Somers Point School District

Curriculum

Science

Grade 8

August 2016

Board Approved: September 2016

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Somers Point Schools

Mission and Beliefs

Mission

Empower each student to make responsible choices, meet challenges, achieve personal success, and to contribute to a global society as they apply the New Jersey Core Curriculum Standards to become autonomous, lifelong learners who are literate, problem solvers across all disciplines.

Beliefs

Beliefs: We believe that our empowered learners:

- Participate in educational programs that are designed to meet the needs of learners while providing challenging activities in the context of real life situations.
- Are aware of community issues and take part in activities to better their community.
- Acquire basic skills in obtaining information, thinking critically, solving problems and communicating effectively.
- Develop intellectual curiosity and the ability to access information as needed
- Become reflective learners that have an understanding of their own strengths and weaknesses.
- Develop the aptitudes and skills to adjust to a changing world and an unpredictable future.
- Are lifetime learners who value and accept learning as a continuing and dynamic process affecting all aspects of life.

PROGRAM PHILSOSOPHY, GOALS, AND BELIEFS

Philosophy

An effective science curriculum…

- Reflects the belief that all students can and must learn enough science to assume their role as concerned citizens equipped with necessary information and decision-making skills;
- Reflects a nature of knowledge, pedagogy, and nature of human development linked to empirical research;
- Recognizes that an inquiry-based method is used to study sound science content;
- Encourages teachers to view that the study of science should be interesting and relevant to students' lives, emphasize student understanding through inquiry and be connected with other school subjects especially math.

Unifying Concepts and Processes

An effective science curriculum incorporates the following while addressing the content areas…

1. Systems, order and organizations
2. Evidence, models and explanation
3. Changes, constancy and measurement
4. Evolution and equilibrium
5. Form and function
6. Abilities to do and understanding of scientific inquiry
7. Technology
8. Social perspective

Educational Goals & Beliefs

- Inquiry is an effective method to actively involve students.
- All students share a natural curiosity about the world around them.
- Curriculum provides real world connections.
- Effective instruction integrates concepts within science and other content areas.
- Assessment is ongoing, diagnostic, and aligned with instruction.
- Students can improve their community and the world through problem-solving.
- The broad goal of a science program should be to foster understanding, interest, and appreciation of the world in which we live.

New Jersey State Department of Education
Student Learning Standards

Science Education in the 21st Century

"Today more than ever before, science holds the key to our survival as a planet and our security and prosperity as a nation" (Obama, 2008).

Scientific literacy assumes an increasingly important role in the context of globalization. The rapid pace of technological advances, access to an unprecedented wealth of information, and the pervasive impact of science and technology on day-to-day living require a depth of understanding that can be enhanced through quality science education. In the 21st century, science education focuses on the practices of science that lead to a greater understanding of the growing body of scientific knowledge that is required of citizens in an ever-changing world.

Mission: *Scientifically literate students possess the knowledge and understanding of scientific concepts and processes required for personal decision-making, participation in civic and cultural affairs, and economic productivity.*

Vision: A quality science education fosters a population that:

- Experiences the richness and excitement of knowing about the natural world and understanding how it functions.
- Uses appropriate scientific processes and principles in making personal decisions.
- Engages intelligently in public discourse and debate about matters of scientific and technological concern.
- Applies scientific knowledge and skills to increase economic productivity.

Then 2016 NJ science standards can be accessed at: http://www.state.nj.us/education/aps/cccs/science/

Assessment Note:
All 4th & 8th grade students take the state end of year assessment the NJ ASK or the Alternative Proficiency Assessment when applicable.

Unit Title: Body Systems
Grade Level: 8th
Timeframe: 15 days (40 minute periods)

Essential Questions

1. What are the building blocks of life?
2. How does each part of a cell function?
3. How is the body a system of interacting subsystems composed of groups of cells?
4. What are fundamental differences between animal and plant cells pertaining to cell reproduction?
5. How do our sensory receptors send information to our brain?

Standards

Standards/Cumulative Progress Indicators (Taught and Assessed):

This unit is based on MS-LS1-3 and MS-LS1-8.

Highlighted Career Ready Practices:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

Instructional Plan				Reflection
Pre-assessment: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.				
SLO	**Student Strategies**	**Formative Assessment**	**Activities and Resources**	**Reflection**
Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.	Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.	Use an oral and written argument supported by evidence to support or refute an explanation or a model of how the body is a system of interacting subsystems composed of groups of cells.	In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS1-3) Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. (MS-LS1-8)	All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of

				cells that work together to form tissues and organs that are specialized for particular body functions. Cells form tissues, which form organs, which form systems. Sensory receptors send messages to our brain.
Benchmark Assessment: Sense receptors respond to different inputs (electromagnetic, mechanical, chemical). Sense receptors transmit responses as signals that travel along nerve cells to the brain. Signals are then processed in the brain. Brain processing results in immediate behaviors or memories. Cause-and-effect relationships may be used to predict response to stimuli in natural systems.				
Summative Written Assessments				
1. What are the building blocks of life? 2. How does each part of a cell function? 3. How is the body a system of interacting subsystems composed of groups of cells? 4. What are fundamental differences between animal and plant cells pertaining to cell reproduction? 5. How do our sensory receptors send information to our brain?				
Summative Performance Assessment				
Determine whether something is living or non-living.				

Explain how cells are the building blocks of life Build models of both a plant and animal cell and be able to demonstrate key characteristics that define both Describe how multicellular subsystems interact and work together to form tissue and organs that are specialized to particular body functions. Explain the similarities and differences between a chicken wing and a human arm Explain how our brain receives messages	

Unit Title: Chemical Reactions
Grade Level: 8th
Timeframe: 25 days (40 minute periods)

Essential Questions

1. What happens when substances react chemically?
2. What happens to atoms of the original substances when a reaction occurs?
3. Will the properties of the substance that is produced as part of a reaction be the same as those of the original substances?
4. What happens to the total mass of all atoms as a reaction takes place?
5. How does the amount of stored energy change during a chemical reaction?
6. How does the everyday definition of “heat” differ from the scientific definition?
7. When does heat transfer between two objects?
8. How are temperature and energy related?

Standards

Standards/Cumulative Progress Indicators (Taught and Assessed):

This unit is based on MS-PS1-5, MS-PS1-6 & MS-ETS1-3.

Highlighted Career Ready Practices:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

Instructional Plan				
Pre-assessment: When two or more different substances are mixed, a new substance with different properties may be formed. No matter what reaction or change in properties occurs, the total weight of the substances does not change.				
SLO	**Student Strategies**	**Formative Assessment**	**Activities and Resources**	**Reflection**
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. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.	Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms, that represent atoms. Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces. 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	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.	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) 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) 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)	How to determine if a chemical reaction has occurred. How atoms can rearrange and combine to form new substances. Key, easily observable properties of chemical substances. That properties of substances may change during a chemical reaction. That total mass in a reaction must be conserved. That some reactions can

	dissolving ammonium chloride or calcium chloride.] Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.		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)	absorb energy That some reactions can release energy That heat is transferred from an object at higher temperature to an object at lower temperature. That heat transfer stops when the objects reach the same temperature.
Benchmark Assessment: 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 created in a chemical process have different properties from those of the reactants. The total number of each type of atom in a chemical process is conserved, and thus the mass does not change (the law of conservation of matter). Matter is conserved because atoms are conserved in physical and chemical processes. The law of conservation of mass is a mathematical description of natural phenomena.				
Summative Written Assessments				
1. What happens when substances react chemically? 2. What happens to atoms of the original substances when a reaction occurs? 3. Will the properties of the substance that is produced as part of a reaction be the same as those of the original substances? 4. What happens to the total mass of all atoms as a reaction takes place? 5. How does the amount of stored energy change during a chemical reaction? 6. How does the everyday definition of “heat” differ from the scientific definition? 7. When does heat transfer between two objects? 8. How are temperature and energy related?				

Summative Performance Assessment	
Describe observable cues that a chemical reaction has occurred. Distinguish between chemical substances based on observable properties. Develop an atomic level model to explain how atoms rearrange to form new substances during a chemical reaction. Distinguish between reactions that absorb energy and reactions that release energy. Explain when heat will transfer between two objects and in which direction the heat will flow.	

Unit Title: Earth Systems
Grade Level: 8th
Timeframe: 30 days (40 minute periods)

Essential Questions

1. Have the Earth's continents always looked the way they do today?
2. What causes Earth's continents to move?
3. In what ways do Earth's plates interact? What happens at these plate boundaries?
4. What causes earthquakes, tsunamis and volcanoes?

Standards

Standards/Cumulative Progress Indicators (Taught and Assessed):

This unit is based on MS-ESS1-4, MS-ESS2-1, MS-ESS2-2 & MS-ESS2-3

Highlighted Career Ready Practices:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

Instructional Plan	
Pre-assessment: Some kinds of plants and animals that once lived on Earth are no longer found anywhere. Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features of Earth. Living things affect the physical characteristics of their regions. A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.	

SLO	Student Strategies	Formative Assessment	Activities and Resources	Reflection

Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.	Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions. Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials. Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic	Construct a scientific explanation based on valid and reliable evidence from rock strata obtained from sources (including the students' own experiments). Construct a scientific explanation based on rock strata and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	The geological time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1-4) All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1) The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2) Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)	Earth's continents were once all connected in one supercontinent. Earth's plates continue to move still today as a result of convection currents in the mantle. Earth's plates meet at convergent, divergent and transform boundaries.. Convergent boundaries create mountain ranges. Divergent boundaries cause seafloor spreading. Transform boundaries can result in earthquakes. Tsunamis are caused by underwater earthquakes. Volcanoes can form at both convergent and divergent plate boundaries.

	events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate. Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).			
Benchmark Assessment: The geologic time scale is used to organize Earth's 4.6-billion-year-old history. Rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.				
Summative Written Assessments				
1. Have the Earth's continents always looked the way they do today? 2. What causes Earth's continents to move? 3. In what ways do Earth's plates interact? What happens at these plate boundaries? 4. What causes earthquakes, tsunamis and volcanoes?				
Summative Performance Assessment				
Explain how fossil records provide scientists with evidence of continental drift and Pangaea.				

Relate the convection currents in the mantle to the motion of the tectonic plates on the surface. Identify the three types of plate boundaries and explain how plate interactions reshape Earth's surface.	

Unit Title: Interactions of Matter
Grade Level: 8th
Timeframe: 20 days (40 minute periods)

Essential Questions

1. What is matter and how do we measure it?
2. What is an atom and how is it structured?
3. How is the Periodic Table of Elements arranged and what does an element's placement tell you about the substance?
4. What is the difference between a physical and a chemical property and what are some examples of each?
5. What are the states of matter and what role does thermal energy play in changing matter's state?

Standards

Standards/Cumulative Progress Indicators (Taught and Assessed):

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

Highlighted Career Ready Practices:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

Instructional Plan				
Pre-assessment: Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) When two or more different substances are mixed, a new substance with different properties may be formed. No matter what reaction or change in properties occurs, the total weight of the substances does not change.				
SLO	**Student Strategies**	**Formative Assessment**	**Activities and Resources**	**Reflection**
Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. 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.	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. 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	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.	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) 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,	Everything in the universe is made of matter. Elements are composed of atoms which are simple substances that can't be broken down into other substances. How the Periodic Table is arranged. Molecules are combinations of various elements that result in brand new substances. Examples of physical and chemical properties of matter and the difference between the two groups.

	include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.		atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models matter. (MS-PS1-4)	How to calculate using the density formula. Characteristics of solids, liquids and gases and that thermal energy is responsible for the changes of phases of matter.
Benchmark Assessment: 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.	
Summative Written Assessments	
1. What is matter and how do we measure it? 2. What is an atom and how is it structured? 3. How is the Periodic Table of Elements arranged and what does an element's placement tell you about the substance? 4. What is the difference between a physical and a chemical property and what are some examples of each? 5. What are the states of matter and what role does thermal energy play in changing matter's state?	
Summative Performance Assessment	
Describe the basic structures of atoms and molecules Demonstrate how both mass and volume are measured and then use this information to calculate for density. Distinguish between weight and mass. Describe the difference between physical and chemical properties and give examples of each. Display the ability to read the Periodic Table of Elements and describe elements based on their location in the chart. Distinguish between solids, liquids and gases based on distinct characteristics.	

Unit Title: Structure and Properties of Matter **Grade Level: 8th** **Timeframe: 20 days (40 minute periods)**
Essential Questions
1. What is matter and how do we measure it? 2. What is an atom and how is it structured? 3. How is the Periodic Table of Elements arranged and what does an element's placement tell you about the substance? 4. What is the difference between a physical and a chemical property and what are some examples of each? 5. What are the states of matter and what role does thermal energy play in changing matter's state?

Standards
Standards/Cumulative Progress Indicators (Taught and Assessed): This unit is based on MS-PS1-1 and MS-PS1-2 **Highlighted Career Ready Practices:** CRP2. Apply appropriate academic and technical skills. CRP4. Communicate clearly and effectively and with reason. CRP5. Consider the environmental, social and economic impacts of decisions. CRP6. Demonstrate creativity and innovation. CRP7. Employ valid and reliable research strategies. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity. CRP12. Work productively in teams while using cultural global competence.

Instructional Plan	Reflection
Pre-assessment: Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) When two or more different substances are mixed, a new substance with different properties may be formed. No matter what reaction or change in properties occurs, the total weight of the substances does not change.	

SLO	Student Strategies	Formative Assessment	Activities and Resources	Reflection
Develop models to describe the atomic composition of simple molecules and extended structures. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.	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 Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.	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.	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) Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)	Everything in the universe is made of matter. Elements are composed of atoms which are simple substances that can't be broken down into other substances. How the Periodic Table is arranged. Molecules are combinations of various elements that result in brand new substances. Examples of physical and chemical properties of matter and the difference between the two groups. How to calculate using the density formula. Characteristics of solids, liquids and gases and that thermal energy is responsible for the changes of phases of matter.
Benchmark Assessment: Substances are made from different types of atoms. Atoms are the basic units of matter. Substances combine with one another in various ways. Molecules are two or more atoms joined together. Atoms form molecules that range in size from two to thousands of atoms. Molecules can be simple or very complex.				

Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).	
Summative Written Assessments	
1. What is matter and how do we measure it? 2. What is an atom and how is it structured? 3. How is the Periodic Table of Elements arranged and what does an element's placement tell you about the substance? 4. What is the difference between a physical and a chemical property and what are some examples of each? 5. What are the states of matter and what role does thermal energy play in changing matter's state?	
Summative Performance Assessment	
Describe the basic structures of atoms and molecules Demonstrate how both mass and volume are measured and then use this information to calculate for density. Distinguish between weight and mass. Describe the difference between physical and chemical properties and give examples of each. Display the ability to read the Periodic Table of Elements and describe elements based on their location in the chart. Distinguish between solids, liquids and gases based on distinct characteristics	

Unit Title: Thermal Energy
Grade Level: 8th
Timeframe: 30 days (40 minute periods)

Essential Questions

1. How is temperature related to kinetic energy?
2. What are three scales commonly used to measure temperature and how do they relate to on another?
3. Why do things feel hot or cold?
4. What is the definition of thermal energy and how does it relate to heat?
5. How do conductors and insulators differ?
6. What are the 1st and 2nd laws of thermodynamics?
7. What to heat engines do?

Standards

Standards/Cumulative Progress Indicators (Taught and Assessed):

This unit is based on MS-PS3-2, MS-PS3-3, MS-PS3-4, MS-ETS1-1, MS-ETS1-2 and MS-ETS1-4

Highlighted Career Ready Practices:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

Instructional Plan	
Pre-assessment:	

Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. Light transfers energy from place to place. Energy can be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. Transforming the energy of motion into electrical energy may have produced the currents to begin with. When objects collide, the contact forces transfer energy so as to change the objects' motions.				
SLO	**Student Strategies**	**Formative Assessment**	**Activities and Resources**	**Reflection**
Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible	Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup. Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added	Individually and collaboratively plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of particles as measured by the temperature of the sample. As part of a planned investigation, identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. Make logical and conceptual connections between evidence and	Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3),(MS-PS3-4) The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4) Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3) When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2)	The temperature of a substance is proportional to the average kinetic energy of the substance's molecules. Things expand when heated and contract when cooled due to the increase/decrease in kinetic energy. The three common scales to measure temperature (Kelvin, Celsius, and Fahrenheit) The difference between temperature and thermal energy. Three methods of heat transfer: convection, conduction and radiation. How conductors and insulators differ.

solutions. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. 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.		explanations.		The direction of heat flow and the 2nd law of thermodynamics. The variables that affect temperature change in an object. The definition of specific heat (capacity). The 1st law of thermodynamics and how it relates to energy. What heat engines do.
Benchmark Assessment: There are relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of particles as measured by the temperature of the sample. Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. Proportional relationships among the amount of energy transferred, the mass, and the change in the average kinetic energy of particles as measured by temperature of the sample provide information about the magnitude of properties and processes.				
Summative Written Assessments				
1. How is temperature related to kinetic energy? 2. What are three scales commonly used to measure temperature and how do they relate to on another? 3. Why do things feel hot or cold? 4. What is the definition of thermal energy and how does it relate to heat? 5. How do conductors and insulators differ? 6. What are the 1st and 2nd laws of thermodynamics? 7. What to heat engines do?				

Summative Performance Assessment	
Relate the motion and spacing of a substance's particles to the substance's temperature. Describe why object's expand or contract in terms of the temperature change of the object as well as the motion of the object's particles. Measure a substance's temperature using a standard thermometer and convert between Kelvin, Celsius and Fahrenheit. Relate thermal expansion/contraction to how thermometers work. Identify when substances can have the same temperature but possess different amounts of thermal energy. Differentiate between examples of convection, conduction and radiation. Use their knowledge of conductors and insulators to maximize and minimize thermal energy transfer. Determine temperature changes between two objects that exchange thermal energy. Be able to describe what happens to usable energy in a system. Describe the relationship between energy transferred, type/amount of matter, and temperature. Use the thermal energy/specific heat equation to calculate: temperature change, heat added or lost, mass of objects, and specific heats. Determine qualitatively the relative temperature of objects given a heat input and the objects' specific heat capacity. Describe examples of the 1^{st} law of thermodynamics Identify examples of heat engines, specifically an internal combustion engine.	