Unit 3: Chemical Reactions

CONTENT AREA: General Physical Science	GRADES: 7	UNIT: 3 of 8
Pacing: Approx. 1 Month (November)		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Developing and Using Models - Develop a model to describe unobservable mechanisms. **(MS-PS1-5)** 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-ETS1-3)**	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-PS1-3) ● 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) 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) 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 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	**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) - **Connections to Nature of Science** **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** ● Laws are regularities or mathematical descriptions of natural phenomena. (MS-PS1-5)

	temperature difference between two objects. *(secondary to MS-PS1-4)*	

Performance Expectations: MS-PS1-5, MS-PS1-6, MS-ETS1-3

Evidence Statement(s): MS-PS1-5, MS-PS1-6, MS-ETS1-3

Essential Question: How do substances combine or change (react) to make new substances?

21st Century Skills: 9.2.8.B.3, 9.2.8.B.4

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-PS1-5 - Chromebook, internet access, smartboard, notebook, pen, pencil, whiteboard. MS-PS1-6- Computer, Internet access, smartboard, notebook, pen, pencil, whiteboard. MS-ETS1-3- Computer, Internet access, smartboard, notebook, pen, pencil, whiteboard.	Students who understand the concepts are able to: ● Use physical models or drawings, including digital forms, to represent atoms in a chemical process. ● Use mathematical descriptions to show that the number of atoms before and after a chemical process is the same.

Modifications

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-PS1-5. 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.** And **MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**				
Engage: Anticipatory Set	Conservation of Mass with Harry Potter https://youtu.be/3TsTOnNmkf8			
Exploration: Student Inquiry	Have students view the following video: The Law of Conservation of Mass https://www.youtube.com/watch?v=2S6e11NBwiw Conservation of Mass Lab http://www.cpalms.org/Public/PreviewResource/PrintResource/19026?display=block&Private=true&IsPrintPreview=true Discussion Questions: In which trials was the Law of Conservation of Mass DEMONSTRATED? In which trials was the Law of Conservation of Mass VERIFIED (confirmed, proven)? Why was there a difference between the mass of the reactants and the mass of the products in Trial #1? If the container in Trial #2 was covered (with the balloon), offer an explanation as to where the discrepancy (difference) arose between the mass of the reactants and the mass of the products.			

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.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. The total number of each type of atom is conserved, and thus the mass does not change.
Elaboration: Extension Activity	Have students create computer-generated models of both experiments using Google slides or another similar application in order to depict how the total number of atoms does not change in a chemical reaction. Labels should be written with details and include the following vocabulary terms: chemical and physical change, reactants, reaction, and law of conservation of mass.
Evaluation: Assessment	

5E Model				
Performance Expectation: MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes."				
Engage: Anticipatory Set	Matter and Its Interactions http://www.ck12.org/ngss/middle-school-physical-sciences/matter-and-its-interactions Discussion Questions: What type of chemical reaction occurs in a cold pack? Define this type of reaction. How is the reaction started in a cold pack? In the cold pack experiment in the video, what chemicals were used in the chemical reaction? What happened when they were mixed together? What did the beaker represent? How did the temperature of the beaker change? What type of chemical reaction occurs in a hot pack? Define this type of reaction. How is the reaction started in a hot pack? Describe the hot pack experiment in the video. Which part of the experiment represents what happens when a hot pack is used? How did the temperature of the beaker change?			
Exploration: Student Inquiry	The Lethargic Lizard http://betterlesson.com/lesson/634027/lethargic-lizard			

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.B: Chemical Reactions Some chemical reactions release energy, others store energy. 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) 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) 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)
Elaboration: Extension Activity	Related Activities Better Lessons: MS-PS1-6 http://betterlesson.com/next_gen_science/browse/2197/ngss-ms-ps1-6-undertake-a-design-project-to-construct-test-and-modify-a-device-that-either-releases-or-absorbs-thermal-energy-by/browse/2197/ngss-ms-ps1-6-undertake-a-design-project-to-construct-test-and-modify-a-device-that-either-releases-or-absorbs-thermal-energy-by
Evaluation: Assessment	

How do substances combine or change (react) to make new substances?

Students provide molecular-level accounts of states of matters and changes between states, of how chemical reactions involve regrouping of atoms to form new substances, and of how atoms rearrange during chemical reactions. Students also apply their understanding of optimization design and process in engineering to chemical reaction systems. The crosscutting concept of energy and matter provides a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in developing and using models, analyzing and interpreting data, designing solutions, and obtaining, evaluating, and communicating information. Students are also expected to use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING PEs and DCIs
1	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. [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms, that represent atoms.] [Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.] (MS-PS1-5)	PS1.5
2	Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.* [Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride.] [Assessment Boundary: Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.] (MS-PS1-6)	PS1.6
3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. (MS-ETS1-3)	ETS1-4

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

Evidence Statements: MS-PS1-5

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 describe unobservable mechanisms.

Connections to Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

Laws are regularities or mathematical descriptions of natural phenomena.

Evidence Statements: MS-PS1-6

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.

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.

Models of all kinds are important for testing solutions.

ETS1.C: Optimizing the Design Solution 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.

PS1.B: Chemical Reactions

Some chemical reactions release energy, others store energy.

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)

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)

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)

Crosscutting Concepts

PS1.5 and ETS1.4

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)

PS1.6

Energy and Matter

The transfer of energy can be tracked as energy flows through a designed or natural system.

Connections to other DCIs in this grade-band:

MS.LS1.C ; MS.LS2.B ; MS.ESS2.A ; MS.PS3.D

Articulation of DCIs across grade-bands:

5.PS1.B ; HS.PS1.B ; HS.PS1.A ; HS.PS1.B ; HS.PS3.A ; HS.PS3.B ; HS.PS3.D

Common Core State Standards Connections:

ELA/Literacy -

RST.6-8.7
RST.6-8.3,
WHST.6-8.7

Mathematics -

MP.2,
MP.4,
6.RP.A.3