SUBJECT: SCIENCE/Life Science

BOE APPROVAL: August 2016

Cliffside Park Public Schools

GRADE: 7

Unit 1: Structure and Properties of Matter

CONTENT AREA: General Physical Science	GRADES: 7	UNIT: 1 of 8
Pacing: Approx. 1 Month (September)		
Science and Engineering Practices **Developing and Using Models** - Develop a model to predict and/or describe phenomena. (MS-PS1-1) **Analyzing and Interpreting Data** - Analyze and interpret data to determine similarities and differences in findings. (MS-PS1- 2)	**Disciplinary Core Ideas** **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) • Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (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-PS1-2) **PS1.B: 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)	**Crosscutting Concepts** **Scale, Proportion, and Quantity** • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1) **Patterns** • Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2) ***Connections to Nature of Science*** **Scientific Knowledge is Based on Empirical Evidence** • Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)
Performance Expectations: MS-PS1-1, MS-PS1-2		
Evidence Statement(s): MS-PS1-1, MS-PS1-2		
Essential Question: How is it that everything is made of stardust?		
21st Century Skills: 9.2.8.B.3, 9.2.8.B.4		

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Career Ready Practices: CRP4, CRP6, CRP7

Technology: HS-ETS1-1 HS-ETS1-3

Technical Terms (Suggested)	Core Instructional Materials	Assessment Statement
Atoms Molecules Substance Pure Substances Characteristic Properties Matter Physical Properties Physical Changes Chemical Properties Chemical Changes Density Melting/Freezing Point Boiling/Condensation Point Solubility Flammability Models Mass Volume Compound Mixture States of Matter ** All terms should be taught in context rather than in isolation. These terms should be addressed after conceptual understanding.**	MS-PS1-1 - Chromebook, internet access, smartboard, notebook, pen, pencil, whiteboard. MS-PS1-2- Computer, Internet access, smartboard, notebook, pen, pencil, whiteboard.	Students who understand the concepts are able to: Part 1: • Develop a model of a simple molecule. • Use the model of the simple molecule to describe its atomic composition. • Develop a model of an extended structure. • Use the model of the extended structure to describe its repeating subunits. [Boundary: The substructure of atoms and the periodic table are learned in high school chemistry.] Part 2: • Analyze and interpret data to determine similarities and differences from results of chemical reactions between substances before and after they undergo a chemical process. • Analyze and interpret data on the properties of substances before and after they undergo a chemical process. • Identify and describe possible correlation and causation relationships evidenced in chemical reactions. • Make logical and conceptual connections between evidence that chemical reactions have occurred and explanations of the properties of substances before and after they undergo a chemical process.

Modifications

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English Language Learners	Special Education	At Risk	Gifted & Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning
Annotation guides	Extended time	Counseling	Critical/Analytical thinking tasks
Think-pair-share	Answer masking		Self-directed activities
Visual aides	Answer eliminator		
Modeling	Highlighter		
Cognates	Color contrast		

5E Model	
Performance Expectation: MS-PS1-1 **Develop models to describe the atomic composition of simple molecules and extended structures.**	
Engage: Anticipatory Set	What is an Atom? To introduce this topic, have students view the following video. This video will provide a basic introduction into structure of atoms and molecules. http://www.makemegenius.com/science-videos/grade_7/all-about-atoms-and-molecules-for-kids
Exploration: Student Inquiry	Have the students work in groups. Each group will be given a different simple molecule. Ex: ammonia, methanol. Research their molecule, find out its composition, identify the type of bond, and uses of the compound. Marshmallow Molecules http://betterlesson.com/lesson/634009/marshmallow-molecules Digital Models: https://phet.colorado.edu/en/simulation/build-a-molecule Research the molecular structure of ammonia and methanol. Using PowerPoint, work in a group to create a digital model of these simple molecules structures.
	In these lessons:

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Explanation: Concepts & Practices	Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): 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. Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)
Elaboration: Extension Activity	Have students create a digital model of a complex, extended structure. Some extended structures the students' research can include: Diamonds, Sugar, Nylon. https://phet.colorado.edu/en/simulation/build-a-molecule
Evaluation: Assessment	

5E Model	
Performance Expectation: MS-PS1-2 **Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.**	
Engage: Anticipatory Set	Amazing Chemical Reactions: https://www.youtube.com/watch?v=FofPjj7v414 http://betterlesson.com/lesson/634016/chemical-reactions-un-notes
Exploration: Student Inquiry	http://www.education.com/science-fair/article/balloon-gas-chemical-reaction/ Students are placed in small groups, and given samples of baking soda and white vinegar. In their groups, they must observe and classify each substance's individual physical properties. Using a graphic organizer, a list of each substance's properties will be collaboratively developed. After the initial investigation, one representative from each student group will share their group's list of physical properties with the whole class. During this time, students from different groups can record additional properties or correct mislabeled properties. The teacher will then briefly explain the exploration activity and appropriate safety procedures to students. Prior to the exploration activity, the teacher may ask the following guiding questions to engage students: · What do you think will happen when baking soda and vinegar come in contact (what will be produced)? · What do you think will happen to the balloon attached?

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	Using the funnel, each student group will add 2 tablespoons of baking soda to each balloon (two people may be needed for this; one person to hold the balloon open and the other person to put the baking soda inside of the balloon). Then the group will pour 4 ounces of vinegar into the bottle. Students will carefully fit the balloon over the bottle opening, and be careful not to drop the baking soda into the vinegar yet. Once the balloon is fitted snugly on the nozzle, students will hold up the balloon and allow the baking soda to fall into the vinegar. Students will observe the chemical reaction and effect on the balloon and record observations/data/visuals in their science journals. · Which two substances combined? · What happened when the two substances combined? How do you know? · What was formed as a product of the reaction? Explain your reasoning. · Why is this a chemical reaction? Use evidence to support your thinking.
Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): PS1.A: Structure and Properties of Matter Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2) PS1.B: 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)
Elaboration: Extension Activity	Student groups will reassemble and follow the same procedure from the exploration activity. However, the vinegar component will be replaced with a “mystery substance”. Each group will receive a different mystery substance (water, hydrogen peroxide) to combine with the baking soda. Following the experiment, students will have to determine whether or not a chemical reaction took place. If time permits, each group of students will research (using online resources) a career in the field of Chemistry in pursuit of the following information: · Briefly describe the purpose of this job. · What are some specific tasks? · What kind of education and experience is required? · Describe the kinds of places that people with this job might work. (For example, in a lab, outside, or in an office?) · In what types of companies do people with this job work? Using this research as a guide, each individual student of the group will create a narrative piece describing a day in the life of a person with that particular profession.
Evaluation: Assessment	

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How is it that everything is made of stardust?

Students build understandings of what occurs at the atomic and molecular scale. Students apply their understanding that pure substances have characteristic properties and are made from a single type of atom or molecule. They also provide a molecular level accounts to explain states of matter and changes between states. The crosscutting concepts of *cause and effect*, *scale, proportion and quantity*, *structure and function*, *interdependence of science, engineering, and technology*, and *the influence of science, engineering and technology on society and the natural world* provide a framework for understanding the disciplinary core ideas. Students demonstrate grade appropriate proficiency in *developing and using models*, and *obtaining, evaluating, and communicating information*. Students are also expected to use the scientific and engineering practices to demonstrate understanding of the core ideas.

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING PEs and DCIs
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. The substructure of atoms and the periodic table are learned in high school chemistry.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete depiction of all individual atoms in a complex molecule or extended structure.	PS1.1
2	**Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.** [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.] (MS-PS1-	PS1.2

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The Student Learning Objectives above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Developing and Using Models
Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.

- 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)

Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

- 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)

Obtaining, Evaluating, and Communicating Information
Obtaining, evaluating, and communicating information in 6–8 builds on K–5 and progresses to evaluating the merit and validity of ideas and methods.

- 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 not supported by evidence. (MS-PS1-3)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

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-PS1-2),(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)**

PS1.B: 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)**

PS3.A: Definitions of Energy

- **The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the**

Crosscutting Concepts

Patterns

- Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

Scale, Proportion, and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (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)

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)

Connections to Engineering,Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-PS1-3)

Influence of Science, Engineering and Technology on Society and the Natural World

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• Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2) **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** • Laws are regularities or mathematical descriptions of natural phenomena. (MS-PS1-5)	**transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects.*(secondary to MS-PS1-4)*** • **The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material).The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material.Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. *(secondary to MS-PS1-4)*** **ETS1.B: Developing Possible Solutions** • **A solution needs to be tested, and then modified on the basis of the test results, in order to improve it.*(secondary to MS-PS1-6)*** **ETS1.C: Optimizing the Design Solution** • **Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process - that is, some of the characteristics may be incorporated into the new design.*(secondary to MS-PS1-6)*** • **The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.*(secondary to MS-PS1-6)***	• The uses of technologies and any limitation on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-PS1-3)

Connections to other DCIs in this grade-band:

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MS.PS3.D *(MS-PS1-2),(MS-PS1-6);* ***MS.LS1.C*** *(MS-PS1-2),(MS-PS1-5);* ***MS.LS2.A*** *(MS-PS1-3);* ***MS.LS2.B*** *(MS-PS1-5);* ***MS.LS4.D*** *(MS-PS1-3);* ***MS.ESS2.A*** *(MS-PS1-2),(MS-PS1-5);* ***MS.ESS2.C*** *(MS-PS1-1),(MS-PS1-4);* ***MS.ESS3.A*** *(MS-PS1-3);* ***MS.ESS3.C*** *(MS-PS1-3)*

HS.ESS2.D (HS-LS2-7),(HS-LS4-6); **HS.ESS2.E** (HS-LS2-2),(HS-LS2-6),(HS-LS2-7),(HS-LS4-6); **HS.ESS3.A** (HS-LS2-2),(HS-LS2-7),(HS-LS4-6); **HS.ESS3.C** (HS-LS2-2),(HS-LS2-7); **HS.ESS3.D** (HS-LS2-2),(HS-LS4-6)

Articulation of DCIs across grade-bands:

5.PS1.A (MS-PS1-1); **5.PS1.B** (MS-PS1-2),(MS-PS1-5); **HS.PS1.A** (MS-PS1-1),(MS-PS1-3),(MS-PS1-4),(MS-PS1-6); **HS.PS1.B** (MS-PS1-2),(MS-PS1-4),(MS-PS1-5),(MS-PS1-6); **HS.PS3.A** (MS-PS1-4),(MS-PS1-6); **HS.PS3.B** (MS-PS1-6); **HS.PS3.D** (MS-PS1-6); **HS.LS2.A** (MS-PS1-3); **HS.LS4.D** (MS-PS1-3); **HS.ESS1.A** (MS-PS1-1); **HS.ESS3.A** (MS-PS1-3)

Common Core State Standards Connections:

ELA/Literacy -

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.*(MS-PS1-2)*,(MS-PS1-3)
RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.(MS-PS1-6)
RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). *(MS-PS1-1)*,(MS-PS1-2),*(MS-PS1-4),(MS-PS1-5)*
WHST.6-8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS1-6)
WHST.6-8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-PS1-3)

Mathematics -

MP.2	Reason abstractly and quantitatively. (MS-PS1-1),(MS-PS1-2),(MS-PS1-5)
MP.4	Model with mathematics. *(MS-PS1-1)*,(MS-PS1-5)
6.RP.A.3	Use ratio and rate reasoning to solve real-world and mathematical problems. *(MS-PS1-1),(MS-PS1-2)*,(MS-PS1-5)
6.NS.C.5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.(MS-PS1-4)
8.EE.A.3	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *(MS-PS1-1)*
6.SP.B.4	Display numerical data in plots on a number line, including dot plots, histograms, and box plots. *(MS-PS1-2)*
6.SP.B.5	Summarize numerical data sets in relation to their context. (MS-PS1-2)

ELA/Literacy -

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.*(MS-PS1-2)*,(MS-PS1-3)
RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.(MS-PS1-6)