# Unit 2: Interactions of Matter

| CONTENT AREA: General Physical Science | GRADES: 7 | UNIT: 2 of 8 |
|---|---|---|
| **Pacing: Approx. 1 Month (October)** | | |

## Science and Engineering Practices

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

**Developing and Using Models -**
Develop a model to predict and/or describe phenomena.
**(MS-PS1-4)**

## 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-PS1-3)
- 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 temperature difference between two objects. *(secondary to MS-PS1-4)*

## Crosscutting Concepts

### 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)

### Cause and Effect

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

---

***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

- 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)

| | | |
|---|---|---|
| | | |

**Performance Expectations:** MS-PS1-3, MS-PS1-4

**Evidence Statement(s):** MS-PS1-3, MS-PS1-4

**Essential Question: How can you tell what the molecules are doing in a substance?**

**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<br>Molecules<br>Substance<br>Pure Substances<br>Characteristic Properties<br>Matter<br>Physical Properties<br>Physical Changes<br>Chemical Properties<br>Chemical Changes<br>Density<br>Melting/Freezing Point<br>Boiling/Condensation Point<br>Solubility<br>Flammability<br>Models<br>Mass<br>Volume<br>Compound<br>Mixture<br>States of Matter<br>Thermal Energy<br>Temperature<br><br>** All terms should be taught in context rather than in isolation. These terms should be addressed after conceptual understanding.** | MS-PS1-3 - Chromebook, internet access, smartboard, notebook, pen, pencil, whiteboard.<br><br>MS-PS1-4- Computer, Internet access, smartboard, notebook, pen, pencil, whiteboard. | Students who understand the concepts are able to:<br><br>● Develop a model that predicts and describes changes in particle motion that could include molecules or inert atoms or pure substances.<br><br>● Use cause-and-effect relationships to predict changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed in natural or designed systems. |

**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-PS1-3**<br>**Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.** | | | | |
| **Engage:**<br>Anticipatory Set | Poster paper will be placed around the room. Each poster will have a natural resource as a title Trees, Oil, Soil, Natural Gas. Students will take post-its which includes common materials we use from Earth and place them under the natural resource posted associated with that the production of that material.<br><br>Use the following graph: Common Materials We Use from Earth<br>https://www.ck12.org/earth-science/Materials-Humans-Use/lesson/Materials-Humans-Use/?referrer=concept_details | | | |
| **Exploration:**<br>Student Inquiry | Clothing Matters<br>http://www.mineralseducationcoalition.org/pdfs/study/studyoftheearth.pdf<br>https://www.ck12.org/earth-science/Materials-Humans-Use/ | | | |
| **Explanation:**<br>Concepts & Practices | In these lessons:<br>Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities.<br>Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.<br>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):<br>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)<br>PS1.B: Chemical Reactions<br>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-PS1-3) |
| **Elaboration:**<br>Extension Activity | Have students complete additional activities from the following unit: A Study of the Earth- Natural Resources<br>http://www.mineralseducationcoalition.org/pdfs/study/studyoftheearth.pdf |
| **Evaluation:**<br>Assessment | |

| **5E Model** | | | | |
|---|---|---|---|---|
| **Performance Expectation: MS-PS1-4**<br>**Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.** | | | | |
| **Engage:**<br>Anticipatory Set | Introduction Video: States of Matter<br>http://betterlesson.com/lesson/639789/states-of-matter?from=search_lesson_title<br>https://www.youtube.com/watch?v=HAPc6JH85pM | | | |
| **Exploration:**<br>Student Inquiry | Crack that Marble Lab<br>http://betterlesson.com/lesson/634011/crack-that-marble-properties-of-matter-labs<br>Molecules in Motion<br>http://www.middleschoolchemistry.com/lessonplans/chapter1/lesson2 | | | |
| **Explanation:**<br>Concepts & Practices | In these lessons:<br>Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities.<br>Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.<br><br>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):<br>PS1.A: Structure and Properties of Matter | | | |

| | |
|---|---|
| | Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.<br>In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide.<br>In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.<br>The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.<br>PS3.A: Definitions of Energy<br>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 temperature difference between two objects. (secondary)<br>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) |
| **Elaboration:**<br>Extension Activity | Determine the melting and freezing points of a substance. Analyze a phase change curve.<br>Students will observe what happens as matter undergoes a phase change. Start with cetyl alcohol in the solid phase well below its melting point. Make observations as heat is added. Keep recording the temperature until the substance is totally melted. Reverse the process and let the same sample cool. (it will cool just sitting out at room temperature with the heat removed.)<br>Explain the relationship between temperature and the energy associated with the motion of atoms. Write a hypothesis of what a graph of the temperature changes will look like. Students will graph the results of the temperature changes. A representative from each group will describe each part of the graph using their own words. |
| **Evaluation:**<br>Assessment | |

*How can we trace synthetic materials back to natural ingredients?*

***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** | 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.] [Assessment Boundary: Assessment is limited to qualitative information.] (MS-PS1-3) | PS1.3 |
| **2** | 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. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.] (MS-PS1-4) | PS1.4 |

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-PS1-3**<br>**Obtaining, Evaluating, and Communicating Information**<br>**Obtaining, evaluating, and communicating information in 6–8 builds on K–5 and progresses to evaluating the merit and validity of ideas and methods.** | **PS1.A: Structure and Properties of Matter**<br>**Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.**<br><br>**PS1.B: Chemical Reactions**<br>**Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different** | **Crosscutting Concepts**<br>PS1.3<br>**Structure and Function**<br>**Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.** |

| | | |
|---|---|---|
| **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.**<br><br>**Evidence Statements: MS-PS1-4**<br>**Developing and Using Models**<br>**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.**<br><br>**Develop a model to predict and/or describe phenomena.** | **molecules, and these new substances have different properties from those of the reactants.**<br><br>**PS1.A: Structure and Properties of Matter**<br>**Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.**<br><br>**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.**<br><br>**The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.**<br><br>**PS3.A: Definitions of Energy**<br>**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 temperature difference between two objects. (secondary)**<br><br>**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** | **Connections to Engineering,Technology, and Applications of Science**<br>**Interdependence of Science, Engineering, and Technology**<br>**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.**<br>**Influence of Science, Engineering and Technology on Society and the Natural World**<br>**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.**<br><br>PS1.4<br>**Cause and Effect**<br>**Cause and effect relationships may be used to predict phenomena in natural or designed systems.** |

| | | |
|---|---|---|
| | **total number of atoms in the system, and the state of the material. (secondary)** | |

*Connections to other DCIs in this grade-band:*

*MS.LS2.A ; MS.LS4.D ; MS.ESS3.A ; MS.ESS3.C ; MS.ESS2.C*

*Articulation of DCIs across grade-bands:*

HS.PS1.A ; HS.LS2.A ; HS.LS4.D ; HS.ESS3.A ; HS.PS1.A ; HS.PS1.B ; HS.PS3.A

*Common Core State Standards Connections:*

*ELA/Literacy -*

**RST.6-8.1,**
**WHST.6-8.8**
**RST.6-8.7**

***Mathematics -***

**6.NS.C.5**