III Grade 8 Interactions of Matter G72

Content Area: **Science**
Course(s):
Time Period: **Generic Time Period**
Length: **40 Instructional Days**
Status: **Published**

Stage 1: Desired Results

What is matter, and how does it change?

What physical changes and energy changes occur as matter goes from one state to another?

Is it possible to tell if two substances mixed or if they reacted with each other?

How can you tell what the molecules are doing in a substance?

How can we trace synthetic materials back to natural ingredients?

Unit Overview/ Rationale

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.

This unit is based on MS-PS1-3 and MS-PS1-4.

Standards & Indicators

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.]

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)

(MS-PS1-3)

SCI.6-8.MS-PS1-3	Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
SCI.6-8.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.

Big Ideas - Students will understand that...

Students will locate information that describes changes in particle motion, changes in temperature, or changes in state as thermal energy is added to or removed from a pure substance. Students will then use models to predict and describe the changes in particle motion, temperature, and state of a pure substance. An example could include the change of state of water from its solid (ice) to liquid and vapor with the addition of thermal energy. Students will come to understand that this process is reversible through the removal of thermal energy, where the pure substance can return from a vapor to a liquid and back to a solid state.

Students who accurately demonstrate understanding will be able to develop qualitative molecular-level models of solids, liquids, and gases to show the cause-andeffect relationships of adding or removing thermal energy, which increases or decreases the kinetic energy of the particles until a change of state occurs. Models could include drawings and diagrams.

Students will also need to use mathematics to demonstrate their understanding of the particle motion that is taking place during these changes in state. They will use positive and negative

numbers to represent the changes in particle motion and temperature as thermal energy is added or removed. They will then integrate an expression of that same quantitative information in a visual format.

It is important to note that students will need to be responsible for developing the models that they use. It is possible that the teacher could model the process with one type of model and provide opportunities for students to use different types of model to illustrate the same process. After students have a firm understanding of the motion of particles during a phase change, they will be able to move to the next section of this unit. In this portion of the unit of study, students will apply their understanding of particle and chemical change from Unit 1 to make sense of how natural resources react chemically to produce new substances. Students will explain that as a result of the rearrangement of atoms during a chemical process, the synthetic substance has different characteristic properties than the original pure substance. For example, pure substances like methane, carbon monoxide, and carbon dioxide can be combined chemically to form synthetic fuel. The synthetic fuel would have different characteristic properties than the original pure substances.

Within this unit, students will gather, read, and synthesize qualitative information from multiple sources about the use of natural resources to form synthetic materials and how these new materials affect society. Examples of new materials could include new medicine, foods, and alternative fuels. Some sources could include journals, articles, brochures, or digital media from government publications and/or private industries. Students will cite some of these sources to support the analysis of evidence that these synthetic materials were formed from natural resources and have an impact on society. They will pay special attention to the precise details of explanations or descriptions of how these new substances affect society. Students will also include relevant information from multiple print and digital sources about these impacts. While gathering this information, they will use 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.

Essential Questions - What provocative questions will foster inquiry and transfer of learning

Chapter 7 - Foundations of Chemistry

- What is a substance?
- How do atoms of different elements differ?

- How do mixtures differ from substances?
- How can you classify matter?
- What are some physical properties of matter?
- How are physical properties used to separate mixtures?
- How can a change in energy affect the state of matter?
- What happens when something dissolves?
- What is meant by conservations of mass?
- What is a chemical property?
- What are some signs of chemical change?
- Why are chemical equations useful?
- What are some factors that affect the rate of chemical reactions?

Chapter 8 - States of Matter

- How do particles move in solids, liquids and gases?
- How are the forces between particles different in solids, liquids, and gases?
- How is temperature related to particle movement?
- How are temperature and thermal energy different?
- What happens to thermal energy when matter changes from one state to another?
- How does the kinetic molecular theory describe the behavior of a gas?
- How are temperature, prssure, and volume related in Boyle's Law?
- How is Boyle's Law different from Charles's Law?

Content - Students will know...

- Changes in particle motion, temperature, and state of a pure substance occur when thermal energy is added or removed.
- Qualitative molecular-level models of solids, liquids, and gases can be used to show that adding or removing

thermal energy increases or decreases the kinetic energy of the particles until a change of state occurs.

- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.
- In a liquid, the molecules are constantly in contact with others. • In a gas, the molecules 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.
- The changes of state that occur with variations in temperature or pressure can be described and predicted using models of matter.
- The term heat as used in everyday language refers both to thermal energy and the transfer of that thermal energy from one object to another.
- Thermal energy is the motion of atoms or molecules within a substance. • In science, heat is used to refer to the energy transferred due to the temperature difference between two objects.
- 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 the relationship between the average internal kinetic energy and the potential energy per atom or molecule 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.
- Cause-and-effect relationships may be used to predict and describe changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed in natural systems.
- Each pure substance has characteristic physical and chemical properties that can be used to identify it.
- Substances react chemically in characteristic ways.
- In a chemical process, the atoms that make up the original substances are regrouped into different molecules.
- New substances that result from chemical processes have different properties from those of the reactants.
- Natural resources can undergo a chemical process to form synthetic material.
- Structures can be designed to serve particular functions by taking into account properties of different materials and how materials can be shaped and used.
- Engineering advances have led to discoveries of important synthetic materials, and scientific discoveries have led to the development of entire industries and engineered systems using these materials.
- Technology use varies from region to region and over time.
- The uses of technologies (engineered/synthetic materials) and any limitations on their use are driven by individual or societal needs, desires, and values.

- The uses of technologies (engineered/synthetic materials) and any limitations on their use are driven by the findings of scientific research and by differences in such factors as climate, natural resources, and economic conditions.

Skills - Students will be able to...

- Develop a model that predicts and describes changes in particle motion that could include molecules or inert atoms or pure substances.
- 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.
- Obtain, evaluate, and communicate information to show that synthetic materials come from natural resources and affect society.
- Gather, read, and synthesize information about how synthetic materials formed from natural resources affect society.
- Assess the credibility, accuracy, and possible bias of each publication and methods used within the publication.
- Describe how information about how synthetic materials formed from natural resources affect society is supported or not supported by evidence.

Stage 2: Assessment Evidence

Assessment

End of Unit Assessments (mulitple-choice and contstructed responses.)

Mini-Lab Performance-based Assessments

Essential Question Responses

Page Keeley Science Probes (formative assessments)

Stations Labs Tasks

Stage 3: Learning Plan

Learning Activities

Academic Vocabulary Activities: journals, e-flash cards, puzzles, e-games

Mini-Labs (student engagement)

Launch Labs (teacher and/or student led)

Inquiry Labs (use of inquiry skills)

Interactive technology: classroom presentations, science videos, transparencies, interactive whiteboard activities, online assessments

Language arts strategies: make tables, answer guiding questions, organizing ideas, illustrating ideas, outlines, infer meaning, compare and contrast, make connections

Accommodations for students with IEPs and learning difficulties:

-Visual sentence frames using academic vocabulary for discussion

-Graphic organizers and sentence starters for literary analysis writing

-Graphic organizers for comparing and contrasting of characters, plot, and theme in order to create a written narrative.

-Graphic organizers/worksheets for book club roles that explains in detail about what each role entails

-Use visuals to show important vocabulary for students to make connections

-Have students share their text to text, text to world, and text to self-connections

-One on one teacher support for comprehension and fluency

-Modeling and scaffolding to highlight specific moments, vocabulary, and figurative language, and using context clues to use inference skills

-Show and discuss exemplar writing pieces before students being their own

-Close reading chapters/chunks

-Re-reading key sections for fluency and comprehension

-Colored overlays and reading windows to reduce visual distractions

-Sentence starters for writing assignments

-Vocabulary word banks and strategies (Say it, Define it, Act it)

-Think aloud and Think-Pair-Share

For ELL students:

-Visuals for vocabulary

-Word wall

-Additional word work such as illustrating vocabulary and playing vocabulary games

-Partner reading

-Choral reading

-Think-aloud while modeling writing

-Analyze sample summaries before writing

-Color-coded sticky notes for close reading to identify which sticky notes pertain to vocabulary

-Questions about text, etc.

-When students make an error in speaking, answer or restate what they said using the correct form without drawing attention to the mistake.

For gifted students:

-Have students complete extended research projects on a related issue of their choice as it pertains to a content area

-Students perform a written/oral debate on topics related to content

Resources

NJ DOE Model Curriculum, 2016

Glencoe iScience, McGraw Hill, 2012

Paige Keeley Science Probes

BrainPop shorts

"What's Science Got to Do With It" video segments

Kesler's 5E Lessons and Station Labs

Unit Reflections & Teacher Notes