Science Department
Physics Curriculum

Scope and Sequence

Number of Weeks Running September - June (56 minute block base)	Unit
6 weeks	Mechanics I
6 weeks	Mechanics II
5 weeks	Thermodynamics
5 weeks	Waves, Sound and Light
5 weeks	Electricity and Magnetism
3 weeks	Physics and the Earth

Unit 1

Mechanics I

Summary and Rationale

In this unit of study, students are expected to *plan and conduct investigations*, *analyze data and using math to support claims*, and *apply scientific ideas to solve design problems* students in order to develop an understanding of ideas related to why some objects keep moving and some objects fall to the ground. Students will also build an understanding of forces and Newton's second law. Finally, they will develop an understanding that the total momentum of a system of objects is conserved when there is no net force on the system. Students are also able to apply science and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. The crosscutting concepts of *patterns*, *cause and effect*, and *systems and systems models* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate proficiency in *planning and*

conducting investigations, *analyzing data and using math to support claims*, and *applying scientific ideas to solve design problems* and to use these practices to demonstrate an understanding of the core ideas.

Students plan and conduct investigations and apply scientific ideas to make sense of Newton's law of gravitation and Coulomb's Law. They apply these laws to describe and predict the gravitational and electrostatic forces between objects. The crosscutting concept of *patterns* is called out as an organizing concept for this disciplinary core idea. Students are expected to demonstrate proficiency in *planning and conducting investigations* and *applying scientific ideas* to demonstrate an understanding of core ideas.

The disciplinary core idea of *Energy* is broken down into subcore ideas: *definitions of energy*, *conservation of energy* and *energy transfer*, and *the relationship between energy and forces*. Energy is understood as a quantitative property of a system that depends on the motion and interactions of matter, and the total change of energy in any system is equal to the total energy transferred into and out of the system. Students also demonstrate their understanding of engineering principles when they design, build, and refine devices associated with the conversion of energy. The crosscutting concepts of *cause and effect, systems and systems models, energy and matter, and the influence of science, engineering, and technology on society and the natural world* are further developed in the performance expectations. Students are expected to demonstrate proficiency in *developing and using models, planning and carrying out investigations, using computational thinking and designing solutions*, and they are expected to use these practices to demonstrate understanding of core ideas.

Recommended Pacing

6 weeks

Standards

HS-PS2-1	Analyze data to support the claim that Newton’s second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration
HS-PS2-2	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
HS-PS2-3	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision
HS-PS2-4	Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects.
HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts

HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem
HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known
HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects)
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
Interdisciplinary Connections	
NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.R2	Determine the central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
RI.11-12.1 RI.9-10.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence
MP.2	Reason abstractly and quantitatively
MP.4	Model with mathematics
HSN.Q.A.1	Use units as a way to understand problems and to guide the solution of mult-istep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
Integration of Technology	
8.1	All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge
8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment

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Instructional Focus

Enduring Understandings:	**Essential Questions:**
The linear and projectile motion of objects can be described mathematically through the use of kinematic principles, energy and momentum concepts, Newton's laws, and conservation laws. Motion in two dimensions can be treated separately in each dimension.	What terms are used in describing motion? How are acceleration, time, velocity, and distance related? How can motion be separated into two dimensions using vectors? What is the difference between vector and scalar quantities? How do objects move when they are only influenced by gravity? How does Newton's first law apply to the motion of objects? How do forces affect motion? How do objects interact through forces? How do action and reaction forces act on different masses? How is conservation of momentum used to analyze the motion and interaction of objects? How are concepts of energy used to analyze the motion of systems?

Objectives (SLO)	
Students will know: Terms used in describing the quantities of displacement, motion, work, energy, and momentum Appropriate SI units used in working with the above quantities Appropriate mathematical terminology used in motion analysis e.g. "Vectors" Apply mathematical relationships between the above quantities Newton's laws to describe the motion of objects Calculation of systematic momentum Relationship between impulse and momentum The difference between an elastic and inelastic collisions	Students will be able to: Perform measurements using rulers and timers and use those measurements to calculate required quantities. Use video analysis software to analyze motion mathematically. Collaborate with classmates. State and apply Newton's laws. Differentiate between force and pressure. Apply Newton's second law to explain why objects accelerate at the same rate in free fall regardless of mass. Describe what happens to the speed of a falling object in the presence of air resistance. Define force in terms of interaction.

Define the terms ‘energy”, “work”, “power”, “potential energy”, and “kinetic energy”	Explain why at least two objects are involved whenever a force acts. Identify action and reaction forces. Describe how action reaction forces affect objects of different masses. Explain why action reaction forces do not cancel each other by using the concept of a system. Calculate the momentum of an object or a system of objects. Perform calculations involving time, force, impulse and momentum. State and apply the law of conservation of momentum. Explain how the law of conservation of momentum is affected by the vector nature of momentum. Perform calculations involving work and power. Calculate the amount of work done mathematically. Calculate the amount of power generated during a process. Calculate the amount of kinetic energy in a system using mass and speed. Calculate the amount of potential energy in a system using mass and height. Calculate the efficiency of simple machines.

Suggested Resources/Technology Tools

www.khanacademy.org
Math Sets
Videos
Instructional Supplements
Laboratory Investigations
Measure the velocity of a wave using dominos rulers and timers.
Measure the amount of time it takes for a marble to travel various distances on an inclined plane and develop a relationship between the above two variables.
Apply Newton's second law to studying how changing forces affect the acceleration of a constant mass. (Constant Mass – Changing Force experiment).
Measure the momentum of a system before and after a collision.
Compare the amount of work needed to raise a cart straight up, and raise it to the same height by using an inclined plane.
Photo gates
Logger Pro Software
phet Colorado
Forces in One Dimension
Forces and Motion
Parachute and Terminal Velocity
Gravity Force Lab
Electrostatic Relationships
Electrostatics
Energy Basics

Modifications

Teachers can choose from any of the suggested modifications below based upon teaching style, learner need and instructional practices.

General Modifications for students struggling to learn:

- Focus on building relationships in the classroom.
- Control the stressors for the student and manage alternate pathways for completion of assignments.
- Provide feedback utilizing a growth mindset and praise what is done correctly based upon effort, attitude and strategy.
- Boost engagement with material by providing opportunities of differentiation, group work and alternative assignments/assessments where appropriate.

ELL

- Provide additional wait time for student responses to questions to allow students the ability to undergo the process of translation between languages, composition of response and attempted response.
- Simplification of sentence structure and repetition of questions/sentences exactly as stated before trying to rephrase to allow ELL students to hear the sentence and try to comprehend it.
- Rephrase idioms and teach their meanings as when learning a new language, translations are often very literal. IE "Take a stab at it." Ensure students understand what is meant.
- Use directed reading activities. Ensure preview of text before assigned/read, provide pre-reading questions about the main idea and offer help utilizing key words.
- Allow the use of Google Translate where appropriate.
- Utilize bilingual reading texts provided by the STC program.

G/T

Utilize differentiation in the areas of acceleration, enrichment, and grouping. Examples include, but are not limited to:

- interdisciplinary and problem-based assignments with planned scope and sequence
- advance, accelerated, or compacted content
- abstract and advanced higher-level thinking
- allowance for individual student interests
- assignments geared to development in areas of affect, creativity, cognition, and research skills
- complex, in-depth assignments
- diverse enrichment that broadens learning
- variety in types of resources
- internships, mentorships and independent study where applicable

504/IEP

Modifications and accommodations must be aligned to stated plan and uphold expectations of the plan lawfully. Every student requires a different set of accommodations based upon need. Examples specific to science practice include, but are not limited to:

Note taker or lab assistant
Group lab assignments
Use of scribe
Adjustable tables and lab equipment within reach
Classrooms, labs and field trips in accessible locations
Additional time and separate room for test taking
Additional time for in-class assignments
Additional time in lab
Visual and tactile instructional demonstrations
Computer with voice output, spelling and grammar checker
Seating in the front of the class
Tactile drawings and graphs, and three-dimensional models
Assignments in electronic format
Large-print handouts, lab signs and equipment labels
TV monitor connected to microscope to enlarge images
Computer equipped to enlarge screen characters and images

Auditory lab warning signals
Adaptive lab equipment (talking calculators, talking thermometers, light probes, tactile timers)
Staples on sticks to indicate units of measurement
Visual warning system for lab emergencies

21ST CENTURY LIFE AND CAREER STANDARDS

Please select all standards that apply to this unit of study:

- ✓ Act as a responsible and contributing citizen and employee.
- ✓ Apply appropriate academic and technical skills.
- ○ Attend to personal health and financial well being.
- ✓ Communicate clearly and effectively and with reason.
- ✓ Consider the environmental social and economic impacts of decisions.
- ✓ Demonstrate creativity and innovation.
- ✓ Employ valid and reliable research strategies.
- ✓ Utilize critical thinking to make sense of problems and persevere in solving them.
- ✓ Model integrity, ethical leadership, and effective management.
- ✓ Plan education and career paths aligned to personal goals.
- ✓ Use technology to enhance productivity.
- ✓ Work productively in teams while using cultural global competence.

Suggestions on integrating these standards can be found at: http://www.state.nj.us/education/cccs/2014/career/9.pdf

LINKS TO CAREERS:

Career Applications and Exploration: Mechanics I

Unit 2

Mechanics II

Summary and Rationale

Mechanics II builds upon the principles established in Unit I: Mechanics I. The same laws and principles apply but the type of motion studied is circular motion about internal and external axes, and the law of universal gravitation is introduced. Rotational mechanics, gravitational forces, center of mass, gravitational interactions, and satellite motion are included in the unit. As a result, in this unit of study, in addition to applying the laws of Newton and Coulomb, students *use mathematical and computational thinking* to examine the processes governing the workings of the solar system and universe. The crosscutting concepts of *scale, proportion, and quantity* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate proficiency in *using mathematical and computational thinking* and to use this practice to demonstrate understanding of core ideas.

In application to rotational mechanics, students are expected to *plan and conduct investigations*, *analyze data and using math to support claims*, and *apply scientific ideas to solve design problems* students in order to develop an

understanding of ideas related to why some objects keep moving and some objects fall to the ground. Students will also build an understanding of forces and Newton's second law. Finally, they will develop an understanding that the total momentum of a system of objects is conserved when there is no net force on the system. Students are also able to apply science and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. The crosscutting concepts of *patterns*, *cause and effect*, and *systems and systems models* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate proficiency in *planning and conducting investigations*, *analyzing data and using math to support claims*, and *applying scientific ideas to solve design problems* and to use these practices to demonstrate an understanding of the core ideas.

Students plan and conduct investigations and apply scientific ideas to make sense of Newton's law of gravitation and Coulomb's Law. They apply these laws to describe and predict the gravitational and electrostatic forces between objects. The crosscutting concept of *patterns* is called out as an organizing concept for this disciplinary core idea. Students are expected to demonstrate proficiency in *planning and conducting investigations* and *applying scientific ideas* to demonstrate an understanding of core ideas.

The disciplinary core idea of *Energy* is broken down into subcore ideas: *definitions of energy*, *conservation of energy* and *energy transfer*, and *the relationship between energy and forces*. Energy is understood as a quantitative property of a system that depends on the motion and interactions of matter, and the total change of energy in any system is equal to the total energy transferred into and out of the system. Students also demonstrate their understanding of engineering principles when they design, build, and refine devices associated with the conversion of energy. The crosscutting concepts of *cause and effect, systems and systems models, energy and matter, and the influence of science, engineering, and technology on society and the natural world* are further developed in the performance expectations. Students are expected to demonstrate proficiency in *developing and using models, planning and carrying out investigations, using computational thinking and designing solutions*, and they are expected to use these practices to demonstrate understanding of core ideas.

Recommended Pacing

6 weeks

Standards

HS-PS2-1	Analyze data to support the claim that Newton’s second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration
HS-PS2-2	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
HS-PS2-3	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision
HS-PS2-4	Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects.
HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more

	manageable problems that can be solved through engineering
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts
HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem
HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known
HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects)
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system
Interdisciplinary Connections	
NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.R2	Determine the central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
RI.11-12.1 RI.9-10.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence
MP.2	Reason abstractly and quantitatively
MP.4	Model with mathematics
HSN.Q.A.1	Use units as a way to understand problems and to guide the solution of mult-istep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.

Integration of Technology	
8.1	All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge
8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment

Evidence of Learning (Assessments)

End of Unit 2 Assessment: Mechanics II
Various Formative Assessments
Unit Benchmarks

Instructional Focus

Enduring Understandings:	**Essential Questions:**
The motion of objects undergoing rotation or revolution can be described using mathematical relationships derived from Newton's laws of motion. Concepts of rotational motion can be applied equally to everyday rotational motion such as wheels, cars, and centrifuges; and large scale objects such as planetary systems and galaxies	How do bodies and systems undergoing circular motion behave? How is the center of gravity used to describe motion of matter? How does torque affect the rotation of objects? How do gravitational fields affect satellite motion? How are balanced torques calculated? How does gravity affect matter?

Suggested Resources/Technology Tools

www.khanacademy.org
Math Sets
Videos
Instructional Supplements
Laboratory Investigations
Stripping Centripetal Force from Circular Motion Lab
Torque Lab.
Gravity using a Pendulum Lab.
Photo gates
Logger Pro Software
phet Colorado
Planetary Orbits Lab
Gravity Force Lab
Kepler Activities

Modifications

Teachers can choose from any of the suggested modifications below based upon teaching style, learner need and instructional practices.

General Modifications for students struggling to learn:

- Focus on building relationships in the classroom.
- Control the stressors for the student and manage alternate pathways for completion of assignments.
- Provide feedback utilizing a growth mindset and praise what is done correctly based upon effort, attitude and strategy.
- Boost engagement with material by providing opportunities of differentiation, group work and alternative assignments/assessments where appropriate.

ELL

- Provide additional wait time for student responses to questions to allow students the ability to undergo the process of translation between languages, composition of response and attempted response.
- Simplification of sentence structure and repetition of questions/sentences exactly as stated before trying to rephrase to allow ELL students to hear the sentence and try to comprehend it.
- Rephrase idioms and teach their meanings as when learning a new language, translations are often very literal. IE "Take a stab at it." Ensure students understand what is meant.
- Use directed reading activities. Ensure preview of text before assigned/read, provide pre-reading questions about the main idea and offer help utilizing key words.
- Allow the use of Google Translate where appropriate.
- Utilize bilingual reading texts provided by the STC program.

G/T

Utilize differentiation in the areas of acceleration, enrichment, and grouping. Examples include, but are not limited to:

- interdisciplinary and problem-based assignments with planned scope and sequence
- advance, accelerated, or compacted content
- abstract and advanced higher-level thinking
- allowance for individual student interests
- assignments geared to development in areas of affect, creativity, cognition, and research skills
- complex, in-depth assignments
- diverse enrichment that broadens learning
- variety in types of resources
- internships, mentorships and independent study where applicable

504/IEP

Modifications and accommodations must be aligned to stated plan and uphold expectations of the plan lawfully. Every student requires a different set of accommodations based upon need. Examples specific to science practice include, but are not limited to:

- Note taker or lab assistant
- Group lab assignments
- Use of scribe
- Adjustable tables and lab equipment within reach
- Classrooms, labs and field trips in accessible locations
- Additional time and separate room for test taking
- Additional time for in-class assignments
- Additional time in lab
- Visual and tactile instructional demonstrations
- Computer with voice output, spelling and grammar checker
- Seating in the front of the class
- Tactile drawings and graphs, and three-dimensional models
- Assignments in electronic format
- Large-print handouts, lab signs and equipment labels
- TV monitor connected to microscope to enlarge images
- Computer equipped to enlarge screen characters and images
- Auditory lab warning signals
- Adaptive lab equipment (talking calculators, talking thermometers, light probes, tactile timers)

- Staples on sticks to indicate units of measurement
- Visual warning system for lab emergencies

21ST CENTURY LIFE AND CAREER STANDARDS

Please select all standards that apply to this unit of study:

- ✓ Act as a responsible and contributing citizen and employee.
- ✓ Apply appropriate academic and technical skills.
- ○ Attend to personal health and financial well being.
- ✓ Communicate clearly and effectively and with reason.
- ✓ Consider the environmental social and economic impacts of decisions.
- ✓ Demonstrate creativity and innovation.
- ✓ Employ valid and reliable research strategies.
- ✓ Utilize critical thinking to make sense of problems and persevere in solving them.
- ✓ Model integrity, ethical leadership, and effective management.
- ✓ Plan education and career paths aligned to personal goals.
- ✓ Use technology to enhance productivity.
- ✓ Work productively in teams while using cultural global competence.

Suggestions on integrating these standards can be found at: http://www.state.nj.us/education/cccs/2014/career/9.pdf

LINKS TO CAREERS:

Career Applications and Exploration: Mechanics II

Unit 3

Energy Studies I: Thermodynamics

Summary and Rationale

In this unit of study, students *develop and use models, plan and carry out investigations, use computational thinking and design solutions* as they make sense of the disciplinary core idea. The disciplinary core idea of *Energy* is broken down into subcore ideas: *definitions of energy*, *conservation of energy* and *energy transfer*, and *the relationship between energy and forces*. Energy is understood as a quantitative property of a system that depends on the motion and interactions of matter, and the total change of energy in any system is equal to the total energy transferred into and out of the system. Students also demonstrate their understanding of engineering principles when they design, build, and refine devices associated with the conversion of energy. The crosscutting concepts of *cause and effect, systems and systems models, energy and matter, and the influence of science, engineering, and technology on society and the natural world* are further developed in the performance expectations. Students are expected to demonstrate proficiency in *developing and using models, planning and carry out investigations, using computational thinking and designing solutions*, and they are expected to use these practices to demonstrate understanding of core ideas.

This unit accomplishes the tasks above by examining the area of thermodynamics. It encompasses the study of energy transfer in the form of heat. The topics include temperature, phase change, specific heat, thermal expansion, heat engines, and the laws of thermodynamics.

Recommended Pacing

5 weeks

Standards

HS-PS2-4	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts
HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem
HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known
HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects)
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

Interdisciplinary Connections	
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Integration of Technology	
8.1	All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge
8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment
Evidence of Learning (Assessments)	
End of Unit 3 Assessment: Thermodynamics Various Formative Assessments Unit Benchmarks	
Instructional Focus	
Enduring Understandings:	**Essential Questions:**

Energy transferred between objects as a result of temperature differences is called heat. These transfers of energy can result in phase change, thermal expansion, and transformation into mechanical work. The observed phenomena can be explained by using atomic and molecular concepts. The field of thermodynamics is described by three laws.	How are temperature, heat, and expansion of materials related? How is heat transferred? What causes change of phase and what are its effects? How do the laws of thermodynamics describe processes involving heat transfer? How is the efficiency of heat engines calculated?

Suggested Resources/Technology Tools

www.khanacademy.org
Math Sets
Videos
Instructional Supplements
Laboratory Investigations
Elabs
Solar House
Heat and Thermo Labs
Leslie's cube experiment IE - https://www.3bscientific.com/PhysicsExperiments/UE2020200_EN.pdf
Heat of fusion of water experiment

Modifications

Teachers can choose from any of the suggested modifications below based upon teaching style, learner need and instructional practices.

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ELL

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- Use directed reading activities. Ensure preview of text before assigned/read, provide pre-reading questions about the main idea and offer help utilizing key words.
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- Utilize bilingual reading texts provided by the STC program.

G/T

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- advance, accelerated, or compacted content
- abstract and advanced higher-level thinking
- allowance for individual student interests

- assignments geared to development in areas of affect, creativity, cognition, and research skills
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504/IEP

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- Group lab assignments
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- Classrooms, labs and field trips in accessible locations
- Additional time and separate room for test taking
- Additional time for in-class assignments
- Additional time in lab
- Visual and tactile instructional demonstrations
- Computer with voice output, spelling and grammar checker
- Seating in the front of the class
- Tactile drawings and graphs, and three-dimensional models
- Assignments in electronic format
- Large-print handouts, lab signs and equipment labels
- TV monitor connected to microscope to enlarge images
- Computer equipped to enlarge screen characters and images
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- Adaptive lab equipment (talking calculators, talking thermometers, light probes, tactile timers)
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- ✓ Utilize critical thinking to make sense of problems and persevere in solving them.
- ✓ Model integrity, ethical leadership, and effective management.
- ✓ Plan education and career paths aligned to personal goals.
- ✓ Use technology to enhance productivity.
- ✓ Work productively in teams while using cultural global competence.

Suggestions on integrating these standards can be found at: http://www.state.nj.us/education/cccs/2014/career/9.pdf

LINKS TO CAREERS:

Career Applications and Exploration: Thermodynamics

Unit 4

Energy Studies II: Waves

Summary and Rationale

In this unit of study, students apply their understanding of how wave properties can be used to transfer information across long distances, store information, and investigate nature on many scales. The crosscutting concept of *cause and effect* is highlighted as an organizing concept for these disciplinary core ideas. Students are expected to demonstrate proficiency in *using mathematical thinking*, and to use this practice to demonstrate an understanding of the core idea. In order to achieve this concept of periodic motion such as vibrations and mechanical waves are learned. The idea of energy transfer without the transfer of matter through waves is introduced. The concepts learned in studying mechanical waves are applied to sound and electromagnetic waves. The properties of electromagnetic waves including color, interference, and geometric optics are also studied as students are able to apply their understanding of wave properties to make sense of how electromagnetic radiation can be used to transfer information across long distances, store information, and be used to investigate nature on many scales. Models of electromagnetic radiation as both a wave of changing electrical and magnetic fields or as particles are developed and used. Students also demonstrate their understanding of engineering ideas by presenting information about how technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. The crosscutting concepts of *systems and system models*; *stability and change*; *interdependence of science*, *engineering, and technology; and influence of engineering, technology, and science on society and the natural world* are highlighted as organizing concepts. Students are expected to demonstrate proficiency in *asking questions, engaging in argument from evidence, and obtaining, evaluating, and communicating information*, and they are expected to use these practices to demonstrate an understanding of the core ideas.

Recommended Pacing

5 weeks

Standards

MS-PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media
HS-PS4-2	Evaluate questions about the advantages of using a digital transmission and storage of information
HS-PS4-3	Evaluate the claims, evidence, and the reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other
HS-PS4-4	Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter

HS-PS4-5	Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts
Interdisciplinary Connections	
NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.R2	Determine the central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
RI.11-12.1 RI.9-10.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence
MP.2	Reason abstractly and quantitatively
MP.4	Model with mathematics
HSN.Q.A.1	Use units as a way to understand problems and to guide the solution of mult-istep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
Integration of Technology	
8.1	All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge
8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment
Evidence of Learning (Assessments)	

End of Unit 4 Assessment: Wave Properties
Various Formative Assessments
Unit Benchmarks

Instructional Focus

Enduring Understandings:	**Essential Questions:**
Waves can transmit energy between locations without the movement of matter between the locations. Mechanical waves travel through matter only, while electromagnetic waves travel both through matter, and vacuum. Waves can interact with matter and other waves resulting in phenomena such as interference patterns, and optical effects. Sound and optical phenomena can be explained using principles inherent in wave motion.	• What are waves, and how do they interact with matter? • How can the reflection of sound waves be controlled? • How do mirrors form images? • How do lenses form images? • How do waves form interference patterns?

Suggested Resources/Technology Tools

www.khanacademy.org
Math Sets
Videos
Instructional Supplements
Laboratory Investigations
Waves on a String
Wave Interference
Resonance Tube
Sound Waves
Doppler Effect
Refraction Through Glass
Imagine the Universe
Radio Waves and EM Fields
Photoelectric Effect Phet
Thin Film Interference
Photoelectric Effect OSP
Interaction of Molecules with EMR
Quantum Wave Interference (Duality)
Exploring X-Rays
Pendulum construction to investigate periodic motion.
Speed of sound using resonance.
Investigation of images formed by mirrors.
Investigation of images formed by lenses.
Bright line spectra experiment.
Thin film interference experiment.
Camera obscura.

Modifications

Teachers can choose from any of the suggested modifications below based upon teaching style, learner need and instructional practices.

General Modifications for students struggling to learn:

- Focus on building relationships in the classroom.
- Control the stressors for the student and manage alternate pathways for completion of assignments.
- Provide feedback utilizing a growth mindset and praise what is done correctly based upon effort, attitude and strategy.
- Boost engagement with material by providing opportunities of differentiation, group work and alternative assignments/assessments where appropriate.

ELL

- Provide additional wait time for student responses to questions to allow students the ability to undergo the process of translation between languages, composition of response and attempted response.
- Simplification of sentence structure and repetition of questions/sentences exactly as stated before trying to rephrase to allow ELL students to hear the sentence and try to comprehend it.
- Rephrase idioms and teach their meanings as when learning a new language, translations are often very literal. IE "Take a stab at it." Ensure students understand what is meant.
- Use directed reading activities. Ensure preview of text before assigned/read, provide pre-reading questions about the main idea and offer help utilizing key words.
- Allow the use of Google Translate where appropriate.
- Utilize bilingual reading texts provided by the STC program.

G/T

Utilize differentiation in the areas of acceleration, enrichment, and grouping. Examples include, but are not limited to:

- interdisciplinary and problem-based assignments with planned scope and sequence
- advance, accelerated, or compacted content
- abstract and advanced higher-level thinking
- allowance for individual student interests
- assignments geared to development in areas of affect, creativity, cognition, and research skills
- complex, in-depth assignments
- diverse enrichment that broadens learning
- variety in types of resources
- internships, mentorships and independent study where applicable

504/IEP

Modifications and accommodations must be aligned to stated plan and uphold expectations of the plan lawfully. Every student requires a different set of accommodations based upon need. Examples specific to science practice include, but are not limited to:

- Note taker or lab assistant
- Group lab assignments
- Use of scribe
- Adjustable tables and lab equipment within reach
- Classrooms, labs and field trips in accessible locations
- Additional time and separate room for test taking
- Additional time for in-class assignments
- Additional time in lab
- Visual and tactile instructional demonstrations
- Computer with voice output, spelling and grammar checker
- Seating in the front of the class
- Tactile drawings and graphs, and three-dimensional models
- Assignments in electronic format
- Large-print handouts, lab signs and equipment labels
- TV monitor connected to microscope to enlarge images
- Computer equipped to enlarge screen characters and images

- Auditory lab warning signals
- Adaptive lab equipment (talking calculators, talking thermometers, light probes, tactile timers)
- Staples on sticks to indicate units of measurement
- Visual warning system for lab emergencies

21ST CENTURY LIFE AND CAREER STANDARDS

Please select all standards that apply to this unit of study:

- ✓ Act as a responsible and contributing citizen and employee.
- ✓ Apply appropriate academic and technical skills.
- ○ Attend to personal health and financial well being.
- ✓ Communicate clearly and effectively and with reason.
- ✓ Consider the environmental social and economic impacts of decisions.
- ✓ Demonstrate creativity and innovation.
- ✓ Employ valid and reliable research strategies.
- ✓ Utilize critical thinking to make sense of problems and persevere in solving them.
- ✓ Model integrity, ethical leadership, and effective management.
- ✓ Plan education and career paths aligned to personal goals.
- ✓ Use technology to enhance productivity.
- ✓ Work productively in teams while using cultural global competence.

Suggestions on integrating these standards can be found at: http://www.state.nj.us/education/cccs/2014/career/9.pdf

LINKS TO CAREERS:

Career Applications and Exploration: Energy and Waves

Unit 5

Electricity and Magnetism

Summary and Rationale

In this unit of study, students are able to apply their understanding of wave properties to make sense of how electromagnetic radiation can be used to transfer information across long distances, store information, and be used to investigate nature on many scales. Models of electromagnetic radiation as both a wave of changing electrical and magnetic fields or as particles are developed and used. Students also demonstrate their understanding of engineering ideas by presenting information about how technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. The crosscutting concepts of *systems and system models*; *stability and change*; *interdependence of science*, *engineering, and technology; and influence of engineering, technology, and science on society and the natural world* are highlighted as organizing concepts. Students are expected to demonstrate proficiency in *asking questions, engaging in argument from evidence, and obtaining, evaluating, and communicating information*, and they are expected to use these practices to demonstrate an understanding of the core ideas.

In order to achieve the desired outcomes listed above, this unit focuses on electric and magnetic charges and fields. Topics studied are: origin of electric charges, their interaction with each other, the generation of magnetic fields by

moving electric charges, the interactions between moving electric charges and magnetic fields, and the application of these interactions in science and technology.	
Recommended Pacing	
5 weeks	
Standards	
HS-PS2-4	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
HS-PS4-2	Evaluate questions about the advantages of using a digital transmission and storage of information
HS-PS4-3	Evaluate the claims, evidence, and the reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other
HS-PS4-4	Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter
HS-PS4-5	Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts
Interdisciplinary Connections	
NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.R2	Determine the central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
RI.11-12.1 RI.9-10.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence
MP.2	Reason abstractly and quantitatively
MP.4	Model with mathematics

HSN.Q.A.1	Use units as a way to understand problems and to guide the solution of mult-istep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
Integration of Technology	
8.1	All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge
8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment

Evidence of Learning (Assessments)

End of Unit 4 Assessment: Wave Properties
Various Formative Assessments
Unit Benchmarks

Instructional Focus

Enduring Understandings:	**Essential Questions:**
Electric charge is a property of an object or system that affects its interactions with other objects or systems containing charge. There are two types of electric charge, positive and negative. Protons are examples of positively charged objects, and electrons are examples of negatively charged objects. Neutral objects and systems are ones whose net charge is zero. The magnitudes of the charge of a proton and an electron are equal, and this is the smallest unit of charge that is found in an isolated object. Electric charge is conserved in all known processes and interactions. The movement of electric charge creates electric currents, which in turn create magnetic fields.	What are electrical forces charges? What is meant by conservation of charge? What is Coulomb's Law? How can objects be charged? What is charge polarization?

Suggested Resources/Technology Tools

www.khanacademy.org
Math Sets
Videos
Instructional Supplements
Laboratory Investigations
Magnets and Electromagnets
Charges and Fields
Faraday's Law

Static cling – static electricity
Simple circuits
Parallel and serial circuits.
Jump rope generator – electromagnetic induction.
Magnetic field investigations.

Modifications

Teachers can choose from any of the suggested modifications below based upon teaching style, learner need and instructional practices.

General Modifications for students struggling to learn:

- Focus on building relationships in the classroom.
- Control the stressors for the student and manage alternate pathways for completion of assignments.
- Provide feedback utilizing a growth mindset and praise what is done correctly based upon effort, attitude and strategy.
- Boost engagement with material by providing opportunities of differentiation, group work and alternative assignments/assessments where appropriate.

ELL

- Provide additional wait time for student responses to questions to allow students the ability to undergo the process of translation between languages, composition of response and attempted response.
- Simplification of sentence structure and repetition of questions/sentences exactly as stated before trying to rephrase to allow ELL students to hear the sentence and try to comprehend it.
- Rephrase idioms and teach their meanings as when learning a new language, translations are often very literal. IE "Take a stab at it." Ensure students understand what is meant.
- Use directed reading activities. Ensure preview of text before assigned/read, provide pre-reading questions about the main idea and offer help utilizing key words.
- Allow the use of Google Translate where appropriate.
- Utilize bilingual reading texts provided by the STC program.

G/T

- Utilize differentiation in the areas of acceleration, enrichment, and grouping. Examples include, but are not limited to:
- interdisciplinary and problem-based assignments with planned scope and sequence
- advance, accelerated, or compacted content
- abstract and advanced higher-level thinking
- allowance for individual student interests
- assignments geared to development in areas of affect, creativity, cognition, and research skills
- complex, in-depth assignments
- diverse enrichment that broadens learning
- variety in types of resources
- internships, mentorships and independent study where applicable

504/IEP

Modifications and accommodations must be aligned to stated plan and uphold expectations of the plan lawfully. Every student requires a different set of accommodations based upon need. Examples specific to science practice include, but are not limited to:

- Note taker or lab assistant
- Group lab assignments
- Use of scribe
- Adjustable tables and lab equipment within reach
- Classrooms, labs and field trips in accessible locations
- Additional time and separate room for test taking
- Additional time for in-class assignments

- Additional time in lab
- Visual and tactile instructional demonstrations
- Computer with voice output, spelling and grammar checker
- Seating in the front of the class
- Tactile drawings and graphs, and three-dimensional models
- Assignments in electronic format
- Large-print handouts, lab signs and equipment labels
- TV monitor connected to microscope to enlarge images
- Computer equipped to enlarge screen characters and images
- Auditory lab warning signals
- Adaptive lab equipment (talking calculators, talking thermometers, light probes, tactile timers)
- Staples on sticks to indicate units of measurement
- Visual warning system for lab emergencies

21ST CENTURY LIFE AND CAREER STANDARDS

Please select all standards that apply to this unit of study:

- ✓ Act as a responsible and contributing citizen and employee.
- ✓ Apply appropriate academic and technical skills.
- ○ Attend to personal health and financial well being.
- ✓ Communicate clearly and effectively and with reason.
- ✓ Consider the environmental social and economic impacts of decisions.
- ✓ Demonstrate creativity and innovation.
- ✓ Employ valid and reliable research strategies.
- ✓ Utilize critical thinking to make sense of problems and persevere in solving them.
- ✓ Model integrity, ethical leadership, and effective management.
- ✓ Plan education and career paths aligned to personal goals.
- ✓ Use technology to enhance productivity.
- ✓ Work productively in teams while using cultural global competence.

Suggestions on integrating these standards can be found at: http://www.state.nj.us/education/cccs/2014/career/9.pdf

LINKS TO CAREERS:

Career Applications and Exploration: Electricity and Magnetism

Unit 6

Relationships: Physics and our Earth

Summary and Rationale

In this unit of study, students construct explanations for the scales of time over which Earth processes operate. An important aspect of Earth and space sciences involves making inferences about events in Earth's history based on a data record that is increasingly incomplete the farther one goes back in time. A mathematical analysis of radiometric dating is used to comprehend how absolute ages are obtained for the geologic record. Students develop *models and explanations* for the ways that feedback among different Earth systems controls the appearance of the Earth's surface. Central to this is the tension between internal systems, which are largely responsible for creating land at Earth's surface

(e.g., volcanism and mountain building), and the sun-driven surface systems that tear down land through weathering and erosion. Students demonstrate proficiency in *developing and using models, constructing explanations, and engaging in argument from evidence.* The crosscutting concepts of *stability and change, energy and matter, and patterns* are called out as organizing elements of this unit.	
Recommended Pacing	
3 weeks	
Standards	
HS-ESS2-1	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features
HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems
HS-ESS2-3	Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection
HS-ESS1-5	Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.
Interdisciplinary Connections	
NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.R2	Determine the central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
RI.11-12.1 RI.9-10.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence
MP.2	Reason abstractly and quantitatively
MP.4	Model with mathematics
HSN.Q.A.1	Use units as a way to understand problems and to guide the solution of mult-istep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.

Integration of Technology	
8.1	All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge
8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment

Integration of Technology

- Chromebooks
- Schoology
- Google Suite
- Online Simulations
- Laboratory Tools and Devices

Instructional Focus

Enduring Understandings:	**Essential Questions:**
Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within the Earth's crust. Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, and a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior. Geologists use seismic waves and their reflection at the interfaces between layers to probe structures deep in the planet.	How long to geological processes take to develop features of the Earth? IE - creation of a mountain What forces are responsible for moving continents? What is the origin of the force that is able to move continents? Are the rocks on the Earth all the same age? How can one change in an area of the earth affect other areas? IE - geosphere and atmosphere

The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection. Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old. Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.	

Evidence of Learning (Assessments)

End of Unit 6 Assessment: Relationships: Physics and Our Earth
Various Formative Assessments
Unit Benchmarks

Objectives (SLO)

Students will know: The timeline of geological processes on Earth. The forces at work within the Earth that result on the visible features on the surface of the Earth. The origins of the forces that move earth's plates and contribute to the Theory of Plate Tectonics. The manner in which rocks and other objects on the Earth can be identified by radioactive decay or absolute dating. The results of actions in one of the Earth's layers and how all of those actions affect one another.	Students will be able to: Study and develop models to illustrate understanding of the development of sea-floor features. Study and develop models to explain resulting land and sea floor features from both constructive and destructive forces. Understand the role of time in geological processes. Illustrate convection currents and the effect on plate movement using a model that is driven by massive amounts of energy. Evaluate evidence of plate interactions and determination of the age of crustal rocks.

Suggested Resources/Technology Tools

Earth's Geological and Climatic History
Convection Currents Simulator
Plate Tectonics Phet
Volcanoes
Sea Floor Spreading
Earthquakes and the Theory of Plate Tectonics
Mountain Formation
Absolute Dating with MandM's

Radiometric Dating Activity
Air Quality Research

Modifications

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ELL

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- Utilize bilingual reading texts provided by the STC program.

G/T

Utilize differentiation in the areas of acceleration, enrichment, and grouping. Examples include, but are not limited to:

- interdisciplinary and problem-based assignments with planned scope and sequence
- advance, accelerated, or compacted content
- abstract and advanced higher-level thinking
- allowance for individual student interests
- assignments geared to development in areas of affect, creativity, cognition, and research skills
- complex, in-depth assignments
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504/IEP

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- Additional time for in-class assignments
- Additional time in lab
- Visual and tactile instructional demonstrations
- Computer with voice output, spelling and grammar checker
- Seating in the front of the class

- Tactile drawings and graphs, and three-dimensional models
- Assignments in electronic format
- Large-print handouts, lab signs and equipment labels
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Please select all standards that apply to this unit of study:

- ✓ Act as a responsible and contributing citizen and employee.
- ✓ Apply appropriate academic and technical skills.
- ○ Attend to personal health and financial well being.
- ✓ Communicate clearly and effectively and with reason.
- ✓ Consider the environmental social and economic impacts of decisions.
- ✓ Demonstrate creativity and innovation.
- ✓ Employ valid and reliable research strategies.
- ✓ Utilize critical thinking to make sense of problems and persevere in solving them.
- ✓ Model integrity, ethical leadership, and effective management.
- ✓ Plan education and career paths aligned to personal goals.
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- ○ Work productively in teams while using cultural global competence.

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LINKS TO CAREERS:

Career Applications and Exploration: Earth's Processes