Great Meadows Regional School District
Science Curriculum
Grade 8

CURRICULUM GUIDE
Approved
August 22, 2017

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Developed by:

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This curriculum may be modified through varying techniques, strategies and materials, as per an individual student's Individualized Education Plan (IEP).

Approved by the Great Meadows Board of Education
At the regular meeting held on August 22, 2017

And

Aligned with the New Jersey Student Learning Standards for Science

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Philosophy and Rationale

Science, engineering, and technology influence and permeate every aspect of modern life. Some knowledge of science and engineering is required to engage with the major public policy issues of today as well as to make informed everyday decisions, such as selecting among alternative medical treatments or determining how to invest public funds for water supply options. In addition, understanding science and the extraordinary insights it has produced can be meaningful and relevant on a personal level, opening new worlds to explore and offering lifelong opportunities for enriching people's lives. In these contexts, learning science is important for everyone, even those who eventually choose careers in fields other than science or engineering.
Source: NJ Student Learning Standards for Science.

Scope and Sequence

Unit 1 – Measurement systems and units of measurement – 12 days

Content

- Explain origins of metric and U.S. systems of measurement.
- Introduce units of measurement for each system.
- Teach and practice measurement conversions within each system and between systems.

Practices

- Ask questions and define problems.
- Display, explain, and practice with measurement tools.
- Introduce the fraction conversion method for changing from U.S. to metric or vice versa.

Unit 2 – Properties of Matter - 24 days

Content

- Describe physical and chemical properties and how they differ.
- Analyze properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- Predict the buoyancy of various objects in water by calculating density.

Practices

- Develop and use a model to describe phenomena.
- Analyze and interpret data to determine similarities and differences in findings.
- Construct a scientific explanation based on valid and reliable evidence obtained from a variety of sources and interpretations of theories and laws that govern the natural world.

Unit 3 – States of Matter and Changes of State – 24 days

Content

- Describe that matter can exist in different phases or states.
- Develop a model that describes changes in particle motion and state of a pure substance when energy is added or removed.

Practices

- Ask questions to identify and clarify evidence of an argument.
- Analyze and interpret data to determine similarities and differences in findings.
- Construct a scientific explanation based on valid and reliable evidence obtained from a variety of sources and interpretations of theories and laws that govern the natural world.

- Construct arguments supported by evidence and scientific reasoning.

Unit 4 – Energy and Energy Transfer – 28 days

Content

- Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and its speed.
- Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
- Describe seven forms of energy and the ability of energy to change forms.
- Demonstrate that the total amount of energy in a closed system remains the same even when energy conversions take place.
- Use scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- Use mathematical principles of scale to construct a graph of the three different temperature scales.

Practices

- Develop a model to describe phenomena and unobservable mechanisms.
- Ask questions to identify and clarify evidence of an argument.
- Analyze and interpret data to determine similarities and differences in findings.
- Analyze and interpret data to provide evidence for phenomena.
- Construct a scientific explanation based on valid and reliable evidence obtained from a variety of sources and interpretations of theories and laws that govern the natural world.
- Construct arguments supported by evidence and scientific reasoning.

Unit 5 – Electromagnetic waves – 8 days

Content

- Use mathematical representations to describe how the amplitude of a wave is related to the energy transmitted
- Relate the types of electromagnetic radiation (infrared, visible light, etc.) to the electromagnetic spectrum
- Use models to show that when light shines on an object it can be reflected, absorbed, or transmitted

Practices

- Ask questions and define problems.
- Plan and carry out investigations of wave properties, both mechanical and electromagnetic.

Unit 6 – Atomic Structure – 24 days

Content

- Describe the subatomic particles which make up an atom, and their relationship to each other
- Introduce the concept of electrical charge (positive and negative)
- Develop models to describe the atomic composition of simple molecules and extended structures.
- Classify matter as either a pure substance or a mixture depending on the types of atoms/molecules the matter contains.

Practices

- Develop a model to describe phenomena and unobservable mechanisms.
- Analyze and interpret data to determine similarities and differences in findings.
- Construct a scientific explanation based on valid and reliable evidence obtained from a variety of sources and interpretations of theories and laws that govern the natural world.
- Construct arguments supported by evidence and scientific reasoning.

Unit 7 – Periodic Table of the Elements – 26 days

Content

- Explain that all matter is made of atoms and that each element is made of a different type of atom
- Use a model to demonstrate the concept of periodicity
- Describe the development of the modern Periodic Table, using atomic structure as the guide
- Introduce the concept of valence electrons and their relevance to the Table.

Practices

- Develop a model to describe phenomena and unobservable mechanisms.
- Analyze and interpret data to determine similarities and differences in findings.
- Construct a scientific explanation based on valid and reliable evidence obtained from a variety of sources and interpretations of theories and laws that govern the natural world.
- Construct arguments supported by evidence and scientific reasoning.
- 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 solutions.

- 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.

Unit 8 - Chemical Reactions – 18 days

Content

- Use models to show that the atoms of the original molecules are rearranged into different molecules and those new substances have different properties from those of the reactants.
- Conduct experiments to show that some chemical reactions release energy and that some store (absorb) energy.
- Conduct an experiment to show that the total mass of the reactants is the same as the total mass of the products (Law of Conservation of Energy).

Practices

- Develop a model/conduct experiments to describe phenomena and unobservable mechanisms.
- Ask questions to identify and clarify evidence of an argument.
- Analyze and interpret data to determine similarities and differences in findings.
- Analyze and interpret data to provide evidence for phenomena.
- Construct a scientific explanation based on valid and reliable evidence obtained from a variety of sources and interpretations of theories and laws that govern the natural world.

Mission Statement

The Great Meadows Regional School District will provide quality educational opportunities that ensure the individual success of all students within a safe and supportive environment. and build lifelong learners who will meet society's challenges into and beyond the 21'st century. To that end, it is anticipated that all students will achieve The NJ Student Learning Standards at all grade levels.

Unit 1 – Measurements and Measurement Systems

Stage 1: Desired Results

Content Standards

- **6**.**RP-3-d** (Math) Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

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Essential Questions

- What are the units of measurement, in each system, for mass, distance, volume, and temperature?
- How are conversions made within each system and between systems (e.g. feet to meters)?

Enduring Understandings

- Most countries and scientists use the metric (S.I.) system for daily use and commerce. The United States uses the "English" system — now known as the U.S Standard System — for daily use, but U.S. scientists work in the metric system.
- Because of the two different systems, an understanding of how to mathematically convert between them is helpful for science and daily living.

Knowledge and Skills (SWBAT)

- Recognize by name which units of measurement are metric and which are U.S.
- Make number conversions within each system (feet to inches, kilograms to grams).
- Use the fraction conversion (ratio) method to change from units of one system to the other (e.g. ounces to grams).

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods (formative, summative, other evidence and/or student self-assessment)

Formative: informal observation, discussion (large group and partner share), quizzes.
Summative: Practical based unit tests, mid-year and year-end grade level assessment.

Stage 3: Learning Plan

In this unit, students will learn the units of measurement for the two different systems and practice making measurements, as well as using math to convert between the two systems. The unit will be introduced through an activity during which students attempt to fill in the blanks of an enlarged U.S. ruler. Students will progress to reviewing the U.S. units for volume and mass.

As the metric system is introduced students will be taught the fraction conversion method for unit conversion, which can be used either to change within the same system or between systems.

Student learning will progress as students memorize a few conversion factors (e.g. one inch = 2.54 cm) which are useful in science and daily living. A metric number line will then be introduced to provide students a useful tool for making conversions within the metric system.

Cross curricular connections:

Mathematics - Students will utilize mathematics to collect data related to mass, distance, and volume. They will use fraction multiplication and division when performing conversions, and will be shown how units of measurement "move through" the conversion problem as they calculate.

English Language Arts/Literacy - Students will utilize ELA skills through online research of measurement systems, and knowledge of measurement vocabulary.

21st Century Skills -

- Critical thinking and Problem Solving
- Communication and Collaboration through lab reports and small group activities
- Information and Media Literacy
- Classroom Computers and Laptops for research, data collection, and lab reports

Modifications

- Structure lessons around questions that are authentic/phenomena based, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a phenomena-based, social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Time Allotment: 12 days

Resources:

Suggested resources will include but are not limited to the following:

- District approved science textbook
- Assessments
- Websites
- Videos
- Teacher-created metric number line
- Nonfiction/fiction sources
- Laboratory investigations
- STEM/STEAM activities

Unit 2 – Properties of Matter

Stage 1: Desired Results

Content Standards

- **MS-PS1-1** Develop models to describe the atomic composition of simple molecules and extended structures
- **MS-PS1-2** Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- **MS-PS1-3**. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society

Essential Questions

- What are the physical and chemical properties of matter, and how do they differ?
- What is density, how does density affect buoyancy, and how is density calculated?
- What changes at the atomic level when a substance undergoes a chemical change?

Enduring Understandings

- Substances are made from different types of atoms, which combine with one another in various ways.
- Density is the physical property of matter which relates the mass of a substance/object to its volume. Objects/substances with lower density will float on substances of higher density.
- Each pure substance has characteristic physical and chemical properties that can be used to identify it.

Knowledge and Skills (SWBAT)

- Distinguish between chemical and physical properties of matter.
- Distinguish between chemical and physical changes of matter.
- Create or draw a model describing the atomic composition of simple molecules.
- Examine data and materials to determine if a chemical change has occurred.
- Describe how a pure substance is made of one type of particle, either atom or molecule.
- Ask questions and define problems.
- Plan and carry out investigations identifying independent and dependent variables and controls, necessary tools, and adequate data collection procedures.
- Construct explanations and design solutions by applying scientific ideas and principles.
- Construct arguments supported by evidence and scientific reasoning.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods (formative, summative, other evidence and/or student self-assessment)

Formative: informal observation, discussion (large group and partner share), lab reports, quick writes, short constructed response, quizzes.

Summative: written lab summaries/explanations, practical based unit tests, mid-year and year-end grade level assessment.

Stage 3: Learning Plan

In this unit, students will begin their investigation of chemistry by reviewing the physical properties of matter and then learning some of the chemical properties of matter. Models of atomic structure will be used to demonstrate the difference between a physical change and chemical change. Density will be explored in depth, both mathematically and physically. Students will measure and calculate the density of various substances/objects and will be able to predict how they might arrange themselves when combined. A pictorial chart will be created showing the difference between a pure substance and a mixture.

Cross curricular connections:

Mathematics - Students will use mathematics to collect, organize, and compare data related to objects/substances in the classroom. They will calculate density using correct units of measurement, and during these exercises will utilize the skills learned in Unit 1 to change between U.S. and metric measurements.

English Language Arts/Literacy - Students will utilize ELA skills through the recording of data and observations in a lab journal or note packet. They will have opportunities to express their understanding of concepts and explain results through short constructed responses.

21st Century Skills -

- Critical thinking and Problem Solving
- Communication and Collaboration through lab reports and small group activities
- Classroom computers/laptops through use of Google Classroom and various websites and online resources.

Modifications

- Structure lessons around questions that are authentic/phenomena based, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a phenomena-based, social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Time Allotment: 24 days

Resources:
Suggested resources will include but are not limited to the following:

- District approved science textbook
- Assessments
- Websites
- Videos
- Nonfiction/fiction sources
- Laboratory investigations

Unit 3 – States of Matter and Changes of State

Stage 1: Desired Results

Content Standards

- **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.

Essential Questions

- How is the movement of molecules related to the state of a substance/object?
- What happens to the structure/phase of a substance or object when thermal energy is added or removed?

Enduring Understandings

- Tiny particles that make up all matter are always in motion.
- If energy is added to matter, the particles will move faster and their temperature will increase. If energy is removed, the particles will move slower and their temperature will decrease.

Knowledge and Skills (SWBAT embedded course proficiencies)

- Describe the movement and arrangement of particles for each phase (state) of matter
- Predict and analyze what happens to that movement and arrangement if heat (thermal energy) is added or removed.
- Name and describe eight changes of state, and recognize if the change is endothermic or exothermic.
- Conduct experiments with dry ice and use recently gained knowledge to explain observed phenomena.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)
Assessment Methods (formative, summative, other evidence and/or student self-assessment)

Formative: informal observation, discussion (large group and partner share), lab reports, quick writes, short constructed response, quizzes.

Summative: written lab summaries/explanations, practical based unit tests, mid-year and year-end grade level assessment.

Stage 3: Learning Plan

In this unit students will explore how the arrangement of particles in a substance will determine the properties of the substance. Because these particles are too small to be seen, students have to use models and their imaginations to grasp the concepts. Students will begin the unit by memorizing part of the Kinetic Theory of Matter, which will provide the foundation for what they'll be learning during the unit. The four phases of matter will be covered quickly, and then emphasis will turn to phase changes. Students will work in groups during two hands-on experiments which will ask them to reflect on energy transfer during changes of state:

- Create a "steam bath" in the room by boiling water, and then make that water condense on cooler surfaces.
- Perform multiple experiments with solid carbon dioxide to observe sublimation and its effects

Cross curricular connections:

Mathematics – The nature of this unit is such that there is minimal mathematics required.

English Language Arts/Literacy - Students will utilize ELA skills through class discussions. They will have opportunities to express their understanding of concepts and explain results through short constructed responses.

21st Century Skills -

- Critical thinking and Problem Solving
- Communication and Collaboration through small group activities and class discussions.
- Information and media literacy through the use of various online sources.
- Classroom computers/laptops through use of Google Classroom and various websites and online resources.

Modifications

- Structure lessons around questions that are authentic/phenomena based, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a phenomena-based, social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Time Allotment: 24 days

Resources

Suggested resources will include but are not limited to the following:

- District approved science textbook
- Assessments
- Websites
- Videos
- Nonfiction/fiction sources
- Laboratory investigations
- STEM/STEAM activities

Unit 4 – Energy and Energy Transfer

Stage 1: Desired Results

Content Standards

- **MS-PS3-3** Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- **MS-PS3-5** Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Essential Questions

- In terms of kinetic energy, what is meant by The Law of Conservation of Energy?
- Describe the transfer of energy when two objects at different temperatures are in contact.

Enduring Understandings

- Energy has two main types: energy of motion (kinetic) and positional (potential) energy.
- There are at least seven different forms of kinetic and potential energy, and energy can change from one form to another.
- Whenever an energy conversion takes place, the total amount of energy remains the same but the usefulness of the energy decreases with each conversion.
- Thermal energy is transferred in one of three ways: conduction, convection, and radiation
- Objects which allow thermal energy to transfer easily are good conductors and poor insulators
- Temperature is measure of the average kinetic energy of the particles in a substance.

Knowledge and Skills (SWBAT embedded course proficiencies)

- Define the challenging concept of energy
- Recognize different forms of energy and describe some energy conversions
- Distinguish between renewable and nonrenewable forms of energy
- Relate convective heat transfer to Earth's geology and Earth's atmosphere.

- Construct, to scale, a graph showing the three different temperature scales (Fahrenheit, Celsius, Kelvin)

- Ask questions to identify and clarify evidence of an argument.
- Analyze and interpret data to determine similarities and differences in findings.
- Construct arguments supported by evidence and scientific reasoning.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods (formative, summative, other evidence and/or student self-assessment)

Formative: informal observation, discussion (large group and partner share), lab reports, quick writes, short constructed response, quizzes.

Summative: written lab summaries/explanations, practical based unit tests, mid-year and year-end grade level assessment.

Stage 3: Learning Plan

Students will begin the unit by mastering the vocabulary of energy: the two main types, the seven forms, fossil fuels, and renewable vs. nonrenewable. The model of a roller coaster will be used to help explain energy conversions and conservation of energy. Energy resources (renewable and nonrenewable) will be evaluated as to their cost, efficiency, and impact on the environment.

The three methods of transfer of thermal energy (heat) will be compared and related to geo-systems. Students will construct a graph showing how the Celsius, Fahrenheit, and Kelvin temperature scales are related.

Cross curricular connections:

Mathematics - Students will utilize mathematics to interpret and construct graphs, compare scales, and calculate different temperatures using their graph.

English Language Arts/Literacy - Students will utilize ELA skills to discuss ideas and concepts, express their thoughts and opinions, and develop written arguments to support a claim or thesis.

21st Century Skills -

- Global awareness and Environmental literacy through the discussion of human impacts as related to societal values and lifestyles
- Creativity and Innovation through the development of a method to monitor and minimize human impacts on the atmosphere
- Critical thinking and Problem Solving
- Communication and Collaboration through small group activities, class discussions, and short constructed responses.
- Information and media literacy through the use of various online sources.
- Classroom computers/laptops through use of Google Classroom and various websites and online resources.

- Social and Cross-Cultural Skills as students learn about the differences in societal values and lifestyles.

Modifications

- Structure lessons around questions that are authentic/phenomena based, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a phenomena-based, social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Time Allotment 28 days

Resources

Suggested resources will include but are not limited to the following:

- District approved science textbook
- Assessments
- Websites
- Videos
- Nonfiction/fiction sources
- Laboratory investigations
- STEM/STEAM activities

Unit 5 – Electromagnetic Waves and the E-M Spectrum

Stage 1: Desired Results

Content Standards

- **MS-PS4-1** Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in the wave.
- **MS-PS4-2** Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

Essential Questions

- How are light (E-M) waves different from matter (sound or water) waves?
- What are the different types of electromagnetic wave and how are they useful or important to humans?

Enduring Understandings

- The energy of a wave is determined by its amplitude and frequency

- Electromagnetic waves range from low energy (radio) to high energy (gamma) waves, with visible light comprising a small portion of the spectrum.

Knowledge and Skills (SWBAT embedded course proficiencies)

- Describe how the amplitude of a wave is related to the energy in the wave.

- Understand that electromagnetic waves can travel through a vacuum but sound and water waves cannot.
- Describe that light waves are reflected, absorbed or transmitted through materials.
- Explain why the sky appears blue when we look straight up, but shows different colors near the horizon during sunrise and sunset.
- Ask questions to identify and clarify evidence of an argument.
- Analyze and interpret data to provide evidence for phenomena.
- Construct a scientific explanation based on valid and reliable evidence obtained from a variety of sources and interpretations of theories and laws that govern the natural world.
- Construct arguments supported by evidence and scientific reasoning.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods (formative, summative, other evidence and/or student self-assessment)

Formative: informal observation, discussion (large group and partner share), lab reports, quick writes, short constructed response, quizzes.

Summative: written lab summaries/explanations, practical based unit tests, mid-year and year-end grade level assessment.

Stage 3: Learning Plan

In this short unit, students will first review the definition and vocabulary associated with waves and that a wave transfers energy. The focus here is on electromagnetic waves, which can travel through a vacuum, unlike matter waves which cannot. Students will be exposed to the electromagnetic spectrum to emphasize how wavelength impacts the energy of a wave. Reflection and refraction will be demonstrated, as will ultraviolet light and possibly infrared.

Cross curricular connections:

Mathematics – Students will use scientific notation skills to help interpret the electromagnetic spectrum.

English Language Arts/Literacy - Students will utilize ELA skills to discuss ideas and concepts, express their thoughts and opinions, and develop written arguments to support a claim or thesis.

21st Century Skills -

- Global awareness and Environmental literacy through the discussion of human impacts as related to societal values and lifestyles
- Creativity and Innovation through the development of a method to monitor and minimize human impacts on oceans and freshwater bodies
- Critical thinking and Problem Solving

- Communication and Collaboration through small group activities, class discussions, and short constructed responses.
- Information and media literacy through the use of various online sources.
- Classroom computers/laptops through use of Google Classroom and various websites and online resources. through the use of Google Classroom and various websites/online resources.
- Social and Cross-Cultural Skills as students learn about the differences in societal values and lifestyles.

Modifications

- Structure lessons around questions that are authentic/phenomena based, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a phenomena-based, social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Time Allotment 8 days

Resources

Suggested resources will include but are not limited to the following:

- District approved science textbook
- Assessments
- Websites
- Videos
- Nonfiction/fiction sources
- Laboratory investigations
- STEM/STEAM activities

Unit 6 – Atomic Structure

Stage 1: Desired Results

Content Standards

- **MS-PS1-1** Develop models to describe the atomic composition of simple molecules and extended structures

Essential Questions

- What are the subatomic particles which make up the atom, and how are they arranged within the atom?
- What are the four fundamental forces of the universe and how do they function to keep an atom together?

Enduring Understandings

- Atoms are made of protons, neutrons, and electrons, which have different masses and different electric charge.
- The nucleus of the atom contains protons and neutrons, most of the atom's mass, and has a positive charge.
- Electrons are relatively tiny, have a negative charge and zip around the nucleus at extremely high speed and within prescribed energy levels
- Electrons in the outermost energy level are the valence electrons which play a critical role in chemical bonding

Knowledge and Skills (SWBAT embedded course proficiencies)

- Describe the structure of the atom using the terms proton, neutron, nucleus, and electron
- Explain the forces which act to keep the atom together
- Distinguish between atomic number and mass number (or atomic weight)
- Label blank Bohr diagrams of atoms, indicating the number of subatomic particles, using a Periodic Table as a guide
- Construct arguments supported by evidence and scientific reasoning.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods (formative, summative, other evidence and/or student self-assessment)

Formative: informal observation, discussion (large group and partner share), lab reports, quick writes, short constructed response, quizzes.

Summative: written lab summaries/explanations, practical based unit tests, mid-year and year-end grade level assessment.

Stage 3: Learning Plan

In this unit, students will study some early scientists' efforts to understand matter as they work to determine how the parts of the atom fit together. Beginning emphasis will be on subatomic particle vocabulary, followed by exercises using sample squares of a Periodic Table so students can see the relationship between the subatomic particles and the numbers included on each square.

Students will be exposed to the four fundamental forces in our universe and how each might affect the structure of the atom, with emphasis on the electromagnetic force and the strong force. As students' progress to the study of the electron, Bohr diagrams will be used as models to show how the electrons in different elements are arranged, and the concept of valence electron will be introduced.

Cross curricular connections:

Mathematics - Students will utilize mathematics to calculate the number of subatomic particles in an atom, using the numbers in the Periodic Table square as a guide.

English Language Arts/Literacy - Students will utilize ELA skills via online research of the development of atomic theory and atomic structure.

21st Century Skills -

- Critical thinking and Problem Solving
- Communication and Collaboration through small group activities and class discussions.
- Information and media literacy through the use of various online sources.
- Classroom computers/laptops through use of Google Classroom and various websites and online resources.

Modifications

- Structure lessons around questions that are authentic/phenomena based, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a phenomena-based, social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Time Allotment: 24 days

Resources

Suggested resources will include but are not limited to the following:

- District approved science textbook
- Assessments
- Websites
- Videos
- Nonfiction/fiction sources
- Laboratory investigations
- STEM/STEAM activities

Unit 7 – Periodic Table of the Elements

Stage 1: Desired Results

Content Standards

- **MS-PS1-1** Develop models to describe the atomic composition of simple molecules and extended structures
- **MS-PS1-3** Gather and make sense of information to describe that synthetic materials come from natural resources and impact society

Essential Questions
- Why is the Periodic Table arranged the way it is?
- How can knowing the position of an element on the Periodic Table help one predict how that element might react with other elements?

Enduring Understandings
- All matter is made of atoms, and each chemical element has its own type of atom with different numbers of subatomic particles
- The modern Periodic Table is arranged in order of increasing atomic number
- The number of protons determines the identity of an element, and the number of valence electrons determines how the element will react with other elements
- When the elements are arranged in rows in a particular manner, elements will be found in groups (columns) with other elements which have similar properties.
- All of our manmade (synthetic) products come from some combination of atoms of the chemical elements, and thus they are derived from natural resources
- All elements are classified as either metals, nonmetals, or metalloids
- The number of valence electrons for atoms of a particular element can be inferred from the element's position on the Periodic Table

Knowledge and Skills (SWBAT embedded course proficiencies)
- Distinguish between groups and periods on the Periodic Table
- Identify metals, nonmetals, and metalloids based on their position on the Table
- Relate the group number of some elements to the number of valence electrons in each atom of that element
- Follow complex instructions to create a colored Periodic Table for use in this class and in future science classes

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods (formative, summative, other evidence and/or student self-assessment)

Formative: informal observation, discussion (large group and partner share), lab reports, quick writes, short constructed response, quizzes.

Summative: written lab summaries/explanations, practical based unit tests, mid-year and year-end grade level assessment.

Stage 3: Learning Plan

This unit will begin with a look at the first efforts to arrange the elements and then move to the modern Periodic Table. Students will participate in an activity which requires them to arrange cards in a particular method, similar to the process that Mendeleev employed to

construct his seminal table. Terminology will be covered extensively so that students know the difference between groups and periods (and their synonyms).

Students will proceed with the Periodic Table coloring project, during which they will follow a complicated set of instructions to create a table for use during class. The different groups and categories of elements will be reviewed, with emphasis on how the elements within a group are similar and what those elements are used for in industry. Finally, the concept of valence electrons will be reviewed, and students will be able to recognize a pattern between the number of valence electrons and the reactivity of the elements. Students will practice what they've learned by playing Periodic Table Bingo, which is designed to review most of the concepts and facts covered during this unit and the previous unit (Atomic Structure).

Cross curricular connections:

Mathematics – Students will use math skills to calculate the number of subatomic particles in a particular atom, and to determine the number of valence electrons for atoms of particular elements.

English Language Arts/Literacy – There will be extensive new vocabulary for students to master during this unit, centered around the structure of the Periodic Table and the names of groups/categories —all of which will be new to students. Students will also utilize ELA skills as they conduct online research of the chemical elements.

21st Century Skills -

- Global awareness and Environmental literacy through the discussion of human impacts as related to societal values and lifestyles
- Creativity and Innovation through the development a working solar car
- Critical thinking and Problem Solving
- Communication and Collaboration through small group activities, class discussions, and short constructed responses.
- Information and media literacy through the use of various online sources.
- Classroom computers/laptops through use of Google Classroom and various websites and online resources.
- Flexibility and Adaptability through teamwork
- Initiative and Self-Direction as a member of a team
- Productivity and Accountability for assigned team role
- Social and Cross-Cultural Skills as students learn about the differences in societal values and lifestyles.

Modifications

- Structure lessons around questions that are authentic/phenomena based, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).

- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a phenomena-based, social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Time Allotment: 26 days

Resources

Suggested resources will include but are not limited to the following:

- District approved science textbook
- Assessments
- Websites
- Videos
- Nonfiction/fiction sources
- Laboratory investigations

Unit 8 – Chemical Reactions

Stage 1: Desired Results

Content Standards

- **MS-PS1-2.** Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- **MS-PS1-5.** Develop and use a model to describe how the total number of atoms does not change in a chemical reaction.
- **MS-PS1-6** Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.

Essential Questions

- What happens to the atoms which make up different substances after those substances have reacted chemically?
- What's the difference between an endothermic and exothermic chemical reaction?

Enduring Understandings

- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules.
- The new substances created after a chemical reaction have properties different from those of the original substances.
- The total number of each type of atom remains the same after a chemical reaction, and thus the mass does not change.

- Some chemical reactions release energy (exothermic), and some absorb energy (endothermic).

Knowledge and Skills (SWBAT embedded course proficiencies)

- Trace the change in position of different atoms (using chemical formulas) from reactant to product.
- Compare the properties of the product(s) with those of the reactants to determine if those properties have changed.
- Measure the mass of the reactants of a chemical reaction and compare to the mass of the products to investigate whether the mass changes.
- Measure the temperature of the reactants and compare to the temperature of the products to determine if temperature can change during a chemical reaction.
- Count the number of atoms of each element represented by a chemical formula
- Count the number of atoms of each element on both sides of the yield arrow.
- Distinguish between the coefficient and subscript numbers which are used in chemical formulas
- Recognize whether a chemical formula is balanced and make simple changes if it is not.
- Construct arguments supported by evidence and scientific reasoning.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods (formative, summative, other evidence and/or student self-assessment)

Formative: informal observation, discussion (large group and partner share), lab reports, quick writes, short constructed response,quizzes.

Summative: written lab summaries/explanations, practical based unit tests, mid-year and year-end grade level assessment.

Stage 3: Learning Plan

In this unit, students will first learn how chemical symbols are used to describe substances, and what the functions of a subscript number and coefficient number are. Following this will be a lab during which baking soda and vinegar are combined. This reaction will be analyzed to determine if the mass of the reactants and the mass of the reactants remains the same. The properties of the both reactants and products will be examined to determine if they're different, and the temperature of both reactants and products will be measured to check for any change. The chemical formula which describes the reaction will be provided, and students will determine if it's a balanced formula and, if not, how to balance it. Additional practice at balancing equations will follow.

Cross curricular connections:

Mathematics – Counting atoms and balancing equations utilizes basic math skills as well as order of operations.

English Language Arts/Literacy - Students will utilize ELA skills through online research of chemical reactions and through the writing of a formal science lab report.

21st Century Skills -

- Critical thinking and Problem Solving
- Communication and Collaboration through small group activities and class discussions.
- Information and media literacy through the use of various online sources.
- Classroom computers/laptops through use of Google Classroom and various websites and online resources.

Modifications

- Structure lessons around questions that are authentic/phenomena based, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a phenomena-based, social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Time Allotment: 18 days

Resources

Suggested resources will include but are not limited to the following:

- District approved science textbook
- Assessments
- Websites
- Videos
- Nonfiction/fiction sources
- Laboratory investigations
- STEM/STEAM activities

New Jersey Student Learning Standards

http://www.state.nj.us/education/cccs/

Integration of 21st Century Theme(s)

The following websites are sources for the following 21st Century Themes and Skills: http://www.nj.gov/education/code/current/title6a/chap8.pdf http://www.p21.org/about-us/p21-framework . http://www.state.nj.us/education/cccs/standards/9/index.html

21st Century Interdisciplinary Themes (into core subjects)

- **Global Awareness**
- **Financial, Economic, Business and Entrepreneurial Literacy**
- **Civic Literacy**
- **Health Literacy**
- **Environmental Literacy**

Learning and Innovation Skills

- **Creativity and Innovation**
- **Critical Thinking and Problem Solving**
- **Communication and Collaboration**

Information, Media and Technology Skills

- **Information Literacy**
- **Media Literacy**
- **ICT (Information, Communications and Technology) Literacy**

Life and Career Skills

- **Flexibility and Adaptability**

- **Initiative and Self-Direction**
- **Social and Cross-Cultural Skills**
- **Productivity and Accountability**
- **Leadership and Responsibility**

Integration of Digital Tools

- **Classroom computers/laptops**
- **Technology Lab**
- **FM system**
- **Other software programs**