

Hoboken Public Schools

**Earth Science & Physics Curriculum
Grade 7**



Science Grade 7

HOBOKEN PUBLIC SCHOOLS

Course Description

The Hoboken Public Schools seventh grade science program is designed to introduce and develop a foundation in science through hands-on learning in the areas of Physics and Earth Sciences. These units of study will assist students in gaining an understanding of various scientific processes. With the use of a Physics program along with the Integrated Science series embedded in a 3:2 weekly schedule, 7th grade science students will have a vast knowledge of Optics while still grasping Next Generation Science Standards in the area of Earth Sciences. Hoboken Public School's 7th grade science curriculum aims to boost classroom engagement through various lab activities, student interactions, understanding phenomena, and implementing the basic methods of scientific research. As students engage in different science-based experiences, they will begin to see a range of paths and possibilities they can pursue in their education and careers.

Course Resources

1. Physics in a Box - Optics
2. *McGraw Hill* Integrated iScience Course 2
3. [New Jersey Student Learning Standards - Science](#)
4. [New Jersey Student Learning Standard 8 - 8.2 Design Thinking](#)
5. [New Jersey Student Learning Standard 9 - Career Readiness, Life Literacies and Key Skills](#)
6. [STEAM Tank Challenge Playbook](#)
7. New Jersey Center for Teaching & Learning (NJCTL) <https://njctl.org/courses/science/>

Pacing Guide:

The Physics Program will work in alignment with the Integrated iScience Program in a 3:2 weekly schedule. Each unit will simultaneously be taught within the below pacing guide.

Unit #	Unit Title	Student Designed Laboratory Rubric	Standards	Resources
1	Optics Phenomena, Colors of Light, & Propagation of Light	Color Filters Lab	MS-PS1-1 MS-PS1-2 MS-PS1-3 MS-PS1-4 MS-PS1-5 MS-PS1-6	Physics in a Box- Optics
1	Understanding Matter (Classification & Properties)	Matter IDs; Growing Air; Phase Out, Phase In; STEM Project: Cycling Across States	MS-PS1-1 MS-PS1-2 MS-PS1-4 MS-PS1-5 MS-PS1-6 MS-ETS1-3	<i>McGraw Hill</i> Integrated iScience Course 2

			MS-ETS1-4	
1	STEAM TANK	STEAM Tank Scoring Rubric	8.2	STEAM Tank Challenge Playbook
2	Polarization of Light, Reflection of Light, Refraction of Light, & Mirrors	Mirrors Lab Refractions of Light Experiment	MS-PS4-1 MS-PS4-2 MS-PS4-3	Physics in a Box- Optics
2	The Changing Earth (Dynamic Earth & Natural Hazards)	Reconstructing Gondwana; Simulating Sonar; Living on the Edge; STEM Project: Rockin' Around the Park	MS-ESS2-1 MS-ESS2-2 MS-ESS2-3 MS-ESS3-2	<i>McGraw Hill</i> Integrated iScience Course 2
3	Prisms, Dispersion of Light, Converging and Diverging Lenses, & Lenses in Depth	How Prisms Work lab	MS-PS4-1 MS-PS4-2 MS-PS4-3	Physics in a Box- Optics
3	Earth's Resources (Distribution of Earth's Resources & Materials Science)	Identifying Resources; Mineral Mining; STEM Project: Where in the World...?	MS-ESS3-1 MS-PS1-3	<i>McGraw Hill</i> Integrated iScience Course 2
4	Interference and Diffraction, The Eye as an Optical System, & Optical Instruments	Optics Lab	MS-PS4-3 MS-PS4-2 MS-PS4-1 MS-LS1-6 MS-LS2-1	Physics in a Box- Optics

4	Interactions with Ecosystems (Matter and Energy, Dynamic Ecosystems, & Biodiversity in Ecosystems)	Photosynthesis and Light; Web of Life; Movin'Matter; Fishy Population Changes; Coral Colleagues; Bead Biodiversity; Turning Trash into Treasure; STEM Project	MS-LS1-6 MS-LS1-7 MS-LS-1 MS-LS2-2 MS-LS2-3 MS-LS2-4 MA-LS2-5 MS-ETS1-1 MS-ETS1-2 MS-ETS1-3	
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Unit 1

Physics Unit 1 - Optics Phenomena, Colors of Light, & Propagation of Light

Earth Science Unit 1 - Understanding Matter (Classification and States of Matter & Properties and Changes)

STEAM Tank Challenge

Timeframe: Marking Period 1 (September-November)

Overview

Students examine the basic principles of physics classroom safety and have an understanding of how to care for a variety of science tools. Students will work with angles, units of measurement, degrees, and utilize these concepts to angle equations. During this unit, students will understand the Pythagorean Theorem by using it in practice to determine triangles and angles in scientific equations. This initial unit of study will lead into Colors of Light which analyzes light spectrums and prisms. Students will understand the color wheel of Newton and its purpose in determining color filters, absorption, and transmissions of light. Students investigate the controlling properties of important materials and construct explanations based on the analysis of real data. Students are expected to demonstrate proficiency in analyzing and interpreting data and constructing explanations. They are also expected to use these practices to demonstrate an understanding of the core ideas.

Alongside the Optics Physics Unit, students are expected to explore basic Earth components such as atoms and molecules and how they make up matter. This unit will introduce students to Earth Science concepts by first guiding learners on types of matter and how matter can change through time. During the first module, Classification and States of Matter, students will investigate states of matter and how matter can change during temperature, pressure, and in molecular structure. This lab-based module will lead into module 2 which is composed of properties and changes in matter. Students will apply atom and molecule concepts previously reviewed and apply it to molecule design, construct, and chemical changes. In cooperative learning groups, learners will engage in inquiry-based activities in order to determine real-world connections to Earth Science topics.

The STEAM Tank Challenge is an opportunity for our students to reimagine and redesign New Jersey to ensure our state is sustainable, healthy, equitable and safe for everyone to live, work, and play. STEAM Tank is designed to provide a way for student teams, as well as teachers, to work collaboratively and learn more about an integrative process of STEAM education. In addition, STEAM Tank helps develop critical thinking and problem-solving skills that will serve students in future careers, and in their everyday lives.

We hope this challenge inspires our students to become the next generation of entrepreneurs, inventors, scientists and engineers that will help make our world a better place for everyone.

Resource

1. Physics in a Box - Optics
 - a. Optics Phenomena Unit
 - b. Colors of Light Unit
 - c. Propagation of Light Unit
2. *McGraw Hill* Integrated iScience Course 2
 - a. Understanding Matter (Classification and States of Matter & Properties and Changes)
3. STEAM Tank Challenge Playbook

Essential Questions

1. What are the geometrical properties of polygons and their angles?
2. How can we use the metric system to calculate angles? Degrees?
3. What are observations you can make in natural and artificial light sources?
4. What does a prism do to light?
5. What do color filters do to colors?
6. What does propagation of light mean?
7. How do atomic structure, pressure, and temperature determine the state of a substance?
8. What effect does changing pressure have on substances?
9. How do properties and energy change during a chemical reaction?
10. How can I improve upon some of the problems and obstacles our world faces?
11. What situations need resolution?
12. What problems need to be solved?
13. How can I recognize an opportunity?
14. What is sustainability?
15. How can I create a sustainable product?

Essential Learning Outcomes

1. Students will learn the main geometrical properties of simple regular polygons in regard to their angle
2. Students will be able to apply their knowledge of the metric system to calculate a variety of angles and prisms.
3. Students will make observations to determine light sources.
4. Students will determine the importance of and purpose of light filters.
5. Students will explore how the temperature, pressure, and structure at the molecular level affect a substance's properties.
6. Students will develop and use models and work with scale, proportion, and quantity to enhance their understanding of matter.
7. Students will apply the concepts they learn throughout the unit to predict matter changes.
8. Students will explore properties and changes of matter, including the changes in energy associated with chemical reactions.
9. Students will be able to use the engineering design process collaboratively.
10. Students will be able to know and understand the interaction of technology and humans.
11. Students will be able to experience the nature of technology and its advancement through the imaginative and inventive nature of people by creating invention or innovation.

12. Students will be able to understand that technology has an effect on the natural world and they will be able to create a sustainable product.
13. Students will be able to demonstrate the effects of ethics and culture from the use of new technologies.

Standards Addressed

- 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.
- 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.
- MS-PS1-5 - Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved
- MS-PS1-6 - Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
- MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- MS-ETS1-4 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.

Disciplinary Core Ideas

- **PS1.A: Structure and Properties of Matter** Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1) Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2), (MS-PS1-3) Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4) In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4) Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)
- **PS1.B: Chemical Reactions** Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2), (MS-PS1-3), (MS-PS1-5) The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5) Some chemical reactions release energy, others store energy. (MS-PS1-6)
- **PS3.A: Definitions of Energy** The term “heat” as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MS-PS1-4) The temperature of a system is proportional to the average internal

kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary to MS-PS1-4)

- **ETS1.B: Developing Possible Solutions** A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (secondary to MS-PS1-6)
- **ETS1.C: Optimizing the Design Solution** Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of the characteristics may be incorporated into the new design. (secondary to MS-PS1-6) The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (secondary to MS-PS1-6)

Crosscutting Concepts

- **Patterns** Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)
- **Cause and Effect** Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)
- **Scale, Proportion, and Quantity** Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1)
- **Energy and Matter** Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5) The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6)
- **Structure and Function** Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)
- **Interdependence of Science, Engineering, and Technology** Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-PS1-3)
- **Influence of Science, Engineering, and Technology on Society and the Natural World** All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1) The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)

Integrated Accommodations and Modifications

- **Special Education Students**
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
 - Extended time for revisions or opportunity to identify and develop areas of personal interest
 - [Unique Learning System](#) enables educators in self-contained classes to deliver differentiated, standards-aligned content from one convenient, cloud-based platform enhanced by robust assessments, data tools, and evidence-based instructional support. Students from pre-K through transition have the advantage of consistent, high-quality

instruction, a motivating interactive learning environment, engaging symbol support, and a path to independence.

- **English Language Learners**
 - Invite students to explore different points of view on a topic of study and compare.
 - Translated literature on tape
- **Skills Fragile Students**
 - Encourage students to make transformations - use a common task or item in a different way
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
 - Extended time for revisions or opportunity to identify and develop areas of personal interest
- **504 Students**
 - Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment.
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
 - Extended time for revisions or opportunity to identify and develop areas of personal interest
- **Gifted & Talented Students**
 - Encourage students to explore concepts in depth and encourage independent studies or investigations.
 - Modeling or independent student led research

Assessments (Formative, Summative, Benchmark, Alternative)

1. Research Simulation Tasks and Peer Review
2. Formal Assessments by way of Tests and Quizzes
3. Formal Lab Reports using [HMS Science Lab Template](#)
4. Module-based labs
 - a. Physics
 - b. Life Science
5. STEAM Tank Challenge Submission
6. Multimedia Presentation
7. Journal Writing Prompts
8. Vocabulary Quizzes
9. Weekly Night Writes that act as a springboard for the next day's lesson
10. Formative assessments in the form of quizzes, class participation, discussion, topic blogging, and/or journaling

NJSLS 8.2 Design Thinking

- 8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
- 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem. •
- 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
- 8.2.8.ED.4: Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team

- 8.2.8.ED.5: Explain the need for optimization in a design process.
- 8.2.8.ED.6: Analyze how trade-offs can impact the design of a product.
- 8.2.8.ED.7: Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).
- 8.2.8.ITH.1: Explain how the development and use of technology influences economic, political, social, and cultural issues.
- 8.2.8.ITH.2: Compare how technologies have influenced society over time.
- 8.2.8.ITH.3: Evaluate the impact of sustainability on the development of a designed product or system.
- 8.2.8.ITH.4: Identify technologies that have been designed to reduce the negative consequences of other technologies and explain the change in impact.
- 8.2.8.ITH.5: Compare the impacts of a given technology on different societies, noting factors that may make a technology appropriate and sustainable in one society but not in another.
- 8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem.
- 8.2.8.NT.2: Analyze an existing technological product that has been repurposed for a different function.
- 8.2.8.NT.3: Examine a system, consider how each part relates to other parts, and redesign it for another purpose.
- 8.2.8.NT.4: Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product.
- 8.2.8.ETW.1: Illustrate how a product is upcycled into a new product and analyze the short- and long-term benefits and costs.
- 8.2.8.ETW.2: Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital).
- 8.2.8.ETW.3: Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact.
- 8.2.8.ETW.4: Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best.
- 8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies.
- 8.2.8.EC.2: Examine the effects of ethical and unethical practices in product design and development.

Integration of NJSL Standard 9: Career Readiness Life Literacies and Key Skills

- 9.1.8.CP.1: Compare prices for the same goods or services.
- 9.1.8.FP.6: Compare and contrast advertising messages to understand what they are trying to accomplish.
- 9.1.8.FP.7: Identify the techniques and effects of deceptive advertising.
- 9.1.8.PB.7: Brainstorm techniques that will help decrease expenses including comparison shopping, negotiating, and day-to-day expense management
- 9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., cross cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions.
- 9.4.8.CI.2: Repurpose an existing resource in an innovative way.
- 9.4.8.CI.3: Examine challenges that may exist in the adoption of new ideas.
- 9.4.8.CI.4: Explore the role of creativity and innovation in career pathways and industries

- 9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective.
- 9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option.
- 9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
- 9.4.8.DC.1: Analyze the resource citations in online materials for proper use.
- 9.4.8.DC.2: Provide appropriate citation and attribution elements when creating media products.
- 9.4.8.DC.8: Explain how communities use data and technology to develop measures to respond to effects of climate change. (e.g., smart cities).
- 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

Interdisciplinary Connections/Crosscutting Concepts

- The science curriculum includes unifying themes such as systems, changes, and models. These themes combine with connected skills such as using measurement and representations. These themes and skills, along with the shared processes of observing and predicting, provide teachers with a myriad of opportunities for making meaningful curricular connections across disciplines.
- For example, investigations of local issues can engage students in thinking about science and social science concepts and help develop their understanding of probability and data analysis, which are parts of the mathematics standards. Learning, understanding, and using scientific vocabulary allows students to attach their ideas to content specific words and phrases. Students must understand appropriate levels of scientific terminology to be able to meet the lesson objectives. In addition, teachers may use journals, night writes, lab reports, and outlines to provide students with opportunities to write in the science classroom.
- Throughout each module and in culminating module projects/tasks, students will integrate relevant Science and Engineering Practices (SEPs) and Crosscutting Concepts (CCCs) into their learning and understanding of the Disciplinary Core Ideas (DCIs).

Unit 2

Physics Unit 2- Polarization of Light, Reflection of Light, Refraction of Light, & Mirrors

Earth Science Unit 2 - The Changing Earth (Dynamic Earth & Natural Hazards)

Timeframe: Marking Period 2 (November-January)

Overview

Students examine and study the polarization of light and how it reflects, scatters, and refracts in various scenarios and environments. Students will utilize experimental observations to analyze light in nature. During this unit, students will investigate light reflection using a plane mirror to build critical thinking skills in cooperative learning groups. Students will build light and light property concepts by using mirrors, convex and concave, to understand reflection and reflection properties. Students investigate the controlling properties of important materials and construct explanations based on the analysis of real data. Students are expected to demonstrate proficiency in analyzing and interpreting data and constructing

explanations. They are also expected to use these practices to demonstrate an understanding of the core ideas.

In tandem with the Optics Physics component, students will be engaged in aspects of geoscience processes following up with Unit 1 of the Earth Sciences. Throughout Unit 2, The Changing Earth, learners will dig deeper into Earth concepts such as continents, Earth's changing surface, and natural physical features in geoscience. With these core Earth concepts, students can investigate theories about Earth's surface and make predictions utilizing several hands-on labs and STEM-related activities. Module 2 of The Changing Earth Unit will focus on natural phenomena such as earthquakes, volcanic eruptions, and unique weather patterns. Students will analyze and interpret data regarding natural hazards which will enable them to apply further Earth surface concepts to assist in testing methods and observing results. In cooperative learning groups, learners will participate in inquiry-based activities in order to determine real-world connections to Earth Science topics.

Resource

1. Physics in a Box - Mechanics
 - a. Polarization of Light unit
 - b. Reflection of Light unit
 - c. Refraction of Light unit
 - d. Concave and Convex Mirrors unit
2. *McGraw Hill* Integrated iScience Course 2
 - a. The Changing Earth Unit

Essential Questions

1. What are the types of waves throughout the entire electromagnetic spectrum?
2. What are some of the theories of light from the past, and what is today's theory?
3. What is polarization of light?
4. What is the law of reflection of light?
5. What are different types of mirrors?
6. What is the speed of light in a diamond and other materials?
7. How do geoscience processes shape and change Earth's surface over time?
8. How does the flow of energy and cycling of matter produce chemical and physical changes in Earth's materials?
9. How can analyzing data on natural hazards forecast future events and develop ways to lessen their effects?

Essential Learning Outcomes

1. Students will learn what a polarized light is and how it is created.
2. Students will learn how light reflected from different surfaces is polarize
3. Students will learn how refracted light is polarized.
4. Students will learn what reflection is and will understand the law of reflection of light.
5. Students will learn what the specular and diffuse reflections are and consider various situations when these two types of reflection are met in nature.
6. Students will learn what a concave mirror is and its elements.

7. Students will experimentally confirm the law of light refraction on the boundary between two media.
8. Students will explore how geoscience processes shape Earth's surface.
9. Students will develop and use models to describe the stability and change of these geoscience processes.
10. Students will analyze and interpret data about natural hazards and learn how these data points are used, along with technology, to help forecast catastrophic events.
11. Students will model and test methods to mitigate the effects of various natural hazards.

Standards Addressed

- 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 a wave.
- MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
- MS-PS4-3 Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.
- MS-ESS2-1 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process
- MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
- MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

Disciplinary Core Ideas

- **ESS1.C: The History of Planet Earth** Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C GBE) (secondary to MS-ESS2-3)
- **ESS2.A: Earth's Materials and Systems** All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1) The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2)
- **ESS2.B: Plate Tectonics and LargeScale System Interactions** Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)
- **ESS2.C: The Roles of Water in Earth's Surface Processes** Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. (MS-ESS2-2)
- **ESS3.B: Natural Hazards** Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS-ESS3-2)
- **PS4.A: Wave Properties** A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1) A sound wave needs a medium through which it is

transmitted. (MS-PS4-2)

- **PS4.B: Electromagnetic Radiation** When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2) The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2) A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2) However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2)
- **PS4.C: Information Technologies and Instrumentation** Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)

Crosscutting Concepts

- **Patterns** Graphs and charts can be used to identify patterns in data. (MS-PS4-1) Structure and Function Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2) Structures can be designed to serve particular functions. (MS-PS4-3)
- **Influence of Science, Engineering, and Technology on Society and the Natural World** Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3)
- **Patterns** Graphs, charts, and images can be used to identify patterns in data. (MS-ESS3-2)

Integrated Accommodations and Modifications

- **Special Education Students**
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 - [Unique Learning System](#) enables educators in self-contained classes to deliver differentiated, standards-aligned content from one convenient, cloud-based platform enhanced by robust assessments, data tools, and evidence-based instructional support. Students from pre-K through transition have the advantage of consistent, high-quality instruction, a motivating interactive learning environment, engaging symbol support, and a path to independence.
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 - Translated literature on tape
- **Skills Fragile Students**
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- **504 Students**

- o Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment.
- o Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
- o Extended time for revisions or opportunity to identify and develop areas of personal interest
- **Gifted & Talented Students**
 - o Encourage students to explore concepts in depth and encourage independent studies or investigations.
 - o Modeling or independent student led research

Assessments (Formative, Summative, Benchmark, Alternative)

1. Research Simulation Tasks and Peer Review
2. Formal Assessments by way of Tests and Quizzes
3. Formal Lab Reports using [HMS Science Lab Template](#)
4. Module-based labs
 - a. Physics
 - b. Life Science
5. Multimedia Presentation
6. Journal Writing Prompts
7. Vocabulary Quizzes
8. Weekly Night Writes that act as a springboard for the next day's lesson
9. Formative assessments in the form of quizzes, class participation, discussion, topic blogging, and/or journaling

Integration of NJSL Standard 9: Career Readiness Life Literacies and Key Skills

- 9.4.8.CI.2: Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3).
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Interdisciplinary Connections/Crosscutting Concepts

- The science curriculum includes unifying themes such as systems, changes, and models. These themes combine with connected skills such as using measurement and representations. These

themes and skills, along with the shared processes of observing and predicting, provide teachers with a myriad of opportunities for making meaningful curricular connections across disciplines.

- For example, investigations of local issues can engage students in thinking about science and social science concepts and help develop their understanding of probability and data analysis, which are parts of the mathematics standards. Learning, understanding, and using scientific vocabulary allows students to attach their ideas to content specific words and phrases. Students must understand appropriate levels of scientific terminology to be able to meet the lesson objectives. In addition, teachers may use journals, night writes, lab reports, and outlines to provide students with opportunities to write in the science classroom.
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Unit 3

Physics Unit 3 - Prisms, Dispersion of Light, Converging and Diverging Lenses, & Lenses in Depth
Earth Science Unit 3 - Earth's Resources (Distribution of Earth's Resources & Materials Science)
Timeframe: Marking Period 3 (January- April)

Overview

Students will participate in an experimental study of how prisms work in a variety of scenarios. This will be studied by first understanding the different types of prisms present. Students will build on their knowledge by creating a periscope to study angles and angles of light and how images can be projected. The learner will analyze converging and diverging lenses in order to understand how to magnify objects at a great distance. Throughout this unit, there will be a focus on lenses and how lenses can help build objects. Students will have an understanding of the importance of lenses and their optical power. Other concepts that will engage students in this unit include Bessel's Method, Abbe's Method, and Cylindrical lenses. Students investigate the controlling properties of important materials and construct explanations based on the analysis of real data. Students are expected to demonstrate proficiency in analyzing and interpreting data and constructing explanations. They are also expected to use these practices to demonstrate an understanding of the core ideas.

Along with the Optics Unit, students will further enhance their understanding of Earth Science by investigating geoscience concepts which include Earth's physical landscape and how it changes over time. Students will learn how human use of resources impacts the availability and distribution of resources based on location and depletion of resources. Students will understand the importance of Earth's resources and how humans utilize as well as deplete natural resources over time. Various resources such as fossil fuels, groundwater, minerals, and soil will be explored and learners will create alternative ideas on how mankind can survive with limited resource usage or inventing new and innovative ways to create energy. In cooperative learning groups, learners will participate in inquiry-based activities in order to determine real-world connections to Earth Science topics.

Resources

1. Physics in a Box - Optics
 - a. Prisms unit
 - b. Dispersion of Light Unit

- c. Converging and Diverging Lenses Unit
 - d. Lenses in Depth Unit
- 2. *McGraw Hill* Integrated iScience Course 2
 - a. Earth's Resources (Distribution of Earth's Resources & Materials Science)

Essential Questions

1. Explain the behavior of the laser beam using the knowledge of the law of reflection and refraction.
2. Classify the prisms you study experimentally in accordance to the classification you have created.
3. Do you think the periscope would work if the mirrors were at some angle other than 45degrees?
4. Create your own light prism.
5. How can you identify the type of lens being used?
6. What are the equations for the lens focal distance,magnification, and optical power?
7. How do geoscience processes result in the uneven distribution of Earth's mineral energy, and groundwater resources?
8. Why are resources distributed unevenly on Earth?
9. How are synthetic materials made and what are their effects on individuals, society, and the environment?

Essential Learning Outcomes

1. Students will study experimentally what a prism does to light from the point of view of reflection and refraction phenomena.
2. Students will research the description of different types of prisms.
3. The student will study the structure of the simplest periscope to see how it reflects light.
4. Students will refresh their knowledge about or will be introduced to the phenomenon of the dispersion of light.
5. Students will develop an understanding of converging lenses and learn to identify them.
6. Students will learn the lens equation in a form developed by Newton.
7. Students will learn how people use natural resources from geoscience processes which will assist them in understanding how resources are depleted over time.
8. Students will analyze and interpret maps and other data to recognize patterns in the distribution of resources. Learners will identify Earth's natural resources based on location, geography, climate, and human life.
9. Students will investigate the properties of materials, how they are made, and the impact their production and use has on people and the environment.

Standards Addressed

- 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 a wave.
- MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
- MS-PS4-3 Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.
- MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
- MS-PS1-3 Gather and make sense of information to describe that synthetic materials come from

natural resources and impact society.

Disciplinary Core Ideas

- **PS4.A: Wave Properties** A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1) A sound wave needs a medium through which it is transmitted. (MS-PS4-2)
- **PS4.B: Electromagnetic Radiation** When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2) The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2) A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2) However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2)
- **PS4.C: Information Technologies and Instrumentation** Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)
- **ESS3.A: Natural Resources** Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)

Crosscutting Concepts

- **Patterns** Graphs and charts can be used to identify patterns in data. (MS-PS4-1) Structure and Function Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2) Structures can be designed to serve particular functions. (MS-PS4-3)
- **Influence of Science, Engineering, and Technology on Society and the Natural World** Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3) All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ESS3-1), (MS-ESS3-4)

Integrated Accommodations and Modifications

- **Special Education Students**
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
 - Extended time for revisions or opportunity to identify and develop areas of personal interest
 - [Unique Learning System](#) enables educators in self-contained classes to deliver differentiated, standards-aligned content from one convenient, cloud-based platform enhanced by robust assessments, data tools, and evidence-based instructional support. Students from pre-K through transition have the advantage of consistent, high-quality instruction, a motivating interactive learning environment, engaging symbol support, and a path to independence.
- **English Language Learners**

- o Invite students to explore different points of view on a topic of study and compare.
- o Translated literature on tape
- **Skills Fragile Students**
 - o Encourage students to make transformations - use a common task or item in a different way
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- **504 Students**
 - o Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment.
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- **Gifted & Talented Students**
 - o Encourage students to explore concepts in depth and encourage independent studies or investigations.
 - o Modeling or independent student led research

Assessments (Formative, Summative, Benchmark, Alternative)

1. Research Simulation Tasks and Peer Review
2. Formal Assessments by way of Tests and Quizzes
3. Formal Lab Reports using [HMS Science Lab Template](#)
4. Module-based labs
 - a. Physics
 - b. Life Science
5. Multimedia Presentation
6. Journal Writing Prompts
7. Vocabulary Quizzes
8. Weekly Night Writes that act as a springboard for the next day's lesson
9. Formative assessments in the form of quizzes, class participation, discussion, topic blogging, and/or journaling

Integration of NJSL Standard 9: Career Readiness Life Literacies and Key Skills

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- For example, investigations of local issues can engage students in thinking about science and social science concepts and help develop their understanding of probability and data analysis, which are parts of the mathematics standards. Learning, understanding, and using scientific vocabulary allows students to attach their ideas to content specific words and phrases. Students must understand appropriate levels of scientific terminology to be able to meet the lesson objectives. In addition, teachers may use journals, night writes, lab reports, and outlines to provide students with opportunities to write in the science classroom.
- Throughout each module and in culminating module projects/tasks, students will integrate relevant Science and Engineering Practices (SEPs) and Crosscutting Concepts (CCCs) into their learning and understanding of the Disciplinary Core Ideas (DCIs).

Unit 4

Physics Unit 4 - Interference and Diffraction, The Eye as an Optical System, & Optical Instruments
Earth Science Unit 4 - Interactions with Ecosystems (Matter and Energy, Dynamic Ecosystems, & Biodiversity in Ecosystems)

Timeframe: Marking Period 4 (April - June)

Overview

Students will learn about Young's Experiment and will be introduced to superposition of waves and interference. They will practice adding and subtracting waves, and producing constructive and destructive interference. Students also will conduct a classical optics experiment producing an interference of light when it comes from two point light sources. Students will learn about the interference of light in thin films by studying wavelength of light and other methods of light sources. During this unit, students will study the eye and how its mechanics allow sight. The study of the eye will introduce to students the concepts of nearsightedness, farsightedness, and how the eye works. The Optical Instruments unit will touch upon various optical instruments used in the field of study. Students demonstrate grade appropriate proficiency in developing and using models, and obtaining, evaluating, and communicating information. Students are also expected to use the scientific and engineering practices to demonstrate an understanding of the core ideas.

Working alongside the Physics Unit and Physics Standards, Grade 7 students will wrap up Earth Science with a final unit of how ecosystems function at varying levels. Students will explore the processes of different ecosystems and connect back to Unit 1 and cellular growth and changes based on environmental influences. The learner will construct explanations based on scientific research and evidence for how energy is used to make life and ecosystems. Photosynthesis-based activities will show how organisms grow and release energy for other organisms to thrive. Students will apply concepts of Earth Science to develop presentations on the cycling of ecosystems. To close out the Interactions and Ecosystems Unit, learners will study unique ecosystems to understand how the environment changes them to enhance or to hinder growth. In cooperative learning groups, learners will participate in inquiry-based activities in order to determine real-world connections to Earth Science topics.

Resource

1. Physics in a Box- Optics
 - a. Interference and Diffraction unit
 - b. The Eye as an Optical System unit
 - c. Optical Instruments unit
2. *McGraw Hill* Integrated iScience Course 2
 - a. Interactions with Ecosystems

Essential Questions

1. What is interference?
2. Explain the interference pattern using your knowledge about the superposition of waves.
3. How would the data and results of the experiment be affected?
4. How can we observe the diffraction of light?
5. Explain the function of an eye and how you are able to see objects.
6. What are ways we can visually see better?
7. How does a camera obscura function?
8. How do matter and energy move through organisms and the environment?
9. How are interacting populations of organisms affected by changes to ecosystems?
10. Why is biodiversity important, and how can it be protected?

Essential Learning Outcomes

1. Students will be introduced to the superposition of waves and interference.
2. Students also will conduct a classical optics experiment producing an interference of light.
3. Students will learn about the interference of light in thin films.
4. Students will learn what diffraction is and observe the diffraction of light.
5. Students will learn how to experimentally determine the wavelengths for different colors of the visible light spectrum using a diffraction grating.
6. Students will learn the structure of an eye and how it functions to see objects.
7. Students will learn about such a malfunction of a human eye as short-sightedness and how to mitigate it.
8. Students will create the simplest optical device, a camera obscura, and learn how it works.
9. Students will explore the processes of photosynthesis and cellular respiration, and relate these processes to the movement of matter and energy through organisms and the environment.
10. Students will discover how organisms interact and change in an ecosystem, and come to understand how populations are affected by the availability of resources in their ecosystems.

11. Students will design a solution to maintain the biodiversity in a coral reef ecosystem.

Standards Addressed

- MS-PS4-3 Evaluate the claims, evidence, and 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.
- MS-PS4-2 Evaluate questions about the advantages of using a digital transmission and storage of information.
- MS-PS4-1 Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
- MS-LS1-6 Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon based molecules.
- MS-LS1-7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
- MS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
- MS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- MS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
- MS-LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
- MS-LS2-5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
- MS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- MS-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.
- MS-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.

Disciplinary Core Ideas

- **ETS1.A: Defining and Delimiting Engineering Problems** The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions. (secondary to MS-PS3-3) (MS-ETS1-1)
- **ETS1.B: Developing Possible Solutions** A solution needs to be tested, and then modified on the basis of the test results in order to improve it. (MS-ETS1-4) There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. (secondary to MS-PS3-3) (MS-ETS1-2), (MS-ETS1-3) Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3) Models of all kinds are important for testing solutions. (MS-ETS1-4)

- **ETS1.C: Optimizing the Design Solution** Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3) The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)
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Crosscutting Concepts

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