe illustrations, words of various compounds and ask questions in reference to their use such as NaCl (salt) as a brainstorm preference for this research project. Student groups can create a list of familiar compound and connection to how we use it. Students engage in the difference between a compound and an element.	• Periodic table • Smartboard • Teacher's Guide • Vocabulary wall	Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)	"PS1.A: Structure and Properties of Matter Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1) Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3) Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4) In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but	Structure and Function Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)

				do not change relative locations. (MS-PS1-4) Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)"	
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Students observe illustrations of everyday chemical and physical changes such as: baking a cake, frying an egg, etc. In small groups student read and discuss "A Brief History of Salt" and then share with whole class. Students will review the framework for the research project and personalize it.	• Student guide pages 114-119			
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Overview: Students work with partner or independent to research a compound found in "real life" using the knowledge they have gained on matter. They will study the historical background of the compound and its occurrence in nature and/or discovery in the laboratory. This exploration consists of four parts: choosing a compound, researching the compound, creating an exhibit and giving an oral presentation.	• Student Guide pages102-113 • Internet access required • Student Sheet 9a and 9b	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)"	Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2),(MS-PS1-3),(MS-PS1-5)	Structure and Function Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)

Explain: How will you help students connect their exploration to the concept/topic under investigation?	Students share objects and make reference to their research findings. Students are actively engaged in helping each other from group to group.	• Teacher's Guide pages 101-A –C, 104-B and 105	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)"		Structure and Function Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Students are evaluated based upon their process of the research, cube and oral presentation following a rubric.	• Student Sheet 9b "Exploration Activity Schedule • Inquiry Masters 9a and 9b (Rubric)	Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)		
Lesson Title/Number: Chemical Reactions involving Metals/10		**Learning Objective(s):** I can design and conduct an experiment to compare how different metals corrode.			**Lesson Duration:** 300 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Student will create a on the properties of metals. Students can refer to lesson 8 as guidance to identifying metals. Students will discuss their properties in groups.				

Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Each group will investigate the chemical properties of one metal in more detail using information from Student Sheet 7.1a and Inquiry 8.2. Assign one of the following metals to each group: copper, iron, magnesium, sodium, aluminum, zinc, calcium or tin. whole class discussion on their findings	• Teacher's Guide p 122-A • Student Guide pg. 122	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)"	Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2),(MS-PS1-3),(MS-PS1-5)	Structure and Function Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)
Explore: What hands-on/minds-on common experience(s) will you provide for students?	The inquiries in this lesson focus on the properties and chemical behavior of four metals. Inquiry 10.1 students observe what happens when the metals are placed in hydrochloric acid. Inquiry 10.2 students design an experiment that compares the effect of air and water on the same metals.	• Teacher's Guide pages 119-C-D • Student Guide pages 122-127 • Student Sheets 10.1 and 10.2 • Kit materials for investigations	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)" Constructing Explanations and Designing Solutions • Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MS-PS1-6) Analyzing and Interpreting Data • Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2)	Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2),(MS-PS1-3),(MS-PS1-5)	

Explain: How will you help students connect their exploration to the concept/topic under investigation?	Students discuss their exploration activity that contained metals. Students can refer to common familiar objects, such as the chemical reaction that has occurred with the Statue of Liberty for connection.		"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)"		
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Students will reflect on investigations with reading selection "About Acids and Bases" and compare their response to questions, connecting to the experiments.	• Student Guide page 128	Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)		Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Students journal observations, response to questions on Student sheet 10.1 and 10.2		Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)		
Extend: How will students deepen their conceptual understanding through use in new context?	In small groups students can read "Panning for Gold" as a reference for discussion whole class answer this question: "What is gold used for today? Why is gold an appropriate metal for those uses? Students can present arguments for how we use gold today and extend to how common it is through research. Student should present additional evidence from resources via internet, print materials or video documentaries. (allow 2-3 days)	• Student Guide pages 131-133 • Internet access • History text on Gold Mining	Engaging in Argument -Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence and/or interpretations of facts	Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)	Structure and Function Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)
Lesson Title/Number: Countering Corrosion/11		**Learning Objective(s):** I can design and conduct an experiment to compare the effectiveness of different rust-prevention techniques.			**Lesson Duration:** 80 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Students will observe several rusted objects in the classroom to speculate the conditions that may have caused this reaction. Students can illustrate objects and their statements from discussion in small groups.	• Teacher needs to get different objects from any resource (i.e. nail, bike rim, etc.)	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)"		Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

Explore: What hands-on/minds-on common experience(s) will you provide for students?	In this lesson students continue to work in small groups to design an investigation that will prevent rusting using a standard set of materials. Students will design a table to formulate the data for evaluation of the best method over a period of 3-4 days of observing and gathering information. Students will summarize the class results creating an additional table for the best method.	• Student Guide pg. 138-139 • Science Journals • Teacher's Guide page 138A-138B	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)" Constructing Explanations and Designing Solutions • Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MS-PS1-6) Analyzing and Interpreting Data • Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2)	Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2),(MS-PS1-3),(MS-PS1-5)	Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Teacher will monitor student observations, design set-up, table format to ensure students reflect on previous lesson on how metal reacts with oxygen and water.				

Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Students can read the selection "The Work Never Ends" to build background and assist with the design of rust prevention. Students can also make connections to other bridges that they are familiar with that has been recently noted in the media as having to be repainted.	• Student Guide pages 140-141	"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)" Constructing Explanations and Designing Solutions • Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MS-PS1-6) Analyzing and Interpreting Data • Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2)		

Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Students demonstrate their mastery of chemical reactions, alloys by the designing project, data table, and analysis of all gathered information. Students continue to use key vocabulary and reference previous lessons, and exploration activity research.		"Obtaining, evaluating and communicating information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)" Constructing Explanations and Designing Solutions • Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MS-PS1-6) Analyzing and Interpreting Data • Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2)		