REGION ONE LEARNING SUPPORT CENTER
Irma Zardoya, Regional Superintendent

Imagination is more important than knowledge.
Knowledge is limited. Imagination encircles the world."
Albert Einstein

SCIENCE SYLLABUS
GRADE 8
LIFE SCIENCE

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Introduction

How was the Syllabus Developed?

Alignment with NYS/NYC Standards: Our goal was to develop a document that would help teachers to know "what" to teach and "how" to teach it. The "what" was determined by the New York State Intermediate Level Science Core Curriculum (Core Curriculum). This Core Curriculum provides the major conceptual understandings and science process skills that students should attain as they address the Mathematics, Science, and Technology Learning Standards (Standards 1, 2, 4, 6, and 7). The "how" evolved from the belief that students learn science best when they have opportunities to construct scientific knowledge for themselves and develop their inquiry skills. In addition, the NYC Performance Standards provide a framework for assessing student performance in science. As a result a performance-based, or hands-on, minds-on, inquiry-based, approach was developed.

How Is the Document is Organized?

- **Curriculum Map:** The curriculum map provides an overview of the units and concepts to be explored at each grade level as well as suggested times for each unit. The suggested times help to provide a sense for how much a given unit should be emphasized within the syllabus. The curriculum map may be used by teachers and administrators for school-based curriculum mapping, alignment with thematic units, as well as and long-term unit planning.

- **Units:** On each grade, the syllabus is organized into units spanning anywhere from 1 to 8 weeks. Next to each unit heading (in bold type), the suggested time for the unit is provided.

- **Key Ideas:** Within each unit, several key ideas are addressed. The key ideas are italicized, with key words in bold. Each key idea is referenced to the Performance Indicator it addresses in the NYS Intermediate Level Science Core Curriculum. Most of the key ideas are taken directly from the Major Understandings found in the Core Curriculum. Other key ideas provide background or help to specify additional content knowledge that students will require in order to fully meet the NYS content standards.

- **Performance Tasks:** Suggested performance tasks address each key idea, which allow students to develop an understanding of the key idea and demonstrate important science process and inquiry skills. In addition to content, the Core Curriculum incorporates process skills based on Standard 4, the Science content standard (See pages 10 to 11, Core Curriculum.). For example, students are expected to be competent in the use of a metric ruler, triple beam balance, stop watch, graduated cylinder, thermometer, spring scale, and voltmeter, as well as a compound microscope. These and other process skills have been embedded into the performance tasks throughout the curriculum. By incorporating assessment strategies, such as checklists, observations, student self-reflections, written work, and student/teacher-designed rubrics, the performance tasks may also be used as performance assessments.

  The performance tasks are *suggested* activities. Students are not expected to accomplish all the tasks that are provided. Nor are teachers expected to adhere to the sequence as given. Instead the performance tasks show how students can develop an

understanding of each key idea by engaging in hands-on, minds-on, inquiry-based activities. Teachers may substitute other suitable activities that accomplish similar objectives.

- **NYS MST Standards and NYC Performance Standards in Science:** By completing the performance tasks, including analysis and explanation of their observations and results, student work will always address a variety of standards. References to these standards are provided. Nevertheless, these references are highly dependent on how teachers approach instruction and the types of outcomes or student products that are expected. As a result, the references are not all inclusive. In addition, some of the performance tasks for a given key idea may address all the standards cited, while others may not. However, the references help to illustrate how students can address a variety of standards numerous times and in multiple ways on their journey towards meeting and even exceeding them.

  The NYC Performance standards also address the question of, "How good is good enough?" In order to determine whether student work, that might contain all the elements required by the standards, does in fact meet the standards, teachers must also evaluate the quality of the student's work. The NYC edition of the Performance Standards in Science provides work samples with commentaries that help to illustrate ""How good is good enough?"

- **Resources:** The resources section contains references to curriculum guides, such as AIMS or GEMS, and textbooks, where the actual or similar activities to the performance tasks may be found. In addition, this section may also contain suggested classroom library titles. Technology resources are listed in the Technology Connections, including sciLINKS, and other multimedia resources, such as laser discs, videos or CD-ROMS. SciLINKS are Internet resources for teachers, students, and parents, maintained by the National Science Teachers Association. They contain links to Web sites that include additional information about each topic, classroom/home activities, lesson plans, interactive programs, etc. Teachers should preview all Web sites before students explore them on their own.

- **Mathematics, Technology, and Literacy Connections**: The Mathematics, Technology, and Literacy connections help to illustrate the ways in which these skill areas are embedded in the Science curriculum. Typically these connections allow students to engage in analysis, explanation, evaluation, and presentation of their observations and the data they gather. In addition, many of the Technology connections allow students to build or extend their knowledge of Science and to observe scientific processes that would otherwise be difficult to see. It is understood that these connections are more than add-ons to the Science curriculum. Instead, they are an integral part of scientific study, incorporating what scientists do all the time in the conduct of their research.

- **Inquiry Activities:** Inquiry activities provide teachers with ideas about how to integrate the inquiry process and in-depth investigations into virtually every unit in the science curriculum. In addition, these inquiry units lend themselves to Science Exposition or Eighth Grade Exit Projects. Both the NYS Standards and the NYC Performance Standards in Science require students to complete scientific inquiry projects, including controlled experiments, field studies, designs, and secondary research. The NYC Performance Standards in Science indicate that on an annual basis, students will complete a project that integrates several aspects of Science

Standards 1 to 7. In addition, it is expected that over the course of their middle school years, students will have the opportunity to engage in each of the four kinds of in-depth investigations.

Role of Textbooks in Science Instruction: Textbooks are an important resource for students and teachers. The background information, diagrams, illustrations, and practice problems provide a foundation for student learning. Support materials that accompany textbooks typically provide laboratory activities, assessment strategies, etc. that allow teachers to focus more on tailoring the activities and assessments to their students rather than starting from ground zero. However, exclusive use of textbooks without opportunities for hands-on activities is extremely undesirable, as it will not allow students to achieve the standards or become proficient in science process skills.

Anticipated Changes: Science is not a static subject. Rather, science is constantly changing as scientific laws, models, and theories are periodically redefined and our ways of thinking about the world shift. This syllabus will reflect such changes. The Science department will continue to refine and enhance the performance tasks and resource sections and the Technology department will continue to provide updated and enhanced technology connections, such as software titles and student project ideas. More importantly, as teachers begin to actively use the syllabus for lesson planning and other instructional purposes, their suggestions for improvement will guide the revision process.

Eighth Grade Earth Science
Curriculum Map
Key Ideas

Scientific Inquiry
(Integrated Science Exposition/Exit Projects)

- The central purpose of scientific inquiry is to develop explanations of scientific phenomena.
- Scientific inquiry involves testing proposed explanations using conventional techniques and procedures.
- When observations are analyzed using conventional and invented methods, they provide new insights into phenomena.

Minerals and Rocks
(2 weeks)

- Rocks are composed of minerals.
- A mineral is a naturally formed, inorganic solid with crystalline structure.
- Minerals are identified on the basis of properties such as streak, luster, cleavage, hardness, and reaction to acid.
- Rocks are classified according to their method of formation.
- The three classes of rocks are sedimentary, metamorphic, and igneous.
- The rock cycle model shows how types of rock or rock material may be transformed from one type to another.

Fossils and Earth's History
(2 weeks)

- Many thousands of layers of sedimentary rock show the long history of Earth.
- Fossils are usually found in sedimentary rock.
- Fossils can be used to study past climates, environments, and living things.
- In horizontal sedimentary rock layers the oldest layer is at the bottom and the youngest layer is at the top.
- Scientists use the law of superposition to determine the relative ages of rocks.
- The relative ages of rocks are also determined by examining intrusions and extrusions, as well as index fossils.
- Scientists use radioactive dating to determine the absolute ages of rocks.

Eighth Grade Earth Science
Curriculum Map
Key Ideas

Energy Resources
(1week)

- The Sun is a mjor source of energy for Earth.
- Fossil fuels contain stored solar energy and are considered nonrenewable resources.
- Fossil fuels are a major source of energy in the United States.
- Solar energy, wind, moving water, and biomass are examples of renewable energy sources.
- Other sources of energy include nuclear and geothermal energy.

The Interior of the Earth
(6 weeks)

- Globes are useful models of the Earth. Latitude and longitude can be used to find a location on a globe or map.
- The layers of the Earth – crust, mantle, outer core, and inner core have distinct properties.
- Folded, tilted, and displaced rock layers suggest past movements of earth's crust.
- Stresses on the Earth's crust produce compression, tension, and shearing in rock.
- Faulting and folding of the crust cause mountains and other features to form on the surface.
- An earthquake is the movement of the ground caused by seismic waves.
- Seismic waves are vibrations that carry the energy of an earthquake away from the focus.
- Analysis of earthquake-wave data leads to the conclusion that there are layers within the Earth.
- Volcanoes are openings on the Earth's surface where magma escapes.
- Continents fitting together like puzzle parts and fossil correlation provided initial evidence that continents were once together.
- The Theory of Plate Tectonics explains how "solid" lithosphere consists of a series of plates that "float" on the partially molten mantle.
- Convection cells within the mantle may be the driving force for plate movement.
- Plates may collide, move apart, or slide past one another.
- Most volcanic activity, earthquakes, and mountain building occur at plate boundaries.

Eighth Grade Earth Science
Curriculum Map
Key Ideas

The Hydrosphere
(2 weeks)

- The majority of the lithosphere is covered by a relatively thin layer of water called the hydrosphere.
- About 97% of the Earth's water is salt water stored in oceans. Less than 1% is usable freshwater.
- Water circulates through the atmosphere, lithosphere, and hydrosphere in the water cycle.
- The ocean floor has features similar to those on land: plains, hills, mountains, volcanoes, and trenches.
- Sources of drinking water include rivers, lakes, reservoirs, and groundwater.
- Fresh water is scarce in many areas.

The Atmosphere
(2 weeks)

- Nearly all the atmosphere is confined to a thin shell surrounding Earth.
- The atmosphere is a mixture of gases, including nitrogen and oxygen, with small amounts of water vapor, carbon dioxide and other trace gases.
- As altitude increases air pressure decreases.
- Earth receives energy in the form of radiation.
- When absorbed, radiant energy becomes heat.
- Near earth's surface air is heated by conduction.
- Convection currents are caused by unequal heating of Earth's surface.
- Nearly all weather occurs in the lowest layer of the atmosphere.

Eighth Grade Earth Science
Curriculum Map
Key Ideas

Weather and Climate
(6 weeks)

- Air masses form when air remains over a large section of Earth's surface.
- Most changes in local weather conditions are caused by movement of air masses
- Fronts are boundaries between air masses.
- Precipitation is likely to occur at front boundaries.
- High-pressure systems generally bring fair weather.
- Low-pressure systems usually bring cloudy unstable conditions.
- The general movement of highs and lows is from west to east across the United States.
- Weather patterns become evident when weather variables are observed, measured, and recorded.
- Hazardous weather conditions include thunderstorms, tornadoes, hurricanes, ice storms, and blizzards.
- Climate is the characteristic weather that prevails from season to season and year to year.
- Climate variations influence the form and nature of the landscape.
- Substances enter the atmosphere naturally and from human activity.
- Some substances affect weather, climate, and living things.

Environmental Monitoring
(4 weeks)

- Human activities can bring about environmental degradation through resource acquisition, urban growth, land use decisions, and waste disposal.
- Human activities have resulted in major pollution of air, water, and soil.
- Pollution has cumulative effects such as acid rain, global warming, and ozone depletion.
- The environment may contain dangerous level of substances.
- Health of environments and individuals requires monitoring of soil, air, and water.
- The survival of living things depends on conservation and protection of Earth's resources.

Eighth Grade Earth Science
Curriculum Map
Key Ideas

Astronomy
(8 weeks)

- The Universe is comprised of a wide array of objects, a few of which can be seen with the unaided eye.
- Celestial objects, distinct from earth, are in motion relative to Earth and each other.
- The latitude/longitude system and our system of time are based on celestial observations.
- Earth's Sun is an average-sized star.
- The Sun is more than a million times greater in volume than Earth.
- Other stars are like the Sun, but so far away they look like points of light.
- The Sun and the planets that revolve around it are the major bodies in the solar system.
- Every object exerts gravitational force on every other object.
- Gravity is the force that keeps planets in orbit around the Sun and governs the rest of the motion in the Solar System.
- The apparent motions of the Sun, Moon, planets, and stars across the sky can be explained by Earth's rotation and revolution.
- Earth's rotation causes the length of one day to be approximately 24 hours.
- Earth's revolution around the Sun defines the length of the year as 365 1/4.
- The tilt of Earth's axis of rotation and the revolution of Earth around the Sun cause seasons on Earth.
- Moons are seen by reflected light.
- Our Moon's phases as observed from Earth are the result of seeing different portions of the lighted area of the Moon's surface.
- The Moon's phases repeat in a cyclic pattern in about one month.
- Most objects in the Solar system are in regular and predictable motion. These motions help explain eclipses, tides, meteor showers, and comets.

Science Syllabus: Grade 8: Earth Science

Scientific Inquiry	**Integrated Science Exposition/Exit Projects**
Key Idea	· *The central purpose of **scientific inquiry** is to develop **explanations** of natural **phenomena** in a continuing, creative process.*
NYS MST Standards	· Standard 1: Analysis, Inquiry, and Design: Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.
Performance Tasks	· Students explore and develop explanations and hypotheses about scientific phenomena.
NYS MST Standards	Standard 1: Analysis Inquiry, and Design: Scientific Inquiry: · Key Idea 1: S1.1 - S1.4 Process Skills Based on Standard 4 · General Skills: 4, 5, 8
NYC Performance Standards	Scientific Connections and Applications · S4a, S4e Scientific Thinking · S5a-c, S5d Scientific Communication · S7a-e
Key Idea	· *Scientific inquiry involves the **testing** of proposed explanations of scientific phenomena (hypotheses) using conventional techniques and procedures and usually requiring considerable ingenuity.* · ***Observations** made while testing hypotheses, when analyzed using conventional and invented methods, provide new insights into phenomena.*
NYS MST Standards	· Standard 1: Analysis, Inquiry, and Design: Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.
Performance Tasks	· Student groups develop and execute a research plan to test their hypotheses about particular phenomena culminating in a poster board presentation for school Science Expositions
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 2: S2.1-2.2 · Key Idea 3: S3.1- S3.3 Standard 2: Information Systems · Key Idea 1: 1.3 Process Skills Based on Standard 4 · General Skills: 1-4, 5, 8
NYC Performance Standards	Scientific Connections and Applications · S4a, S4e Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e Scientific Investigation · S8a-d

Resources	· Cothron, J. H, Giese, R, N., and Rezba, R. J. Students and Research: Practical Strategies for Science Classrooms and Competitions. Kendall/Hunt Publishing Company · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Scientific Method* (sciLINKS NUMBER: HSTL004)
Minerals and Rocks	**Suggested Time: 2 weeks**
Key Idea	· *Rocks are composed of **minerals**. Only a few rock-forming minerals make up most of the rocks of Earth.*
NYS MST Standards	· Performance Indicator 2.1: Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.
Performance Tasks	· Given an assortment of ten rocks and minerals, students first observe them and describe the similarities and differences among them. Students then develop a dichotomous key to sort the ten samples into categories according to one characteristic or property at a time. Students share their keys with the class and then are asked to classify the rocks as those that appear to be made from just one substance, those that are made form more than one substance and those that are hard to classify. Students are then told that that those samples made of just one substance are minerals, while those that are made of more than one substance are rocks.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.1e Process Skills Based on Standard 4 · General Skills: 1, 5, 6
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5b-c, S5f Scientific Communication · S7a-b, S7d-e
Resources	· GEMS: Stories in Stone: *Properties of Rocks and Minerals; Distinguishing Rocks and Minerals.* · Holt, Rinehart, and Winston: Holt Science & Technology: Physical Science: *Mysterious Minerals* · NeoSCI: Mineral Formation & Identification: Lab Investigation Kit ·
Mathematics Connections	· Explore methods of collecting and organizing data.

Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Geology *Rocks and Minerals* · National Science Teachers Association: www.scilinks.org: Topic: *Identifying Minerals*: (sciLinks Number: HSTE065) · NeoSCI: Minerals: Virtual Identification Lab: CD-ROM · NeoSCI: Key to Minerals: CD-ROM · Windows on Science Laser Disc: Earth Science Volume 1: This Planet Really Rocks!: *Earth's Building Blocks* · Downs, S. Earth's Hidden Treasures · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Green, J. Against the Elements: Earth · Hall, C. Eyewitness Handbooks: Gem Stones · Horenstein, S. Rocks Tell Stories · Lye, K. Our World: Rocks, Minerals, and Fossils · Pellant, C. Eyewitness Handbooks: Rocks and Minerals · Pough, F. H. Peterson First Guides: Rocks and Minerals · Riley, P. Straightforward Science: Materials and Processes · Symes, R. F. and Harding, R. R. Eyewitness Books: Crystal & Gem · Symes, R. F. Eyewitness Books: Rocks & Minerals · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra · Zim, H. S. and Shaffer, P. R. A Golden Guide: Rocks and Minerals
Literacy Connections	· Write a lab report incorporating informational and narrative procedure writing.
Key Idea	· *A mineral is a naturally formed, inorganic solid with a **crystalline** structure.*
NYS MST Standards	· Performance Indicator 2.1: Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.
Performance Tasks	· Students grow crystals using saturated solutions of salt (use kosher salt) or salol. Students use very hot water to form the solutions, mixing in as much of the salt as the solution will hold; then they place a small sample of the solution into a suitable depression for evaporation (a plastic spoon, small cup, test tube with string, etc.) Students may also place 2-3 drops of the solutions into depression slides, allow the water to evaporate and observe the crystals that form under the microscope. Students compare and contrast the types of crystals that form, the rate at which they form, their size, etc.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.1e Process Skills Based on Standard 4 · General Skills: 1, 2, 7

NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5b-c, S5f Scientific Communication · S7a-b, S7d-e
Resources	· GEMS: Stories in Stone: *Growing Salt Crystals.* · Glencoe: Earth Science: *Crystal Formation* · Holt, Rinehart, and Winston: Holt Science & Technology: Physical Science: *Crystal Growth* · NeoSCI: Mineral Formation & Identification: Lab Investigation Kit · NeoSCI: Crystal Growing: Lab Investigation Kit · Downs, S. Earth's Hidden Treasures · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Green, J. Against the Elements: Earth · Hall, C. Eyewitness Handbooks: Gem Stones · Horenstein, S. Rocks Tell Stories · Lye, K. Our World: Rocks, Minerals, and Fossils · Pellant, C. Eyewitness Handbooks: Rocks and Minerals · Pough, F. H. Peterson First Guides: Rocks and Minerals · Riley, P. Straightforward Science: Materials and Processes · Symes, R. F. and Harding, R. R. Eyewitness Books: Crystal & Gem · Symes, R. F. Eyewitness Books: Rocks & Minerals · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra · Zim, H. S. and Shaffer, P. R. A Golden Guide: Rocks and Minerals
Mathematics Connections	· Explore methods of collecting and organizing data.
Technology Connections	· Use a digital camera to document crystal growth. · Prepare a PowerPoint slideshow describing how crystals grow. · National Geographic Society: NGS PictureShow CD-ROM: Geology *Rocks and Minerals* · National Science Teachers Association: www.scilinks.org: Topic: *Identifying Minerals*: (sciLinks Number: HSTE065) · NeoSCI: Minerals: Virtual Identification Lab: CD-ROM · NeoSCI: Key to Minerals: CD-ROM · Windows on Science Laser Disc: Earth Science Volume 1: This Planet Really Rocks!: *Mineral Crystals*
Literacy Connections	· Write a lab report incorporating informational and narrative procedure writing.
Inquiry activity	· Devise an experiment to determine the effect of temperature, solution concentration, or evaporation rate on the size or form of the crystals.
Key Idea	· *Minerals are identified on the basis of* ***properties*** *such as* ***streak, luster, cleavage, hardness****, and* ***reaction to acid.***
NYS MST Standards	· Performance Indicator 2.1: Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.

Performance Tasks	· Students investigate the physical properties of a mineral by determining luster, cleavage, reaction with acid, streak using streak plates, and hardness using glass plates and Moh's scale of hardness. Students then identify unknown minerals by examining their properties (luster, color, streak, hardness, and cleavage) and using a dichotomous mineral identification key.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.1e Process Skills Based on Standard 4 · General Skills: 1, 5 · Physical Setting Skills: 2
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5b-c, S5f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· Glencoe: Earth Science: *Mineral Identification* · NeoSCI: Mineral Formation & Identification: Lab Investigation Kit · Downs, S. Earth's Hidden Treasures · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Green, J. Against the Elements: Earth · Hall, C. Eyewitness Handbooks: Gem Stones · Horenstein, S. Rocks Tell Stories · Lye, K. Our World: Rocks, Minerals, and Fossils · Pellant, C. Eyewitness Handbooks: Rocks and Minerals · Pough, F. H. Peterson First Guides: Rocks and Minerals · Riley, P. Straightforward Science: Materials and Processes · Symes, R. F. and Harding, R. R. Eyewitness Books: Crystal & Gem · Symes, R. F. Eyewitness Books: Rocks & Minerals · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra · Zim, H. S. and Shaffer, P. R. A Golden Guide: Rocks and Minerals
Mathematics Connections	· Explore methods of collecting and organizing data.
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Geology *Rocks and Minerals* · National Science Teachers Association: www.scilinks.org: Topic: *Identifying Minerals*: (sciLinks Number: HSTE065) · NeoSCI: Minerals: Virtual Identification Lab: CD-ROM · NeoSCI: Key to Minerals: CD-ROM · Windows on Science Laser Disc: Earth Science Volume 1: This Planet Really Rocks!: *Mineral Crystals*

Literacy Connections	· Write a lab report incorporating informational and narrative procedure writing.
Key Idea	· *Rocks are classified according to their method of **formation**. The three classes of rocks are **sedimentary, metamorphic**, and **igneous**. Most rocks show characteristics that give clues to their formation conditions.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Using rock samples, students examine the properties used to identify rocks (composition and texture), and classify them as igneous, sedimentary, or metamorphic according to their method of formation. · Students collect rocks in the field and classify them into one of the three major groups by observing properties of the rocks and using a field guide. · Using materials, such as sand, soil, gravel, seashells, plaster of paris, powdered chalk, and salt, students plan and create models of different types of sedimentary rocks (clastic, organic, chemical). Students allow the model rocks to dry completely; then test their properties (color, texture, hardness, pattern, and resistance to weathering). Students prepare design journals including their procedure for making the rock, their observations, and results of their tests. · Students model the conditions that affect the size of crystals that form in igneous rock by melting a small sample of salol crystals (phenyl salicylate) then recrystallizing the sample at room temperature. Students repeat the procedure placing the melted sample over ice. Students compare and contrast the types of crystals formed and infer how similar processes in the earth affect the size of crystals in igneous rock. · Trips – Fort Tryon Park, Inwood Hill Park
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2g Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 5, 7, 8
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5b-c, S5f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e

Resources	· GEMS: Stories in Stone: *Formation of Igneous Rocks; Formation of Sedimentary Rocks.* · Glencoe: Earth Science: *Sedimentary Rocks; MiniLab: How Do Metamorphic Rocks Form?* · Holt, Rinehart, and Winston: Holt Science & Technology: Physical Science: *Let's Get Sedimental; Metamorphic Mash* · NeoSCI: Rock Formation & Identification: Lab Investigation Kit · Prentice Hall: Science Explorer: Integrated Science Laboratory Manual: *Making Models of Sedimentary Rocks* · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Green, J. Against the Elements: Earth · Lye, K. Our World: Rocks, Minerals, and Fossils · Pellant, C. Eyewitness Handbooks: Rocks and Minerals · Pough, F. H. Peterson First Guides: Rocks and Minerals · Riley, P. Straightforward Science: Materials and Processes · Symes, R. F. Eyewitness Books: Rocks & Minerals · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra · Zim, H. S. and Shaffer, P. R. A Golden Guide: Rocks and Minerals
Mathematics Connections	· Explore methods of collecting and organizing data. · Construct two- and three-dimensional figures.
Technology Connections	· Create a database of characteristics of different types of rock using Appleworks or Filemaker Pro. · National Geographic Society: NGS PictureShow CD-ROM: Geology *Rocks and Minerals* · National Science Teachers Association: www.scilinks.org: Topic: *Composition of Rock* (sciLinks Number: HSTE090); *Igneous Rock* (sciLINKS Number: HSTE: 093); *Sedimentary Rock* (sciLINKS Number: HSTE095); *Metamorphic Rock* (sciLINKS Number: HSTE098); *Rock Formations* (sciLINKS Number: HSTE100) · NeoSCI: Rocks & Minerals: Video · Windows on Science Laser Disc: Earth Science Volume 1: This Planet Really Rocks!: *Types of Rock*
Literacy Connections	· Use informational and narrative procedure writing to prepare design journals for model rock project. · Create a graphic organizer to organize and display information about the three types of rock, including their properties and how they form.
Inquiry Activity	· Devise an experiment to determine the conditions under which the smallest and/or largest crystals will form a salol solution.
Key Idea	· *The **rock cycle model** shows how types of rock or rock material may be transformed from one type of rock to another.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.

Performance Tasks	· Using sample rocks, cards, and yarn, students produce a model of the rock cycle. Students describe how any one stage becomes another. Students then prepare timelines indicating the vast amounts of time individual stages in a rock cycle might take. · Using crayons of 4 different colors, heat and pressure, students will model various stages in the rock cycle and be able to identify the process that is occurring. · Using clay, student model some of the processes involved in the formation of metamorphic rock and recycling of rocks and minerals in the Earth's crust through the rock cycle.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2h Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4, 7, 8 · Physical Setting Skills: 3
NYC Performance Standards	Earth and Space Sciences Concepts · S3a, S3b Scientific Connections and Applications · S4a Scientific Thinking · S5b-c, S5f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· GEMS: Stories in Stone: *Formation of Metamorphic Rock; Recycling the Earth's Crust* · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Green, J. Against the Elements: Earth · Lye, K. Our World: Rocks, Minerals, and Fossils · Pellant, C. Eyewitness Handbooks: Rocks and Minerals · Pough, F. H. Peterson First Guides: Rocks and Minerals · Riley, P. Straightforward Science: Materials and Processes · Symes, R. F. Eyewitness Books: Rocks & Minerals · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra · Zim, H. S. and Shaffer, P. R. A Golden Guide: Rocks and Minerals
Mathematics Connections	· Construct scale drawings. · Construct two- and three-dimensional figures.
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Geology *Rocks and Minerals* · National Science Teachers Association: www.scilinks.org: Topic: *Composition of Rock* (sciLinks Number: HSTE090) · Windows on Science Laser Disc: Earth Science Volume 1: This Planet Really Rocks!: *The Rock Cycle*

Literacy Connections	· Summarize observations and findings in a lab notebook. · Write a narrative procedure for how any one type of rock might become another through the rock cycle.
Fossils and Earth's History	**Suggested Time: 2 weeks**
Key Idea	· *Many thousands of layers of sedimentary rock provide evidence for the long history of earth and for the long history of changing life forms whose remains are found in the rocks. More recently deposited rock layers are more likely to contain **fossils** resembling existing **species**. Fossils provide evidence that a great variety of species existed in the past.*
NYS MST Standards	· Performance Indicator 3.2: Describe factors responsible for competition within species and the significance of that competition.
Performance Tasks	· Students construct timelines for the history of Earth and evolution of species using a familiar scale, such as hours on a clock, months on a calendar, or yards on a football field. · Students research an extinct species that is known only from the fossil record, indicating during which era the species lived, what the Earth was like at that time, and whether the species has any descendants among current species. · Field trip: Museum of Natural History
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 Standard 2: Information Systems · Key Idea 1: 1.3 Standard 4: The Living Environment · Major Understanding: 3.2c Standard 6: Interconnectedness: Common Themes · Key Idea 5: Patterns of Change: 5.2 Process Skills Based on Standard 4 · General Skills: 4
NYC Performance Standards	Life Sciences Concepts · S2a Earth and Space Science Concepts · S3b Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e

Resources	· Prentice Hall: Science Explorer: Cells and Heredity: *Life's Long Calendar*. · Arnold, C. Trapped in Tar: Fossils from the Ice Age: · Busbey, A. B., Coenraads, R. R., Willis, P. and Roots, D. The Nature Company Guides: Rocks & Fossils · Eyewitness Visual Dictionaries: The Visual Dictionary of Dinosaurs · Gamlin, L. Eyewitness Science: Evolution · Kricher, J. C. Peterson First Guides: Dinosaurs · Lindsay, W. Eyewitness Books: Prehistoric Life · Lye, K. Our World: Rocks, Minerals, and Fossils · Milner, A. The Nature Company Discoveries Library: Dinosaurs · Norman, D. and Milner, A. Eyewitness Books: Dinosaur · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Evolution · Taylor, P. D. Eyewitness Books: Fossil · Thompson, I. National Audubon Society Field Guide to North American Fossils · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra · Time Life. Understanding Science & Nature: Evolution of Life; Enciclopedia Ilustrada de Sciencia y Naturaleza: La Evolución de la Vida · Walker, C. and Ward, D. Eyewitness Handbooks: Fossils
Mathematics Connections	· Construct a timeline to scale.
Technology Connections	· Use Timeliner to construct a timeline of the history of Earth or the evolution of a species. · National Geographic Society: NGS PictureShow CD-ROM: Age of Dinosaurs: *A Changing World* · Windows on Science Laser Disc: Earth Science Volume 1: Fossils, Dinosaurs and Geologic Time: *The Geologic Time Chart*. · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Earth's Story* (sciLINKS Number: HSTE130; *Geologic Time* (sciLINKS Number: HSTE150)
Literacy Connections	· Students write a report to accompany their timeline or describe the extinct species they researched incorporating informational and or narrative procedure writing.
Key Idea	· ***Fossils*** *are usually found in sedimentary rocks. Types of fossils found in rock include petrified fossils, molds and casts, carbon films, and trace fossils. Other fossils form when organisms are preserved in tar, amber, or ice. Fossils can be used to study past climates and environments.*
NYS MST Standards	· Performance Indicator 2.1: Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.

Performance Tasks	· Students use a hand lens to observe a rock sample that contains fossils. Students draw the shapes that they see, including as many details as possible. Students describe the type of organism observed and how they think the fossils formed. · Students wrap a piece of clay halfway around a sugar cube, then wrap another piece of clay completely around another sugar cube and seal it tightly. Students then drop both cubes along with an uncovered sugar cube into a bowl of water and stir until the uncovered cube dissolves completely. Students remove the other cubes from the water, examine the remains, describe the appearance of the two cubes, and explain how well the clay preserved each of the cubes and how this activity models the way fossils form. · Students research a particular animal, such as the elephant, horse, or dolphin, and explain how the fossil history has provided clues to the story of how these animals evolved.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.1f Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4, 7 - 8
NYC Performance Standards	Earth and Space Sciences Concepts · S3b Scientific Connections and Applications · S4a Scientific Thinking · S5b-f Scientific Communication · S7a-e

Resources	· NeoSCI: Living Sands: Mapping Time & Space with Forams: Lab Investigation Kit · Prentice Hall: Science Explorer: Earth's Changing Surface: *Discover: What's in a Rock; Try This: Sweet Fossils* · Arnold, C. Trapped in Tar: Fossils from the Ice Age: · Busbey, A. B., Coenraads, R. R., Willis, P. and Roots, D. The Nature Company Guides: Rocks & Fossils · Eyewitness Visual Dictionaries: The Visual Dictionary of Dinosaurs · Gamlin, L. Eyewitness Science: Evolution · Kricher, J. C. Peterson First Guides: Dinosaurs · Lindsay, W. Eyewitness Books: Prehistoric Life · Lye, K. Our World: Rocks, Minerals, and Fossils · Milner, A. The Nature Company Discoveries Library: Dinosaurs · Norman, D. and Milner, A. Eyewitness Books: Dinosaur · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Evolution · Taylor, P. D. Eyewitness Books: Fossil · Thompson, I. National Audubon Society Field Guide to North American Fossils · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra · Time Life. Understanding Science & Nature: Evolution of Life; Enciclopedia Ilustrada de Sciencia y Naturaleza: La Evolución de la Vida · Walker, C. and Ward, D. Eyewitness Handbooks: Fossils
Mathematics Connections	· Explore methods of collecting and organizing data.
Technology Connections	· Use Dabbler or Microsoft draw tools to illustrate aerial views of the rock layer models. · Conduct Internet research. · National Geographic Society: NGS PictureShow CD-ROM: Age of Dinosaurs: *Exploring the Evidence* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Earth's Story* (sciLINKS Number: HSTE130); *Looking at Fossils* (sciLINKS Number: HSTE145); *Geologic Time* (sciLINKS Number: HSTE150) · Windows on Science Laser Disc: Earth Science Volume 1: Fossils, Dinosaurs and Geologic Time: *Traveling Through Time*
Literacy Connections	· Write a narrative procedure indicating the steps in fossil formation.
Inquiry Activity	· Given a variety of fossils that provide clues as to the environment they were formed in, construct, via observations of the fossils and secondary research, and defend a proposal for what the environment was like.
Key Idea Enrichment Unit	· *In **horizontal sedimentary rock layers** the **oldest layer** is at the bottom and each higher layer is younger than the layers below it. Since it is difficult to determine the **absolute age** of a rock, scientists use this **law of superposition** to determine the **relative ages** of rocks.*

NYS MST Standards	· Performance Indicator 2.1: Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.
Performance Tasks	· Students make a stack of four different-colored layers of clay. Each layer should be about the size and thickness of a pancake. Students determine which layer is the oldest layer. Half of the students then form the stack into a dome by pressing the stack over the bottom of a small bowl or pie plate and slice off the top of the dome using a plastic knife. The rest of the students form a valley by pressing the stack into the inside of the bowl or pie plate and slicing away the clay that sticks over the edge. Students explain where the oldest and youngest layers of rock are found in both models.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.1f Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4, 7, 8
NYC Performance Standards	Earth and Space Sciences Concepts · S3b Scientific Connections and Applications · S4a Scientific Thinking · S5b-f Scientific Communication · S7a-e
Resources	· Glencoe: Earth Science : *Relative Age Dating of Geologic Features.* · Prentice Hall: Science Explorer: Earth's Changing Surface: *Discover: In What Order are Sediments Deposited*
Mathematics Connections	· Explore methods of collecting and organizing data. · Develop an awareness of when estimation is more appropriate than an exact answer. · Construct three-dimensional figures.
Technology Connections	· Use a digital camera to document stages of model construction. · Use Passport or HyperStudio to create animations of the model and how the layers interact. · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Earth's Story* (sciLINKS Number: HSTE130); *Relative Dating* (sciLINKS Number: HSTE135); *Geologic Time* (sciLINKS Number: HSTE150)
Literacy Connections	· Write a narrative procedure indicating the steps in fossil formation.
Key Idea Enrichment Unit	· *The **relative ages** of rocks can also be determined by examining **index fossils.** Index fossils are fossils of organisms that were widely distributed but only lasted a short time.*
NYS MST Standards	· Performance Indicator 2.1: Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.

Performance Tasks	· Students examine index fossils. Students use laws of superposition and uniformitarianism to interpret the geologic history of rock layers and their relative ages. · Students complete an activity designed to determine the relative ages of rocks using the laws of superposition and index fossils.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.1f Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4, 7, 8
NYC Performance Standards	Earth and Space Sciences Concepts · S3b Scientific Connections and Applications · S4a Scientific Thinking · S5b-f Scientific Communication · S7a-e
Resources	· Holt, Rinehart, and Winston: Holt Science & Technology: *How Do You Stack Up?* · Busbey, A. B., Coenraads, R. R., Willis, P. and Roots, D. The Nature Company Guides: Rocks & Fossils · Lye, K. Our World: Rocks, Minerals, and Fossils · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Explore methods of collecting and organizing data. · Develop an awareness of when estimation is more appropriate than an exact answer.
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Age of Dinosaurs: *Exploring the Evidence* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Earth's Story* (sciLINKS Number: HSTE130); *Relative Dating* (sciLINKS Number: HSTE135; *Looking at Fossils* (sciLINKS Number: HSTE145); *Geologic Time* (sciLINKS Number: HSTE150)
Literacy Connections	· Write a narrative procedure indicating the steps in fossil formation.
Enrichment Unit ***Key Idea***	· ***Radioactive elements*** *occur naturally in* ***igneous rock****. During* ***radioactive decay****, the* ***atoms*** *of one* ***element*** *break down to form atoms of another element. The* ***half-life*** *of a radioactive element is the time it takes for half of the radioactive atoms to decay.* *Scientists use* ***radioactive dating****, the rate at which particular elements decay, to determine the* ***absolute ages*** *of rocks.*
NYS MST Standards	· Performance Indicator 2.1: Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.

Performance Tasks	· Students make a small cube of clay, about 5 cm by 5 cm and find the mass. This cube represents the original amount of radioactive material in a sample. Students prepare a graph placing number of half-lives on the "x" axis and mass on the "y" axis. At the zero point, students graph the mass of the cube. To model radioactive decay, students cut the clay in half using a plastic knife, put one half aside then find the mass of the remaining half. Students repeat this process 3 more times, graph, and analyze their results. Students compare and contrast absolute age to relative age. · Students model radioactive decay by placing 100 pennies heads up in a box. The 100 pennies represent 100% of the unstable (radioactive) element at the time of rock formation. Students close the box, shake it several times, open it and remove all the pennies that are on tails. The pennies removed represent the amount of unstable material that has decayed in one half-life. Students replace the pennies they remove with an equal number of other items to represent the new element produced (i.e. paper clips, brass fasteners). Students repeat this process until they have one or no pennies left (5 to 7 times). Students graph and analyze their results. Students compare and contrast the methods of absolute dating with the methods of relative dating.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.1f Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4, 7, 8
NYC Performance Standards	Earth and Space Sciences Concepts · S3b Scientific Connections and Applications · S4a Scientific Thinking · S5b-f Scientific Communication · S7a-e
Resources	· Glencoe: Earth Science: *Radioactive Decay* · Glencoe: Life Science Activity Worksheets: *A Radioactive Dating Model.* · Lye, K. Our World: Rocks, Minerals, and Fossils · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Explore methods of collecting and organizing data. · Construct a line graph of the data. · Develop an awareness of when estimation is more appropriate than an exact answer.

Technology Connections	· Use a digital camera or computer graphics program to document stages of model development. · Use photos to create a PowerPoint slide show. · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Absolute Dating* (sciLINKS Number: HSTE140)
Literacy Connections	· Write a narrative procedure indicating the steps in fossil formation.
Energy Resources	**Suggested Time: 2 weeks**
Key Idea	· *The **Sun** (and the **wind** and water **energy** derived from it) is a major source of energy for Earth.*
NYS MST Standards	· Performance Indicator 4.1: Describe the sources and identify the transformations of energy observed in everyday life.
Performance Tasks	· Students record all the foods they eat in one day and trace them to their original sources in the plant world. Students construct a human food web, indicating the food they eat and their sources in the plant world, and estimate the amount of Calories they consume.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Key Idea 4: Major Understanding 4.1a Process Skills · General Skills: 4 · Living Environment Skills: 7
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a, S4c Scientific Thinking · S5b-c, S5f Scientific Communication · S7a-e
Resources	· Brown, W. Alternative Sources of Energy · Challoner, J. Eyewitness Science: Energy · Gutnik, M. J. and Browne-Gutnik, N. Projects That Explore Energy: · Hawkes, N. New Technology: Energy · Silverstein, A., Silverstein, V. Silverstein Nunn, L. Energy · Snedden, R. Energy · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Use numbers in real-world situations.
Technology Connections	· Use Inspiration to construct a web diagram. · Use HyperStudio to create a web of foods and their sources. · Investigate energy with Steck-Vaughn Our Environment: A Multimedia Database: *About Energy* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Renewable Resources* (sciLINKS Number: HSTE110) · Windows on Science Laser Disc: Physical Science Volumes 2 & 3: Energy Resources: *Types of Energy*

Literacy Connections	· Construct a web diagram indicating the food and their sources in the plant world
Key Idea	· ***Fossil fuels*** *contain stored* ***solar energy*** *and are considered* ***nonrenewable resources****. Fossil fuels can be burned to release the* ***potential chemical energy*** *stored in them. They are a major source of energy in the United States.*
NYS MST Standards	· Performance Indicator 4.1: Describe the sources and identify the transformations of energy observed in everyday life.
Performance Tasks	· Students study the various fossil fuels (cooperative group mini-reports), how they are formed, their production and refining (ex: fractional distillation) and use. Students obtain statistics about the fuels, i.e. relative abundance, rate of use, and amount of energy obtained from the fuels. Students also explore how the extraction and use of various fossil fuels contribute to environmental degradation and pollution.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 Standard 4: The Physical Setting · Major Understanding 4.1b Process Skills Based on Standard 4 · General Skills: 4, 7
NYC Performance Standards	Earth and Space Sciences Concepts · S3d Scientific Connections and Applications · S4a, S4c Scientific Thinking · S5b-c, S5f Scientific Communication · S7a-b, S7d-e
Resources	· Brown, W. Alternative Sources of Energy · Challoner, J. Eyewitness Science: Energy · Gutnik, M. J. and Browne-Gutnik, N. Projects That Explore Energy: · Hawkes, N. New Technology: Energy · Silverstein, A., Silverstein, V. Silverstein Nunn, L. Energy · Snedden, R. Energy · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Explore methods of organizing and displaying statistical data.
Technology Connections	· Investigate energy with Steck-Vaughn Our Environment: A Multimedia Database: *How We Use Energy* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Natural Resources* (sciLINKS Number: HSTE105) *Nonrenewable Resources* (sciLINKS Number: HSTE115); *Fossil Fuels* (sciLINKS Number: HSTE120) · Windows on Science Laser Disc: Physical Science: Volumes 2 & # Energy Resources: *Types of Energy; Coal, Steam and Oil; Generating Power; Renewable and Nonrenewable Resources; Oil and Natural Gas*

Literacy Connections	· Prepare a report incorporating informational writing.
Key Idea	· ***Solar energy, wind, moving water,*** *and* ***biomass*** *(wood) are some examples of renewable energy resources.*
NYS MST Standards	· Performance Indicator 4.1: Describe the sources and identify the transformations of energy observed in everyday life.
Performance Tasks	· Students apply knowledge of solar energy for practical use by doing a model solar home investigation. Students construct model homes out of paper to find out how windows affect passive solar heating of the house. Students collect and record temperature data every minute for 12 minutes, graph, and analyze their results by calculating the net temperature change and identifying the equilibrium, or final, temperature. · Students investigate the effect of clear covers on water heating efficiency. Working in groups of four, students place one cup of water into an aluminum pan and immerse a thermometer in the water. Students prepare a second set-up then place it in a resealable bag. Students record the starting temperature after about 30 seconds, allow the pans to heat for 15-20 minutes, then take the final temperature. Students calculate the net temperature change and construct bar graphs using class net change data. · Students design and construct solar ovens, solar water heaters, or solar cars and evaluate their effectiveness.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 4.1b Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 2, 3, 8
NYC Performance Standards	Earth and Space Sciences Concepts · S3d Scientific Connections and Applications · S4a-d Scientific Thinking · S5b-c, S5f Scientific Communication · S7a-b, S7d-e

Resources	· GEMS: Hot Water and Warm Homes from Sunlight: *Building Model Houses; The Solar House Experiment; Discussing the Solar House Experiment; The Solar Water Heater Experiment; Discussing the Solar Water Heater Experiment; Making Solar Ovens* · Brown, W. Alternative Sources of Energy · Challoner, J. Eyewitness Science: Energy · Gutnik, M. J. and Browne-Gutnik, N. Projects That Explore Energy: · Hawkes, N. New Technology: Energy · Silverstein, A., Silverstein, V. Silverstein Nunn, L. Energy · Snedden, R. Energy · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Explore methods of collecting and organizing data. · Make and use metric measurements. · Construct bar graphs. · Construct scale drawings. · Construct two- and three-dimensional figures.
Technology Connections	· Design a solar cooker. Use Dabbler or Microsoft draw tools to label a diagram of the solar cooker. · Investigate energy resources with Steck-Vaughn Our Environment: A Multimedia Database: *How We Use Energy* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Renewable Resources* (sciLINKS Number: HSTE110) · Windows on Science Laser Disc: Physical Science: Volumes 2 & 3: Energy Resources: *Renewable and Nonrenewable Resources*
Literacy Connections	· Prepare a design journal.
Inquiry Activity	· Design and construct a solar home that produces the greatest and/or least amount of internal heating by exploring variables such as color of house, window color, material used, etc.
Key Idea	· *Other sources of energy include **nuclear** and **geothermal energy**.*
NYS MST Standards	· Performance Indicator 4.1: Describe the sources and identify the transformations of energy observed in everyday life.
Performance Tasks	· Students study and/or visit a nuclear reactor (Brookhaven Labs, Indian Point) and learn how it operates to produce electricity. Students obtain statistical information about nuclear power plants i.e. efficiency, number of plants, etc. and research the pros and cons of nuclear power plants.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 Standard 4: The Physical Setting · Major Understanding 4.1d Process Skills Based on Standard 4 · General Skills: 4

NYC Performance Standards	Earth and Space Sciences Concepts · S3d Scientific Connections and Applications · S4a-e Scientific Thinking · S5b-c, S5f Scientific Communication · S7a-b, S7d-e
Resources	· Brown, W. Alternative Sources of Energy · Challoner, J. Eyewitness Science: Energy · Gutnik, M. J. and Browne-Gutnik, N. Projects That Explore Energy: · Hawkes, N. New Technology: Energy · Silverstein, A., Silverstein, V. Silverstein Nunn, L. Energy · Snedden, R. Energy · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Explore methods of organizing and displaying statistical data.
Technology Connections	· Investigate energy resources with Steck-Vaughn Our Environment: A Multimedia Database: *Pollution Caused By Energy Use* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Nuclear Energy:* (sciLINKS Number: HSTE122) · Windows on Science Laser Disc: Physical Science: Volumes 2 & 3: Energy Resources: *Nuclear Power; Radioactivity; Geothermal Energy and Tidal Power*
Literacy Connections	· Prepare a report incorporating informational writing.
The Interior of the Earth	**Suggested Time: 6 weeks**
Key Idea	· ***Globes** are useful models of the Earth. **Latitude** and **longitude** can be used to find a location on a globe or map. In addition, a globe or map can be used to find the latitude and longitude of a location.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students use latitude and longitude to locate points on Earth and to describe a location using its coordinates.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 Standard 4: The Physical Setting · Major Understanding 1.1f Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 4 · Physical Setting Skills: 1
NYC Performance Standards	Scientific Connections and Applications · S4a, S4e Scientific Thinking · S5a-c, S5d Scientific Communication · S7a-e

Resources	· Glencoe: Earth Science: *MiniLab: How Are Latitude and Longitude Used to Locate Places on a Map?* · Sunburst: A Field Trip to the Sky: *Looking at Latitude; Looking at Longitude; A Grid for the World* · Barron's Educational Series: Our Planet Earth · Eyewitness Visual Dictionaries: The Visual Dictionary of the earth · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Understand coordinate graphing.
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Latitude and Longitude* (sciLINKS Number: HSTE035) · Sunburst: A Field Trip to the Sky: *Sun Lab* · Windows on Science Laser Disc: Earth Science Volume 2: Address: Earth: *Introducing the Globe; Compass Directions; Labeling a Globe; Latitude and Longitude*
Literacy Connections	· Write a narrative procedure for finding latitude and longitude.
Key Idea	· *There are four major **layers** within the Earth. These layers, the **crust, mantle, outer core**, and **inner core** have distinct **properties**.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students cut a hard-boiled egg in half cross-wise and compare the layers of the egg (shell, white, and yolk) to the three main layers of the Earth (crust, mantle, and core). Students prepare an attribute chart summarizing the properties of all the layers of the Earth.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2b Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5b-c, S5f Scientific Communication · S7a-e
Resources	· Barron's Educational Series: Our Planet Earth · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Create a scale for the average depth of each layer of the earth. · Make real-world comparisons of measurements.

Technology Connections	· Use Inspiration to create attribute chart summarizing the properties of each layer of the Earth · Use HyperStudio to create an animation of the layers of Earth. · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Composition of the Earth* (sciLINKS Number: HSTE155); *Structure of the Earth* (sciLINKS Number: HSTE160); *Layers of the Earth* (sciLINKS Number: HSTE470);
Literacy Connections	· Construct an attribute chart incorporating the properties and dimensions of the layers of the Earth
Key Idea	· ***Folded, tilted,*** *and* ***displaced rock layers*** *suggest past movements of the Earth's* ***crust****. Stresses on the Earth's crust produce compression, tension, and shearing in rock. Cracks in the Earth's' crust (****faults****) result from stress. Faulting and folding of the crust cause mountains and other features to form on the surface.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students model faulting and mountain building by using clay, sponge, and sandwich models. For example, students place a flat piece of clay, a sponge, or sandwich on a table, place their hands at opposite ends and push the ends together, compressing them. Students explain how scientists determine the relative age of rock layers based on their position relative to each other. · Using a sandwich, students investigate core sampling techniques geologists use to gather information about rock formations, relative age, as well as faulting and folding. · Using Milky Way bars, students investigate how plates move about on Earth's surface and observe how geologic features form as a result.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2c Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4, 8
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5e-f Scientific Tools and Technologies · S6b, d-e Scientific Communication · S7a-e

Resources	· Glencoe: Earth Science : *Relative Age Dating of Geologic Features* · Holt Rinehart and Winston: Holt Science and Technology: Earth Science: *Oh, the Pressure* · Prentice Hall: Science Explorer: Inside Earth: *Modeling Movement Along Faults* · Barron's Educational Series: Our Planet Earth · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Silverstein, A., Silverstein, V. and Silverstein Nunn, L. Plate Tectonics · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Develop an awareness of when estimation is more appropriate than an exact answer. · Construct scale drawings. · Construct two- and three-dimensional figures.
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Tectonic Plates* (sciLINKS Number: HSTE165); *Faults* (sciLINKS Number: HSTE170); *Mountain Building* (sciLINKS Number: HSTE175)
Literacy Connections	· Summarize observations and findings in a laboratory notebook.
Inquiry Activity	· Visit an outcrop that shows evidence of folding, tilting, and displacement of rock layers. Through observation and secondary research, develop a hypothesis that describes and explains the geological forces and processes that may have occurred.
Key Idea	· *An **earthquake** is the movement of the ground caused by **seismic waves** generated as rocks move along **faults**. Seismic waves carry the energy of an earthquake away from the **focus** through the Earth's interior, and across the surface.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students construct a seismograph and conduct experiments to collect vibrational data.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 – S2.3 · Key Idea 3: S3.1 – S3.3 Standard 4: The Physical Setting · Major Understanding 2.2a Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1 - 4

NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· Barron's Educational Series: Our Planet Earth · Booth, B. Volcanoes and Earthquakes · Downs, S. When the Earth Moves · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Moores, E. M. The Nature Company Discoveries Library: Volcanoes & Earthquakes · Pope, J. Closer Look at Earthquakes · Silverstein, A., Silverstein, V. and Silverstein Nunn, L. Plate Tectonics · Spies, K. When Diasater Strikes: Earthquakes · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Explore methods of collecting and organizing data.
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *What Is an Earthquake?* (sciLINKS Number: HSTE180); *Earthquake Measurement* (sciLINKS Number: HSTE185) · Windows on Science Laser Disc: Earth Science Volume 1: The "Puzzle" of Plate Tectonics: *Earthquake Damage*
Literacy Connections	· Prepare a lab report incorporating informational and narrative procedure writing.
Key Idea Enrichment Unit	· *The three categories of seismic waves are **primary waves** (P waves), **secondary waves** (S waves), and **surface waves** (L waves). The rates at which S and P waves travel are used to locate the epicenter of an earthquake.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students study S, P, and L waves and complete an attribute chart summarizing the properties of each type of wave. Students use this knowledge and a reference table to locate the epicenter of an earthquake.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2b Process Skills Based on Standard 4 · General Skills: 1, 4

NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5f Scientific Tools and Technologies · S6d Scientific Communication · S7a-e
Resources	· Glencoe: Earth Science: *Epicenter Location* · Glencoe: Earth Science Laboratory Manual: *Locating an Earthquake* · Holt, Rinehart and Winston: Holt Science & Technology: Earth Science: *Earthquake Waves.* · Prentice Hall: Science Explorer: Inside Earth: *Locating an Epicenter* · Barron's Educational Series: Our Planet Earth · Booth, B. Volcanoes and Earthquakes · Downs, S. When the Earth Moves · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Moores, E. M. The Nature Company Discoveries Library: Volcanoes & Earthquakes · Pope, J. Closer Look at Earthquakes · Silverstein, A., Silverstein, V. and Silverstein Nunn, L. Plate Tectonics · Spies, K. When Diasater Strikes: Earthquakes · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Investigate the properties of circles including diameter and radius.
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *What Is an Earthquake?* (sciLINKS Number: HSTE180); *Earthquake Measurement* (sciLINKS Number: HSTE185) · Windows on Science Laser Disc: Earth Science Volume 1: Hitting the Hot Spots: *Mount St. Helens; The Pacific Rim*
Literacy Connections	· Write a narrative procedure for finding the epicenter of an earthquake.
Key Idea	· *Analysis of **earthquake-wave data** (vibrational disturbances) leads to the conclusion that there are **layers** within the Earth.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.

Performance Tasks	· Students research the Moho, shadow zone, and discovery of Earth's solid inner core to understand the effects of density differences of Earth's layers on the movement of seismic waves. · Students determine the density of three samples of liquids: vegetable oil, rubbing alcohol, and water using a graduated cylinder to measure volume and a triple-beam balance to measure mass (Find the mass of the graduated cylinder first, add a set volume of liquid, then find the mass again. Determine the mass of each sample by subtraction.). Students calculate the densities of each sample (D = m / V), and formulate a hypothesis explaining how vibrations will pass through each sample and why. Students then put a vibrating tuning fork into samples of water, alcohol, and vegetable oil that have been placed in shallow pans and explain their results based on the density of each sample. (Place newspaper under pans.) · Teacher Demonstration: The teacher places a vibrating tuning fork into vegetable oil, cleans it off then places it into water to show students how vibrations move at different rates depending on the density of the medium.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2b Process Skills Based on Standard 4 · General Skills: 1 - 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· Glencoe: Earth Science : *Locating an Earthquake* · Barron's Educational Series: Our Planet Earth · Booth, B. Volcanoes and Earthquakes · Downs, S. When the Earth Moves · Eyewitness Visual Dictionaries: The Visual Dictionary of the earth · Moores, E. M. The Nature Company Discoveries Library: Volcanoes & Earthquakes · Pope, J. Closer Look at Earthquakes · Silverstein, A., Silverstein, V. and Silverstein Nunn, L. Plate Tectonics · Spies, K. When Diasater Strikes: Earthquakes · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Use numbers in real-world situations. · Explore methods of collecting and organizing data. · Describe functions and generalize them by the use of rules and algebraic expressions.

Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Earthquake Discoveries Near and Far* (sciLINKS Number: HSTE195)
Literacy Connections	· Write a lab report incorporating informational and narrative procedure writing.
Key Idea	· ***Volcanoes*** *are openings on the Earth's surface where* ***magma*** *escapes from the interior. Magma that reaches Earth's surface is called* ***lava****. Volcanoes have three basic forms: shield, cinder cone, and composite. Volcanoes add new rock to existing land and can form new islands in the oceans.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students research the three types of volcanoes, the different kinds of particles that are blown from a volcano and the surface features that they form. Students describe the environmental impacts of the different types of volcanoes and develop an attribute chart to summarize their findings.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 Standard 4: The Physical Setting · Major Understanding 2.2a Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5f Scientific Tools and Technologies · S6d Scientific Communication · S7a-e
Resources	· Holt, Rinehart and Winston: Holt Science & Technology: Earth Science: *Some Go "Pop," Some Do Not.* · Barron's Educational Series: Our Planet Earth · Booth, B. Volcanoes and Earthquakes · Downs, S. Earth's Fiery Fury · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Moores, E. M. The Nature Company Discoveries Library: Volcanoes & Earthquakes · Silverstein, A., Silverstein, V. and Silverstein Nunn, L. Plate Tectonics · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Use numbers in real-world situations.

Technology Connections	· Use Inspiration to create an attribute chart. · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Volcanic Eruptions* (sciLINKS Number: HSTE205); *Volcanic Effects* (sciLINKS Number: HSTE210); *What Causes Volcanoes?* (sciLINKS Number: HSTE215) · Windows on Science Laser Disc: Earth Science Volume 1: Hitting the Hot Spots: *Iceland and Hawaii; Vesuvius and Pompeii, Underwater Volcanic Activity*
Literacy Connections	· Create an attribute chart.
Key Idea	· ***Continents*** *fitting together like* ***puzzle*** *parts and* ***fossil correlation*** *provided initial evidence that continents were once together.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students model the breakup of Pangaea and chart the subsequent movement of landmasses. Students measure the distances and determine the direction in which each continent has moved. · Students reconstruct Pangaea from present-day distribution of continents by using fossil evidence indicating similar species and climates and by correlation of rock types and mountain ranges.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 Standard 4: The Physical Setting · Major Understanding 2.2d Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a-b Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5f Scientific Tools and Technologies · S6d Scientific Communication · S7a-e
Resources	· Glencoe: Earth Science: *Continental Drift* · Prentice Hall: Science Explorer: Inside Earth: *Discover: How Well Do the Continents Fit Together* · Barron's Educational Series: Our Planet Earth · Booth, B. Volcanoes and Earthquakes · Downs, S. Earth's Fiery Fury · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Moores, E. M. The Nature Company Discoveries Library: Volcanoes & Earthquakes · Silverstein, A., Silverstein, V. and Silverstein Nunn, L. Plate Tectonics · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra

Mathematics Connections	· Use numbers in real-world situations. · Explore the concept of rates (distance, time) · Construct scale drawings. · Construct two- and three-dimensional figures.
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Tectonic Plates* (sciLINKS Number: HSTE165) · Windows on Science Laser Disc: Earth Science Volume 1: The "Puzzle" of Plate Tectonics: *Continental Drift*
Literacy Connections	· Write a fictional story involving the breakup of Pangaea.
Key Idea	· *The **Theory of Plate Tectonics** explains how "solid" **lithosphere** consists of a series of **plates** that "float" on the partially molten section of the **mantle**. Plates come together at **plate boundaries.** The three types of plate boundaries include transform, divergent, and convergent.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Using a world map, a plate boundary map, and a reference sheet illustrating the appearance of the three major types of plate boundaries, students observe that plate boundaries are different from political boundaries and that major geologic features are associated with plate boundaries. Students label major geologic features. · Students explore ready-made or construct diagrams or models of the three types of plate boundaries (convergent, divergent, transform). Students explain the processes that occur at each type of boundary.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2e Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5f Scientific Tools and Technologies · S6d Scientific Communication · S7a-e

Resources	· New York State Education Department: Regents Earth Science Reference Tables: *Tectonic Plates* · Barron's Educational Series: Our Planet Earth · Booth, B. Volcanoes and Earthquakes · Downs, S. Earth's Fiery Fury · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Moores, E. M. The Nature Company Discoveries Library: Volcanoes & Earthquakes · Silverstein, A., Silverstein, V. and Silverstein Nunn, L. Plate Tectonics · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Use numbers in real-world situations. · Understand coordinate graphing. · Construct scale drawings. · Construct two- and three-dimensional figures.
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Dynamic Earth: *The Earth is Alive* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Tectonic Plates* (sciLINKS Number: HSTE165) · Windows on Science Laser Disc: Earth Science Volume 1: The "Puzzle" of Plate Tectonics: *What Is Plate Tectonics?; Plate Boundaries*
Literacy Connections	· Summarize observations and findings in a lab notebook.
Key Idea	· ***Convection cells*** *within the mantle may be the driving force for the movement of the plates.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students investigate and observe the movement of material in a convection cell and synthesize an explanation for the Theory of Plate Tectonics using their understanding of convection cells. For example, students fill a clear colorless casserole dish with water to 5 cm from the top, center the dish on a hot plate and heat. Students add a few drops of food coloring directly above the hot plate and observe what occurs in the water. Students draw a diagram of the convection currents that form and infer what causes them to develop. Students explain how the temperature of the water affects the direction it moves in and infer how their observations of convection cells are related to plate tectonics and the movement of the continents.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2e Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 2, 4

NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· Glencoe: Earth Science: *MiniLab: How Do Convection Currents Form?* · GEMS*:* Convection a Current Event: *Observing Convection in Water; Getting the Whole Picture; Convection in Wind* · Holt, Rinehart and Winston: Holt Science & Technology: Earth Science: *Convection Connection.* · Prentice Hall*:* Science Explorer: Inside Earth: *Hot Plates*
Mathematics Connections	· Explore methods of collecting and organizing data.
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Tectonic Plates* (sciLINKS Number: HSTE165) · Windows on Science Laser Disc: Physical Science Volume 1: Heat and Temperature: *Convection and Insulation*
Literacy Connections	· Prepare a lab report incorporating informational and narrative procedure writing.
Key Idea	· *Plates may* ***collide, move apart****, or* ***slide*** *past one another. Most* ***volcanic activity, earthquakes,*** *and* ***mountain building*** *occur at the* ***boundaries*** *of these plates.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students use latitude and longitude to plot the locations of earthquakes and volcanoes. Students compare these locations to a plate boundary map and investigate the relationship between the type of earthquake and volcanic activity and related plate boundaries.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2f Process Skills Based on Standard 4 · General Skills: 1, 4 · Physical Setting Skills: 1, 4

NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5f Scientific Tools and Technologies · S6d Scientific Communication · S7a-e
Resources	· Glencoe: Earth Science: *Locating Active Volcanoes* · Prentice Hall: Science Explorer: Inside Earth: *Where are Volcanoes Found on Earth's Surface?; Mapping Earthquakes and Volcanoes* · Barron's Educational Series: Our Planet Earth · Booth, B. Volcanoes and Earthquakes · Downs, S. Earth's Fiery Fury · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Moores, E. M. The Nature Company Discoveries Library: Volcanoes & Earthquakes · Silverstein, A., Silverstein, V. and Silverstein Nunn, L. Plate Tectonics · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Understand coordinate graphing.
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Dynamic Earth: *The Earth is Alive* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Tectonic Plates* (sciLINKS Number: HSTE165); *Mountain Building* (sciLINKS Number: HSTE175) · Windows on Science Laser Disc: Earth Science Volume 1: The "Puzzle" of Plate Tectonics: *Plate Boundaries*
Literacy Connections	· Students write a fictional account of how plate movements might affect international relationships in years to come. · Students write a risk assessment for cities or towns near sites of earthquake and volcanic activity.
Inquiry Activity	· Develop a model based on convection currents that shows plate movements and the types of plate boundaries that might form.

The Hydrosphere	**Suggested Time: 2 weeks**
Key Idea	· *The majority of the **lithosphere** is covered by a relatively thin layer of water called the **hydrosphere**. About **97%** of the Earth's water is **salt water** stored in **oceans**. Less than **1%** is usable **freshwater**.*
NYS MST Standards	· Performance Indicator 2.1: Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.
Performance Tasks	· Students model how Earth's waters are distributed using a liter of water by measuring 97% (970 mL) to represent the amount of salt water and pouring it into a large bowl. Students then calculate the amounts for each percentage and divide the remaining fresh water (30 mL) into small cups for ice (76%) shallow groundwater (12%), deep ground water (11%), lakes and rivers (0.34%), and water vapor (0.037%). Use a dropper to measure amounts that are too small to measure accurately. · Students construct a hydrometer and use it to measure the effects of salt content using freshwater and saltwater samples, which they collect and/or make. Students express findings as a function of the densities of the various solutions. An egg may be used in conjunction with the hydrometer; the egg will float in salt water. · Students investigate what happens when ocean water, brackish water, and river water contact one another.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.1d Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· Prentice Hall: Earth's Waters: *Sharpen Your Skills: Calculating* · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Use circle graphs to explore the concept of percent. · Explore methods of collecting and organizing data.

Technology Connections	· Use Microsoft Excel to construct graphs of data. · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Tectonic Plates* (sciLINKS Number: HSTE165); *Mountain Building* (sciLINKS Number: HSTE175) · Windows on Science Laser Disc: Earth Science Volume 3: Water, Water, Everywhere…: *Earth's Water Supply* · Windows on Science Laser Disc: Earth Science Volume 3: Now You Sea It: *The World's Oceans; Sea Salt*
Literacy Connections	· Describe the properties of fresh, brackish, and salt water in a lab notebook.
Inquiry Activity	· Calibrate an egg to show the salinity of solutions by creating a series of solutions of varying salinity, floating; then marking the egg using an indelible marker. Test the egg each day for several days and evaluate the reliability of the egg as a hydrometer.
Key Idea	· ***Water**, which covers the majority of Earth's surface, **circulates** through the **atmosphere, lithosphere,** and **hydrosphere** in what is known as the **water cycle**.*
NYS MST Standards	· Performance Indicator 2.1: Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.
Performance Tasks	· Students are challenged to create a model of the hydrologic cycle. For example, students place hot water in a clear plastic bottle and lay the bottle on its side and observe the system for 15 minutes. Students explain how their model is similar to processes involved in the water cycle.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.1j Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· Holt, Rinehart and Winston: Holt Science & Technology: Earth Science: *Water Cycle – What Goes Up.* · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra

Mathematics Connections	· Explore methods of collecting and organizing data.
Technology Connections	· Use a digital camera to photograph the water cycle model. · Use Powerpoint to create a slide show of the steps and processes involved in the water cycle. · Windows on Science Laser Disc: Earth Science Volume 3: Water, Water, Everywhere…: *The Water Cycle*
Literacy Connections	· Students explain each of the processes involved in the water cycle and the conditions under which they occur in a lab notebook. · Students write a fictional account of the journey of a water molecule through the water cycle.
Key Idea	· *The **ocean floor** has many features that are similar to those on land, such as **plains, hills, mountains, volcanoes**, and **trenches**.*
NYS MST Standards	· Performance Indicator 2.1: Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.
Performance Tasks	· Students use a contour model kit to develop a topographic map of a submerged island. Students place the contour model in the bin and add enough water colored with food coloring to cover the model (Teachers can do this step to allow the final model to be a surprise). Students place the perforated lid on top of the model and measure the distance between the top of the lid and the water level (sea level). This distance must be subtracted form each depth measurement to obtain the depth below sea level. Students then insert a prober down into each hole until it contacts the model, remove the prober, and measure and record the depth below sea level on a grid. Once students have measured and recorded the depth for all locations, they connect all similar depths to form contour lines. Students trace their topographic map onto a plain sheet of paper; indicate the highest and lowest elevations, and prepare a key and scale for the map. Finally, students drain the colored water from the model and compare and contrast their topographic map with the actual model. · Students use ocean depth data to construct an ocean bottom profile. Using the profile, maps of the ocean floor and of the Earth's tectonic plates, students identify features of the ocean bottom in regions of diverging plate boundaries. · Students research how scientists study underwater features.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2a Process Skills Based on Standard 4 · General Skills: 1, 4 · Physical Setting Skills: 7

NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· AIMS: Down to Earth: *Submerged Island* · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Use numbers in real-world situations.
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *The Ocean Floor* (sciLINKS Number: HSTE310); *Ocean Resources* (sciLINKS Number: HSTE320); *Ocean Pollution* (sciLINKS Number: HSTE323) · Windows on Science Laser Disc: Earth Science Volume 3: Now You Sea It: *Mapping the Ocean; Exploring the Ocean Depths; Shaping of the Sea Floor*
Literacy Connections	· Prepare a report incorporating an informational writing style.
Key Idea	· *Sources of **drinking water** include **rivers, lakes, reservoirs,** and **groundwater**. Fresh water is scarce in many areas.*
NYS MST Standards	· Performance Indicator 2.1: Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.
Performance Tasks	· Students measure pore space in different types of soil forming materials, such as fine sand, coarse sand, and gravel by placing 100 mL of each sample into a beaker. Students then fill a graduated cylinder with 100 mL of water and pour the water slowly into one of the beakers, stopping when the water just covers the top of the sample. Students record the volume of water used then repeat the procedure with the other samples. Students determine which sample has the greatest pore space using the formula [(volume of pore spaces of water) / (total volume of sample)] x 100%. Students then infer how particle size of soil-forming materials affects groundwater. · Students research New York City's water supply system. · Students participate in the "Adopt a Watershed" program to study the sources of our drinking water in the field: long-term project.

NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.1j Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1 - 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a, S3d Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· Glencoe: Earth Science: *MiniLab: How Can You Measure Pore Space?* · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Mueller Coombs, K. and Boucher, J. Flush! Treating Wastewater · Time Life: Understanding Science & Nature: Geography; Planet Earth · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra
Mathematics Connections	· Estimate, make, and use metric measurements. · Explore the concept of percent.
Technology Connections	· Use Imagination Express: Ocean to create an electronic storyboard about living in the ocean. · Investigate water and how it is used with Steck-Vaughn Our Environment: A Multimedia Database: *About Water; How Water Is Used.* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Rivers and Streams* (sciLINKS Number: HSTE260; *Water Underground* (sciLINKS Number: HSTE175); *Wetlands* (sciLINKS Number: HSTE300) · Windows on Science Laser Disc: Earth Science Volume 3: Water, Water, Everywhere…: *Ground Water; Rate of Flow; The Water Table; Aquifers; Springs, Geysers, and Runoff; A Trip Down a River; Capturing and Conserving Fresh Water*
Literacy Connections	· Write a fictional story about how a water molecule enters and passes through New York City's water supply system and reaches a faucet at home or in school.
Inquiry Activity	· Collect a variety of soil core samples; then devise a method to test the amount of pore space each sample has and to determine the variables that affect pore space.

The Atmosphere	**Suggested Time: 2 weeks**
Key Idea	· *Nearly all the **atmosphere (air)** is confined to a thin shell surrounding Earth. The atmosphere is a **mixture** of **gases**, including **nitrogen** and **oxygen** with small amounts of **water vapor, carbon dioxide,** and other trace gases. The atmosphere is stratified into **layers**, each having distinct properties*
NYS MST Standards	· Performance Indicator 2.1: Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.
Performance Tasks	· With the aid of a table, students find the different layers of the atmosphere, the interfaces between layers, the altitude, temperature ranges, and pressure of each layer. Students develop an attribute chart to summarize their findings.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.1a Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5f Scientific Tools and Technologies · S6d Scientific Communication · S7a-e
Resources	· New York State Education Department: Earth Science Reference Tables: *Selected Properties of Earth's Atmosphere* · Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., and Whitaker, R. The Nature Company Guides: Weather · Cosgrove, B. Eyewitness Books: Weather · Ellyard, D. Weather · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Gardner, R. and Webster, D. Science Projects About Weather · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Weather and Climate · Time Life: Understanding Science & Nature: Geography; Planet Earth; Weather and Climate · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra; Tiempo y clima
Mathematics Connections	· Use numbers in real-world situations.
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Composition of the Atmosphere* (sciLINKS Number: HSTE 355); *Energy in the Atmosphere* (sciLINKS Number: HSTE 360) · Windows on Science Laser Disc: Earth Science Volume 2: Air and Weather: *The Atmosphere*

Literacy Connections	· Construct an attribute chart summarizing the properties of each layer of the atmosphere.
Key Idea	· *As **altitude** increases, **air pressure** decreases.*
NYS MST Standards	· Performance Indicator 2.1: Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.
Performance Tasks	· Students observe that air has mass by finding the mass of a deflated balloon using a triple beam balance, inflating the balloon, finding the mass again, and calculating the difference between the two values to determine the mass of air in the balloon. As an alternative, students can find the mass of a deflated ball, such as a basketball, soccer ball, or volleyball, then inflate the ball to its maximum recommended pressure, find the mass again, and calculate the difference between the two values. Students explain how the fact that air has mass is related to air pressure. · Students observe that air exerts pressure through various activities investigating the effects of air pressure. For example, students fill a cup halfway with water, place a large index card over the top of the cup, then holding the card in place turn the cup upside down. Students release the card and observe that air pressure causes the card to push against the cup and thus the water remains in the cup. Students draw an arrow diagram to indicate the forces acting on the system. · Teacher Demonstration: To observe how differences in air pressure can crush a soda can, the teacher heats an empty soda can with a little bit of water inside over a hot plate. Use tongs to remove the can from the heat source, place it straight upside down into a bowl of water. Since the pressure inside the can is less than the pressure outside the can due to condensation of the water vapor, the greater air pressure outside the can will immediately cause the soda can to be crushed. · Students examine a reference table or chart to determine how air pressure changes with increasing in altitude. · Students construct a barometer and use it to track daily changes in air pressure. Students also keep a weather journal and determine if a relationship exists between air pressure and weather conditions.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2i Process Skills Based on Standard 4 · General Skills: 1 - 4

NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· Glencoe: Earth Science: *MiniLab: Does Air Have Mass?; Explore Activity: Temperature Affects the Density of Air (Soda Can Crush); Making a Barometer* · Holt, Rinehart, and Winston: Holt Science & Technology: Earth Science: *Under Pressure!* · New York State Education Department: Earth Science Reference Tables: *Selected Properties of Earth's Atmosphere* · Prentice Hall: Science Explorer: Weather and Climate: *Discover: Does Air Have Mass?; Discover: Is Air There?; Skills Lab: Working Under Pressure* · Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., and Whitaker, R. The Nature Company Guides: Weather · Cosgrove, B. Eyewitness Books: Weather · Ellyard, D. Weather · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Gardner, R. and Webster, D. Science Projects About Weather · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Weather and Climate · Time Life: Understanding Science & Nature: Geography; Planet Earth; Weather and Climate · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra; Tiempo y clima
Mathematics Connections	· Explore methods of collecting and organizing data.
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Atmospheric Pressure and Winds* (sciLINKS Number: HSTE370) · Windows on Science Laser Disc: Earth Science Volume 2: Air and Weather: *The Pressure's On*
Literacy Connections	· Prepare a lab report incorporating informational and narrative procedure writing.
Key Idea	· *The Earth receives energy in the form of **radiation**. When radiation is absorbed, its energy is changed to **heat**.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.

Performance Tasks	· Students design an experiment to investigate the rates at which different colors of the same surface or different types of surfaces absorb radiation, thereby increasing in temperature, and relate their observations to the unequal heating of the Earth. For example, students place different colored sands or papers in the sun and record their surface temperatures. Students explain how their observations relate to unequal heating of the Earth's surface. · Students place 300 mL of water and 300 mL of sand into separate beakers and use a ring stand, clamps and string to suspend a thermometer down into the center of each beaker so that the bulb is covered by ~0.5 cm of sand or water. Students then place a lamp about 20 cm above the sand and water, turn the lamp on and record the temperature of the sand and water every minute for 15 minutes. Students then turn the lamp off and read the temperature of the sand and water every minute for another 15 minutes. Students explain how their observations relate to unequal heating of the Earth's surface.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2k Process Skills Based on Standard 4 · General Skills: 1 - 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· AIMS: Down to Earth: *When You're Hot, You're Hot* · Prentice Hall: Science Explorer Weather and Climate: *Heating Earth's Surface.* · Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., and Whitaker, R. The Nature Company Guides: Weather · Cosgrove, B. Eyewitness Books: Weather · Ellyard, D. Weather · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Gardner, R. and Webster, D. Science Projects About Weather · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Weather and Climate · Time Life: Understanding Science & Nature: Geography; Planet Earth; Weather and Climate · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra; Tiempo y clima
Mathematics Connections	· Explore methods of collecting and organizing data. · Construct a line graph to demonstrate data that has been collected.

Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Energy in the Atmosphere* (sciLINKS Number: HSTE360) · Windows on Science Laser Disc: Earth Science Volume 2: Air and Weather: *Measuring Surface Temperatures*
Literacy Connections	· Prepare a lab report incorporating informational and narrative procedure writing.
Inquiry Activity	· Propose a hypothesis as to why there is a lag time in the heating and cooling of water and sand in the performance task above; then design a controlled experiment to test the hypothesis.
Key Idea	· *Near the Earth's surface, air is heated by **conduction**.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students investigate heat transfer from a substance to air using conduction kits (Two insulated containers with removable lids, two thermometers that are inserted into the lids to measure temperature inside the containers, and a U-shaped aluminum bar that is inserted into each lid to serve as a conductor between the two containers). Students place hot water in one container, place the lids with thermometers and conduction bar on top of the containers, then measure the temperature on both sides of the system every minute for 15 minutes. Students touch the bar and observe that it is hot and explain how heat is conducted from the side with hot water to the air in the other container. Students graph and analyze their results and explain how heat is also lost by conduction to the environment through the walls and lid of the container and through the bar.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2k Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1 - 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e

Resources	· Prentice Hall: Science Explorer Weather and Climate: *Heating Earth's Surface.* · Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., and Whitaker, R. The Nature Company Guides: Weather · Cosgrove, B. Eyewitness Books: Weather · Ellyard, D. Weather · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Gardner, R. and Webster, D. Science Projects About Weather · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Weather and Climate · Time Life: Understanding Science & Nature: Geography; Planet Earth; Weather and Climate · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra; Tiempo y clima
Mathematics Connections	· Explore methods of collecting and organizing data. · Construct a line graph to demonstrate data that has been collected.
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Energy in the Atmosphere* (sciLINKS Number: HSTE360)
Literacy Connections	· Prepare a lab report incorporating infrmational and narrative procedure writing.
Key Idea	· ***Convection currents*** *in the atmosphere are caused by unequal heating of the atmosphere; heated, less dense air near the surface rises, while cooler, denser air away from the surface sinks.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students examine the effect of temperature on the density of air. For example, students find the mass of a balloon, inflate the balloon; then measure the mass and circumference. After finding the mass of the air by difference, students calculate the radius of the balloon (Circumference = pi x diameter, $C = \pi d$; radius = diameter/2, $r = d/2$). Then students calculate the volume of the balloon (use the formula for the volume of a circle as an approximate: (Volume = 4/3 x pi x radius cubed, $V = 4/3\pi r^3$). Students then calculate the density of the air (Density = mass / volume, $D = m/V$). Students then place the balloon in a warm water bath, wait several minutes and measure the circumference again. Finally, students place the balloon in an ice water bath, wait several minutes, and measure the circumference. Students calculate the volume and density of air in the balloon as above and discuss the relationship between temperature and the density of air. Students then explain how changes in temperature and density of air relate to convection currents in the atmosphere.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2k Process Skills Based on Standard 4 · General Skills: 1 - 4

NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· GEMS*:* Convection a Current Event: *Convection in Wind* · Prentice Hall: Science Explorer Weather and Climate: *Heating Earth's Surface*.
Mathematics Connections	· Explore methods of collecting and organizing data. · Explore three-dimensional figures to begin the understanding of volume. · Construct a bar graph to demonstrate data that has been collected.
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Energy in the Atmosphere* (sciLINKS Number: HSTE360)
Literacy Connections	· Summarize findings in a lab notebook.
Weather and Climate	**Suggested Time: 6 weeks**
Key Idea	· ***Air masses*** *form when air remains nearly stationary over a large section of Earth's surface and takes on the conditions of* ***temperature*** *and* ***humidity*** *from that location.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students research the characteristics of the six major North American air masses, identifying where the air masses come from, the types of air they bring (temperature and humidity), and the areas they affect. Students summarize their findings using an attribute chart.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 Standard 4: The Physical Setting · Major Understanding 2.2l Process Skills Based on Standard 4 · General Skills: 1, 4 · Physical Setting Skills: 8
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5f Scientific Tools and Technologies · S6d Scientific Communication · S7a-e

Resources	· Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., and Whitaker, R. The Nature Company Guides: Weather · Cosgrove, B. Eyewitness Books: Weather · Ellyard, D. Weather · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Gardner, R. and Webster, D. Science Projects About Weather · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Weather and Climate · Time Life: Understanding Science & Nature: Geography; Planet Earth; Weather and Climate · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra; Tiempo y clima
Mathematics Connections	· Use numbers in real-world situations.
Technology Connections	· Use Inspiration to construct an attribute chart. · National Geographic Society: NGS PictureShow CD-ROM: Introduction to Weather: *What is Weather.* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Air Masses and Fronts* (sciLINKS Number: HSTE 385)
Literacy Connections	· Construct an attribute chart.
Key Idea	· *Most changes in **local weather conditions** are caused by the **movement of air masses**. The movement of air masses is determined by **prevailing winds** and **upper air currents**.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students construct an anemometer to measure wind speed and a wind vane and compass to determine wind direction. Students use these instruments to characterize the speed and direction of winds around their school building. Students compare and contrast the data collected from each side of the building and explain why the data might vary on each side of the building and from group to group.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2m, 2.2n Process Skills Based on Standard 4 · General Skills: 1 – 4 · Physical Setting Skills: 5, 9
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e

Resources	· Glencoe: Earth Science Laboratory Manual: *Wind Power* · Holt, Rinehart, and Winston: Holt Science & Technology: Earth Science: *Gone With the Wind* · Prentice Hall: Science Explorer: Weather and Climate: *Where's the Wind?* · Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., and Whitaker, R. The Nature Company Guides: Weather · Cosgrove, B. Eyewitness Books: Weather · Ellyard, D. Weather · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Gardner, R. and Webster, D. Science Projects About Weather · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Weather and Climate · Time Life: Understanding Science & Nature: Geography; Planet Earth; Weather and Climate · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra; Tiempo y clima
Mathematics Connections	· Explore methods of collecting and organizing data.
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Introduction to Weather: *What is Weather.* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Air Masses and Fronts* (sciLINKS Number: HSTE 385) · Windows on Science Laser Disc: Earth Science Volume 2: Air and Weather: *When Air Masses Move*
Literacy Connections	· Summarize observations and findings in a lab notebook.
Key Idea	· ***Fronts** are **boundaries** between air masses.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.

Performance Tasks	· Students research the characteristics of the four types of fronts that occur (cold fronts, warm fronts, stationary fronts, and occluded fronts) indicating the types of air masses that converge to form the fronts, how the air masses are moving, how the fronts move, and the types of clouds and weather they produce. Students construct an attribute chart to summarize their findings. · Students model the formation and interaction of fronts using a shoebox model. For example, student roll a piece of clay out into a long thin strand and press it onto the center of the shoebox, going down one side, across the center, and up the other side (cutting the box in half lengthwise). Students then cut a piece of heavy duty cardboard or other suitable material to form a barrier and press it firmly into the clay. Students prepare a liter of hot water and a liter of cold water, adding a few drops of red food coloring to the hot water and a few drops of blue food coloring and 100 mL table salt to the cold water. The hot water is place on one side of the barrier (to a depth of 4-5 cm) and the cold water on the other side. Once the water has settled, students remove the barrier and record their observations of the interactions of the fluids. Students infer what would happen if a cold air mass came in contact with a warm air mass, based on their observations of the model. · Students construct a model or diagram of moving air masses and the resultant fronts and weather changes they produce.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2o Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e

Resources	· Prentice Hall: Science Explorer: Weather and Climate: *Discover: How Do Fluids of Different Densities Behave?* · Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., and Whitaker, R. The Nature Company Guides: Weather · Cosgrove, B. Eyewitness Books: Weather · Ellyard, D. Weather · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Gardner, R. and Webster, D. Science Projects About Weather · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Weather and Climate · Time Life: Understanding Science & Nature: Geography; Planet Earth; Weather and Climate · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra; Tiempo y clima
Mathematics Connections	· Explore methods of collecting and organizing data. · Construct two- or three-dimensional figures.
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Introduction to Weather: *What is Weather*. · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Air Masses and Fronts* (sciLINKS Number: HSTE 385)
Literacy Connections	· Summarize findings in a laboratory notebook.
Key Idea	· ***Precipitation*** *is likely to occur at front boundaries.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.

Performance Tasks	· By making a cloud in a jar, students learn about the conditions that must be present for clouds to form. For example, students place about 5 cm of hot water in a wide necked jar, place the lid on the jar and shake the jar. Students allow the contents of the jar to settle for several minutes; then remove the lid and replace it with a flat, circular piece of ice that completely covers the opening of the jar. Students leave the ice in place for several minutes and record their observations. Next, students light a match, allow it to burn for several seconds; then quickly lift the lid and drop the lighted match in the jar. Students observe the system for several minutes and compare and contrast their observations for both trials. Students remove the ice from the top of the jar to let the cloud out and explain what conditions must be present for clouds to form. · Students create dew and determine the dew point of the air. For example, students partially fill a metal can with room temperature water, dry the outer surface of the can and place a thermometer inside. Students use a stirrer to slowly mix the water as they add small amounts of ice to the can. Students note the exact temperature at which a thin film of moisture appears on the outside of the can. Students repeat this procedure two more times then find the average of the three temperatures or the average dew point temperature of the air around the container. Students explain how dew forms and the factors that determine the dew point temperature. · Students make hail and explain the conditions that are necessary for hail to form. For example, students put 15 g of table salt into a beaker, add 50 mL of water, and stir until most of the salt is dissolved. 15 mL are added to a clean test tube, which is then placed in the beaker. Students fill the beaker almost to the top with crushed ice and stir or swirl the beaker every minute for six minutes. Students measure the temperature of the ice water every minute. At the end of six minutes, students remove the test tube from the beaker and drop an ice chip into the test tube. The water in the test tube should begin to solidify. Students explain their observations.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2o Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1 - 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e

Resources	· Glencoe: Earth Science: *MiniLab: How Can Dew Point Be Determined?; MiniLab: Can You Make It Rain?; Skill Assesssment: How Did That Puddle Get There* · Prentice Hall: Science Explorer: Weather and Climate: *Discover: Can You Make Hail?* · Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., and Whitaker, R. The Nature Company Guides: Weather · Cosgrove, B. Eyewitness Books: Weather · Ellyard, D. Weather · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Gardner, R. and Webster, D. Science Projects About Weather · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Weather and Climate · Time Life: Understanding Science & Nature: Geography; Planet Earth; Weather and Climate · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra; Tiempo y clima
Mathematics Connections	· Make and use metric measurements. · Explore methods of collecting and organizing data. · Construct a line graph of changes in temperature data over time.
Technology Connections	· Use temperature probes and computers to collect, organize, and display temperature data. · National Geographic Society: NGS PictureShow CD-ROM: Introduction to Weather: *What is Weather.* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Air Masses and Fronts* (sciLINKS Number: HSTE 385) · Sunburst: Everything Weather: *Name That Precipitation*
Literacy Connections	· Prepare a lab report incorporating informational and narrative procedure writing.
Key Idea	· ***High pressure systems*** *generally bring fair weather.* ***Low pressure systems*** *usually bring cloudy unstable conditions. The general movement of* ***highs*** *and* ***lows*** *is from west to east across the United States.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students study weather station symbols and use a reference table to interpret a basic weather map. Students then collect and analyze daily weather maps for a week, examining highs and lows, wind direction and speed. Students also record the weather conditions for each day and compare the weather map predictions with actual weather conditions. · Students construct field maps and learn to identify patterns that can be used to predict weather.

NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2p Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4 · Physical Setting Skills: 7
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· Glencoe: Earth Science: *Reading a Weather Map* · Holt, Rinehart & Winston: Holt Science & Technology: Earth Science: *Watching the Weather* · New York State Education Department: Earth Science Reference Tables: *Weather Map Symbols* · Prentice Hall: Science Explorer: Weather and Climate: *Reading a Weather Map* · Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., and Whitaker, R. The Nature Company Guides: Weather · Cosgrove, B. Eyewitness Books: Weather · Ellyard, D. Weather · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Gardner, R. and Webster, D. Science Projects About Weather · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Weather and Climate · Time Life: Understanding Science & Nature: Geography; Planet Earth; Weather and Climate · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra; Tiempo y clima
Mathematics Connections	· Use numbers in real-world situations.
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Introduction to Weather: *Weather Forecasting* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Forecasting the Weather* (sciLINKS Number: HSTE 395) · Windows on Science Laser Disc: Earth Science Volume 2: Air and Weather: *High and Low Pressure*
Literacy Connections	· Write a narrative procedure for reading a weather map and making a weather forecast.

Key Idea	· *Weather patterns become evident when **weather variables** are observed, measured and recorded. These variables include **air temperature, air pressure, moisture (relative humidity, dewpoint), precipitation (rain, snow, hail, sleet, etc.), wind speed** and **direction,** and **cloud cover.***
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students measure weather variables using instruments such as thermometers, barometers, psychrometers, precipitation gauges, anemometers, and wind vanes. Students use data collected to make a weather prediction. · Students determine relative humidity from wet-bulb and dry-bulb temperatures using a reference table. · Students use a camera to photograph the sky each day for seven days and record the time of day each photo was taken as well as the weather conditions at the time the photo was taken. Students also listen to a daily weather report or obtain a weather report from a daily newspaper and record the conditions that are reported for each day of the study. Students organize their data for each day, identify the types of clouds they observe using cloud charts and forecast information, and compare the actual weather conditions they observed with the types of weather typically associated with the cloud types they identify.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.1j Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1 - 4 · Physical Setting Skills: 7, 8, 9
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e

Resources	· AIMS: Down to Earth: *Dripping Earth; Temp-Rate* · Glencoe: Earth Science: *Enrichment: What is Weather* · New York State Education Department: Earth Science Reference Tables: *Relative Humidity (%)* · Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., and Whitaker, R. The Nature Company Guides: Weather · Cosgrove, B. Eyewitness Books: Weather · Ellyard, D. Weather · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Gardner, R. and Webster, D. Science Projects About Weather · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Weather and Climate · Time Life: Understanding Science & Nature: Geography; Planet Earth; Weather and Climate · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra; Tiempo y clima
Mathematics Connections	· Explore methods of collecting and organizing data.
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Introduction to Weather: *Weather Forecasting* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Collecting Weather Data* (sciLINKS Number: HSTE 380); *Forecasting the Weather* (sciLINKS Number: HSTE 395) · Sunburst: Everything Weather: *Keep an Eye on the Clouds; Hands on Weather; Stormy Weather* · The Weather Channel Online*: www.weather.com* · Windows on Science Laser Disc: Earth Science Volume 2: Air and Weather: *Junior Meteorologist*
Literacy Connections	· Write a report detailing the weather variables measured, the predictions made and their accuracy.
Inquiry Activity	· Collect weather data for a period of a month, use the data to make weather predictions, compare predictions to local weather reports, and evaluate accuracy of their predictions. Also compare predictions to those published in a Farmer's Almanac.
Key Idea	· ***Hazardous weather conditions*** *include thunderstorms, tornadoes, hurricanes, ice storms, and blizzards. Humans can prepare for and respond to these conditions if given sufficient warning.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students make a model of a tornado, describe what happens and compare their model with a real tornado. To compare their model with a real tornado, students should watch the Nova video: Cyclone! For example, students obtain two 2-liter bottles, fill one about 3/4 full of water, and add one drop of dishwashing soap to the water. Students then put the empty bottle on top and tape the bottles securely. Students flip the bottles so with the water is on top and move the top bottle in a circular motion. · Students track the position of a hurricane, such as hurricane Andrew, for a period of 6 days and distinguish between a hurricane watch and a hurricane warning issued by the National Weather Service.

NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2q Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4 · Physical Setting Skills: 1
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5f Scientific Tools and Technologies · S6d Scientific Communication · S7a-e
Resources	· Glencoe: Earth Science: *Explore Activity: Make a Model of a Tornado; Integration: Tornado Watch! Beware of Angular Momentum.* · Prentice Hall: Science Explorer: Weather and Climate: *Discover: Can You Make a Tornado?; Tracking a Hurricane* · Pulley Sayre: El Niño and La Niña: Weather in the Headlines · Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., and Whitaker, R. The Nature Company Guides: Weather · Cosgrove, B. Eyewitness Books: Weather · Ellyard, D. Weather · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Gardner, R. and Webster, D. Science Projects About Weather · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Weather and Climate · Time Life: Understanding Science & Nature: Geography; Planet Earth; Weather and Climate · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra; Tiempo y clima
Mathematics Connections	· Explore methods of collecting and organizing data. · Understand coordinate graphing.
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Introduction to Weather: *Weather Forecasting* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Severe Weather* (sciLINKS Number: HSTE 390) · Sunburst: Everything Weather: *Working Weather; Severe Weather: What You Need to Know; Tracking a Hurricane* · The Weather Channel Online*: www.weather.com* · Nova Adventures in Science Video: Hurricane! · National Geographic Video: Cyclone! · Windows on Science Laser Disc: Earth Science Volume 2: Air and Weather: *Thunderstorms and Tornadoes; Pet Tornado; Hurricanes*

Literacy Connections	· Summarize observations and findings in a lab notebook.
Key Idea	· ***Climate*** *is the* ***characteristic weather*** *that prevails from* ***season*** *to season and year to year. Climate variations influence the form and nature of* ***landscape development****.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students graph the average monthly temperatures and/or rainfall of coastal and inland continental regions and interpret the range in temperatures. · Students study various climates and learn to identify different climate zones based on the ratio between precipitation and potential evapotranspiration, as well as the effects of latitude, planetary winds, elevation, mountain ranges and large bodies of water on climate. Students use these climatic factors to determine the climate patterns of a region. Summarize findings using an attribute chart.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2j Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5f Scientific Tools and Technologies · S6d Scientific Communication · S7a-e

Resources	· GEMS: The Real Reasons for Seasons: *Temperatures Around the World* · Glencoe: Earth Science: *MiniLab: How Does Earth's Tilt Affect Radiation Received?* · Glencoe: Earth Science Laboratory Manual: *Radiant Energy and Climate* · Holt, Rinehart, and Winston: Holt Science & Technology: Earth Science: *Biome Business.* · Prentice Hall: Science Explorer: Weather and Climate: *Discover: How Does Earth's Shape Affect Climate Zones?; Cool Climate Graphs* · Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., and Whitaker, R. The Nature Company Guides: Weather · Cosgrove, B. Eyewitness Books: Weather · Ellyard, D. Weather · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Gardner, R. and Webster, D. Science Projects About Weather · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Weather and Climate · Time Life: Understanding Science & Nature: Geography; Planet Earth; Weather and Climate · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra; Tiempo y clima
Mathematics Connections	· Construct line graphs.
Technology Connections	· Use Inspiration to construct an attribute chart. · National Geographic Society: NGS PictureShow CD-ROM: Earth's Climate: *What Is Climate?* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *What Is Climate?* (sciLINKS Number: HSTE 405) *Climates of the World* (sciLINKS Number: HSTE 410) · Sunburst: Everything Weather: *Get Ready to Travel; Desert Trek; Part Weather*
Literacy Connections	· Construct an attribute chart to summarize regional climatic conditions. · Write a travel brochure to a particular region, detailing the climatic conditions a traveler can expect.
Key Idea	· *Substances enter the atmosphere naturally and from human activity. Some of these substances, including **dust** from volcanic eruptions and **greenhouse gases** such as carbon dioxide, methane, and water vapor, can affect weather, climate, and living things.*
NYS MST Standards	· Performance Indicator 2.2: Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.
Performance Tasks	· Students demonstrate the greenhouse effect by obtaining two identical aquariums and laying a thermometer inside each one. Students place the aquariums next to each other in a sunny window and place a third thermometer between them. Students record the temperature on all three thermometers; then place a glass lid on one of the aquariums. Students record and graph the temperatures of all three thermometers at the end of 5, 10, and 15 minutes. Students explain how this activity provides a model for the role of greenhouse gases in the atmosphere.

NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 2.2r Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· Glencoe: Earth Science: *The Greenhouse Effect* · Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., and Whitaker, R. The Nature Company Guides: Weather · Cosgrove, B. Eyewitness Books: Weather · Ellyard, D. Weather · Eyewitness Visual Dictionaries: The Visual Dictionary of the Earth · Gardner, R. and Webster, D. Science Projects About Weather · Silverstein, A., Silverstein, V., Silverstein Nunn, L. Weather and Climate · Time Life: Understanding Science & Nature: Geography; Planet Earth; Weather and Climate · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Geografía; Planeta tierra; Tiempo y clima
Mathematics Connections	· Explore methods of collecting and organizing data. · Construct a line graph to demonstrate data that has been collected.
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Earth's Climate: *How Does Climate Change?* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Changes in Climate* (sciLINKS Number: HSTE 415); *The Greenhouse Effect* (sciLINKS Number: HSTE 365); *Air Pollution* (sciLINKS Number: HSTE 375)
Literacy Connections	· Prepare a lab report incorporating informational and narrative procedure writing.
Inquiry Activity	· Introduce other substances into the aquariums and determine which substances produce the lowest and/or highest temperatures.
Environmental Monitoring and Pollution	**Suggested Time: 4 weeks**
Key Idea	· *Human activity can bring about **environmental degradation** through resource acquisition, urban growth, land use decisions, waste disposal, etc.*
NYS MST Standards	· Performance Indicator 7.2: Describe the effects of environmental changes on humans and other populations.

Performance Tasks	· Teachers or students prepare core samples of soil using empty food cans with both ends cut out. The cans are pushed or gently hammered into soft moist soil, then removed. Students estimate the mass of their core sample and weigh the sample using a triple beam balance. After gently pushing the soil from the can, student weigh and record the mass of the can, then subtract the mass of the can to determine the mass of the soil alone. Students sketch the soil profile, then slowly and carefully take the soil sample apart, sorting what they find into categories of their own choice. Students describe and find the mass of each category, then attempt to put the core sample back together exactly the way they got it. Students then evaluate the linkage between this activity and the environmental impact of land use and development.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 7.2c Process Skills Based on Standard 4 · General Skills: 1 - 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3a Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· AIMS: Down to Earth: *What on Earth Can We Do?*
Mathematics Connections	· Make and use metric measurements of mass.
Technology Connections	· Use a triple beam balance. · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Soil Conservation:* sciLINKS Number: HSTE240 · Windows on Science Laser Disc: Earth Science Volume 3: But Not a Drop to Drink: *Not In My Backyard*
Literacy Connections	· Write an environmental impact statement for the core sample detailing what it was like naturally, what it is like now, the effects on wildlife, habitat, soil structure, etc and the estimated cost of the "development."
Key Idea	· *Since the Industrial Revolution,* ***human activities*** *have resulted in major* ***pollution*** *of air, water and soil.*
NYS MST Standards	· Performance Indicator 7.2: Describe the effects of environmental changes on humans and other populations.

Performance Tasks	· Place a white coffee filter over the nozzle of a vacuum cleaner and secure it with a rubber band. Turn the vacuum cleaner on for 5 minutes, holding the nozzle 20 cm off the ground at a particular location in the room. Students remove the filter, label it with the time, date, location, and height and put it in a plastic bag. Test at least four other locations in the room in a similar manner using a new coffee filter each time. Students observe each filter using a microscope and identify the types and sizes of particles collected. · Students estimate how much air pollution a car produces in one minute. · Students observe the breakdown of various materials in water and in sand and will determine if the materials are biodegradable and to what degree.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 · Key Idea 3: S3.1 - S3.3 Standard 2: Information Systems · Key Idea 1: 1.3 Standard 4: The Living Environment · Major Understanding: 7.2d Standard 6: Interconnectedness: Common Themes · Key Idea 1: Systems Thinking: 1.4 Process Skills Based on Standard 4 · General Skills: 1, 4, 8
NYC Performance Standards	Life Sciences Concepts · S2d, S2e Earth and Space Sciences Concepts · S3d Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· AIMS: Down to Earth: *Every Breath You Take* · Hunken, J. Ecology for all Ages: Discovering Nature through Activities for Children and Adults · Rees, R., ed. The Way Nature Works · Scott, M. The Young Oxford Book of Ecology · Time Life: Understanding Science and Nature: Ecology; · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Ecología
Mathematics Connections	· Collect, organize, and display quantitative data using appropriate tables and graphs.

Technology Connections	· Construct tables and graphs. · Use pH probes and a computer to collect and analyze soil and water pH data. · Investigate water, soil, and air pollution with Steck-Vaughn Our Environment: A Multimedia Database: *Water Pollution; Preventing Water Pollution; Soil Erosion and Pollution; Preventing Soil Erosion and Pollution; Pollution Caused By Energy Use; Air Pollution; Preventing Air Pollution.* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Changes in Climate* (sciLINKS Number: HSTE415); *The Greenhouse Effect* (sciLINKS Number: HSTE365); *Air Pollution* (sciLINKS Number: HSTE375; HSTL505) · Windows on Science Laser Disc: Physical Science Volumes 2 & 3: Energy Resources: *Acid Rain* · Windows on Science Laser Disc: Earth Science Volume 3: But Not a Drop to Drink: *Waste water; The Value of Trees; Toxic Waste; Landfills*
Literacy Connections	· Write a lab report incorporating informational and narrative procedure writing.
Inquiry Activity	· Use the vacuum cleaner apparatus to collect dust for varying amounts of time, at various heights in various locations inside and outside the school, and at various times of day. Characterize the types of particles collected, the relative amounts, and whether there are any patterns to the distribution of indoor and/or outdoor air pollution.
Key Idea	· *Pollution has cumulative effects such as **acid rain, global warming** and **ozone depletion**.*
NYS MST Standards	· Performance Indicator 7.2: Describe the effects of environmental changes on humans and other populations.
Performance Tasks	· Students simulate the effects of acid rain on seashells or plants by misting them with a vinegar/water solution. Students observe the shells or plants for 2-3 weeks. · Students model the greenhouse effect by constructing a physical model of the atmosphere using two, 2-liter, clear plastic soda bottles with the tops cut off. Students tape a thermometer to the inside of each bottle, then place about 1-1/2 cups of dry potting soil in the bottom. Clear plastic wrap held in place with a rubber band is used to cover one of the bottles. The bottles are both placed 1/2 inch from an incandescent bulb with the thermometers facing out. Students record the starting temperature (which should be the same: room temperature) and then turn the light on. Students record the temperature in each of the bottles every minute for 15 minutes. Students graph and analyze their results.

NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 · Key Idea 3: S3.1 - S3.3 Standard 2: Information Systems · Key Idea 1: 1.3 Standard 4: The Living Environment · Major Understanding: 7.2d Standard 6: Interconnectedness: Common Themes: Systems Thinking · Key Idea 1: 1.4 Process Skills Based on Standard 4 · General Skills: 1, 4, 8
NYC Performance Standards	Life Sciences Concepts · S2d, S2e Earth and Space Sciences Concepts · S3d Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· Gardner, R. Science Projects About Ecology and the Environment. *A Miniature Greenhouse* · GEMS: Acid Rain · GEMS: Global Warming & the Greenhouse Effect: *What Have You Heard about the Greenhouse Effect? Modeling the Greenhouse Effect* · Project WILD: *Enviro-Ethics; Ethi-Reasoning; Cartoons and Bumper Stickers; What did Your Lunch Cost Wildlife?* · NeoSCI: Simulating the Effects of Acid Rain: Lab Investigation Kit · Edmonds, A. Closer Look at the Ozone Hole · Hunken, J. Ecology for all Ages: Discovering Nature through Activities for Children and Adults · Rees, R., ed. The Way Nature Works · Scott, M. The Young Oxford Book of Ecology · Time Life: Understanding Science and Nature: Ecology; · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Ecología
Mathematics Connections	· Collect, organize, and display quantitative data using appropriate tables and graphs.

Technology Connections	· Construct tables and graphs. · Use pH probes and a computer interface to collect and analyze soil and water pH data. · Investigate water, soil, and air pollution with Steck-Vaughn Our Environment: A Multimedia Database: *Water Pollution; Preventing Water Pollution; Soil Erosion and Pollution; Preventing Soil Erosion and Pollution; Pollution Caused By Energy Use; Air Pollution; Preventing Air Pollution* · National Geographic Society: NGS PictureShow CD-ROM: Earth's Climate: *How Does Climate Change?* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Changes in Climate* (sciLINKS Number: HSTE415); *The Greenhouse Effect* (sciLINKS Number: HSTE365); *Air Pollution* (sciLINKS Number: HSTE375) · Windows on Science Laser Disc: Physical Science Volumes 2 & 3: Energy Resources: *Acid Rain*
Literacy Connections	· Write a lab report incorporating informational and narrative procedure writing.
Inquiry Activity	· Design and conduct controlled experiments to explore the effects of acidity levels on plant growth or shell decomposition. · Explore the effects of varying light, moisture, soil, plants, etc. on their model atmospheres.
Key Idea	· *The environment may contain **dangerous levels** of substances (pollutants) that are harmful to organisms. Therefore, the health of environments and individuals requires the **monitoring** of soil, air, water, and taking steps to keep them safe.*
NYS MST Standards	· Performance Indicator 7.1: Describe how living things, including humans, depend upon the living and nonliving environment for their survival.
Performance Tasks	· Students design an experiment to assess neighborhood pollution. · Students set up pollution sampling procedures for water, soil, or air. Using La Motte environmental test kits students test for harmful levels of substances, chart and graph results and compare them to established environmental quality guidelines and parameters.
Inquiry Activity	· Students track weather conditions and collect pollution data over several days to weeks, then correlate pollution levels to weather conditions.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 · Key Idea 3: S3.1 - S3.3 Standard 2: Information Systems · Key Idea 1: 1.3 Standard 4: The Living Environment · Major Understanding: 7.1e Standard 6: Interconnectedness: Common Themes: Systems Thinking · Key Idea 1: 1.4 Process Skills Based on Standard 4 · General Skills: 1, 4

NYC Performance Standards	Life Sciences Concepts · S2d Scientific Connections and Applications · S4a, S4e Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-b
Resources	· Project WILD- *Planning for People and Wildlife* · Hunken, J. Ecology for all Ages: Discovering Nature through Activities for Children and Adults · Rees, R., ed. The Way Nature Works · Scott, M. The Young Oxford Book of Ecology · Time Life: Understanding Science and Nature: Ecology · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Ecología
Mathematics Connections	· Collect, organize and display quantitative data using appropriate graphs.
Technology Connections	· Construct graphs using Microsoft Excel. · Use temperature and dissolved oxygen probes and a computer to collect and analyze environmental data. · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Air Pollution* (sciLINKS Number: HSTE375; HSTL505)
Literacy Connections	· Write a lab report incorporating informational and narrative procedure writing.
Inquiry Activities	· Students conduct long term fieldwork using soil, air, and/or water sampling techniques.
Key Idea	· *The **survival** of living things on our planet depends on the **conservation** and **protection** of the Earth's resources.*
NYS MST Standards	· Performance Indicator 7.2: Describe the effects of environmental changes on humans and other populations.
Performance Tasks	· Students explore the effectiveness of different methods of cleaning up an oil spill and make recommendations. · Students use dispersants and oil coagulants to clean up an oil spill. · Students conduct a waste-stream audit of their classroom garbage for a week. Students weigh the garbage at the end of the day, then while wearing gloves, separate the garbage into items that can be reused, reduced (in size), recycled, or composted. Students then weigh each group and the remaining garbage. Students construct pie charts to illustrate daily and weekly totals for each category of the waste-stream. Students then develop a recycling and/or composting program for their class or school. Once the recycling and/or composting programs are in place, students continue to audit the waste stream and compare their results to their original audit.

NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 · Key Idea 3: S3.1 - S3.3 Standard 2: Information Systems · Key Idea 1: 1.3 Standard 4: The Living Environment · Major Understanding: 7.2d Standard 6: Interconnectedness: Common Themes: Systems Thinking · Key Idea 1: 1.4 Process Skills Based on Standard 4 · General Skills: 1, 4, 8
NYC Performance Standards	Life Sciences Concepts · S2d, S2e Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· Gardner, R. Science Projects About Ecology and the Environment *Recycling Garbage* · Project WILD: *Enviro-Ethics; Ethi-Reasoning; Cartoons and Bumper Stickers; What did Your Lunch Cost Wildlife?* · Environmental Action Coalition. Road to Recycling · Hunken, J. Ecology for all Ages: Discovering Nature through Activities for Children and Adults · Rees, R., ed. The Way Nature Works · Scott, M. The Young Oxford Book of Ecology · Time Life: Understanding Science and Nature: Ecology; · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Ecología
Mathematics Connections	· Collect, organize, and display quantitative data using appropriate tables and graphs.
Technology Connections	· Construct tables and graphs. · Use pH probes and a computer to collect and analyze soil and water pH data. · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: · Windows on Science Laser Disc: Earth Science Volume 3: But Not a Drop to Drink: *Potable or Polluted?*
Literacy Connections	· Write a lab report incorporating informational and narrative procedure writing.
Astronomy	**Suggested Time: 8 weeks**
Key Idea	· *The **Universe** is comprised of a wide array of **objects**, a few of which can be seen with the unaided eye. Others can only be observed with scientific instruments.*
NYS MST Standards	· Performance Indicator 1.1: Explain daily, monthly, and seasonal changes on Earth

Performance Tasks	· Students build telescopes and use them to observe objects at a distance. · Students research telescopes, such as the Keck telescopes in Hawaii, Hubble space telescope, and the Arecibo radio telescope in Puerto Rico. · Students take a trip to a planetarium and/or space observatory at some point during the Astronomy unit (planetarium: New York City, Hudson River Museum, Yonkers, NY, observatory: Kopernik Space Observatory, Vestal, NY).
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 Standard 4: The Physical Setting · Key Idea 1 Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3c Scientific Connections and Applications · S4a, S4d-e Scientific Thinking · S5b-d, S5f Scientific Tools and Technologies · S6a-c, S6e Scientific Communication · S7a-b, S7d-e
Resources	· GEMS: Messages From Space: *Message From Space* · Glencoe: Earth Science: *Telescopes* · Prentice Hall: Science Explorer: Astronomy: *Making a Telescope.* · TOPS Learning Systems: The Earth, Moon, and Sun · Apfel, N. H. Orion the Hunter · Brindel Fradin, D. The Planet Hunters · Challoner, J. The Atlas of Space · Eyewitness Science: Time & Space · Levy, D. H. Stars & Planets L. Clocks and Rythms · Time Life: Understanding Science & Nature: Space & Planets · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Espacio y Planetas · Stott, C. Eyewitness Books: Space Exploration
Mathematics Connections	· Make and use metric measurements. · Explore the concept of rates (distance, time).
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Stars and Galaxies: *Galaxies* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Telescopes* (sciLINKS Number: HSTE 445) · Windows on Science Laser Disc: Earth Science Volume 2: Planets and Space Exploration: *Optical Telescopes and Observatories; Radio Telescopes; Satellite Views*
Literacy Connections	· Prepare a report about telescopes incorporating an informational writing style. · Prepare a trip report incorporating an informational writing style.

Key Idea	· ***Celestial objects**, distinct from Earth, are in **motion** relative to Earth and each other. Measurements of these motions vary with the **perspective** of the observer.*
NYS MST Standards	· Performance Indicator 1.1: Explain daily, monthly, and seasonal changes on Earth
Performance Tasks	· Students build and or use a compass and define the location of an object in the room by finding the azimuth of each room corner. · Students construct an astrolabe and find the exact altitude of objects suspended in the room and objects outdoors from a set location. Students explain how this activity relates to observing objects in the sky. Students then stand in different locations and determine whether their altitude measurements change. Students explain how their perspective influences the measurements they make. · Students use a compass and an astrolabe to find the coordinates of the moon on different dates, and the azimuth and altitude of the Sun. · Students observe a series of slides that show the movement of Jupiter's moons over a period of eight nights. They record their observations and notice how the moons change position. Students determine how long it takes each moon to complete one revolution around Jupiter and devise a model to explain their observations.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Key Idea 1 Process Skills Based on Standard 4 · General Skills: 1, 4 · Physical Setting Skills: 5, 6
NYC Performance Standards	Earth and Space Sciences Concepts · S3c Scientific Connections and Applications · S4a Scientific Thinking · S5b-d, S5f Scientific Tools and Technologies · S6a-c, S6e Scientific Communication · S7a-b, S7d-e
Resources	· GEMS: Earth Moon and Satrs: *Making a Star Clock; Using Star Maps.* · GEMS: Moons of Jupiter: *Tracking Jupiter's Moons* · TOPS Learning Systems · Glencoe: Earth Science: *Indoor Stargazing* · Apfel, N. H. Orion the Hunter · Brindel Fradin, D. The Planet Hunters · Challoner, J. The Atlas of Space · Eyewitness Science: Time & Space · Levy, D. H. Stars & Planets L. Clocks and Rythms · Time Life: Understanding Science & Nature: Space & Planets · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Espacio y Planetas · Stott, C. Eyewitness Books: Space Exploration

Mathematics Connections	· Use numbers in real-world situations. · Explore methods of collecting and organizing data. · Make and use angular measurements. · Explore the concept of rates (distance, time).
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Early Theories in Astronomy* (sciLINKS Number: HSTE 435)
Literacy Connections	· Write a narrative procedure for finding the altitude and direction of an object.
Key Idea	· *The **latitude/longitude coordinate system** and our system of **time** are based on celestial observations. The rate at which the Sun appears to move is 15° longitude per hour.*
NYS MST Standards	· Performance Indicator 1.1: Explain daily, monthly, and seasonal changes on Earth
Performance Tasks	· Using a map or globe and a watch or wall clock, students determine the latitude, longitude, and current time for New York City. Using New York Time as a reference point, students then determine the latitude, longitude, and time for other given locations. · Students research how latitude, longitude, and time are determined.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 Standard 4: The Physical Setting · Major Understanding 1.1f Process Skills Based on Standard 4 · General Skills: 1, 4 · Physical Setting Skills: 1
NYC Performance Standards	Earth and Space Sciences Concepts · S3a, S3c Scientific Connections and Applications · S4a Scientific Thinking · S5b-d, S5f Scientific Tools and Technologies · S6a-c, S6e Scientific Communication · S7a-b, S7d-e
Resources	· GEMS: Earth, Moon, and Stars: *Making a Star Clock* · Sunburst: A Field Trip to the Sky: *Sun Time; Sun Time Neighbors; Time Zones* · Sunburst: Sun-Earth-Moon: Student Guide · Time Life: Understanding Nature & Science: Geography: *Why Were Time Zones Created?* · Apfel, N. H. Orion the Hunter · Brindel Fradin, D. The Planet Hunters · Challoner, J. The Atlas of Space · Eyewitness Science: Time & Space · Levy, D. H. Stars & Planets L. Clocks and Rythms · Time Life: Understanding Science & Nature: Space & Planets · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Espacio y Planetas · Stott, C. Eyewitness Books: Space Exploration

Mathematics Connections	· Understand coordinate graphing. · Explore angular measurement. · Use numbers in real-world situations. · Explore the concept of rates (distance, time).
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Latitude and Longitude* (sciLINKS Number: HSTE035); *The Stars and Keeping Time* (sciLINKS Number: HSTE430) · Sunburst: A Field Trip to the Sky: *Sun Lab*: *4-Hour Turns* · Windows on Science Laser Disc: Earth Science Volume 2: Address: Earth: *Latitude and Longitude*
Literacy Connections	· Write a narrative procedure for determining the time at any point on the globe given the time at a reference point. · Students create a myth about a constellation.
Key Idea	· *Earth's **Sun** is an average sized **star**. The Sun is more than a million times greater in volume than Earth.*
NYS MST Standards	· Performance Indicator 1.1: Explain daily, monthly, and seasonal changes on Earth
Performance Tasks	· Students draw classroom and/or other familiar objects to scale and observe how corresponding parts in a scale drawing have the same proportion as the actual object. · Students measure the relative diameters of the Earth, Moon, and Sun using scale models to distinguish between apparent size of the model and actual size. Students determine the ratio between the model and the actual diameters. · Students model the sizes of the Sun, Earth, and Moon and the distances between them, all to the same scale to get a sense of relative sizes and distances and the vast emptiness of space. · Students take a class "trip" to the Sun by viewing a series of 14 images. They leave San Francisco at sunrise, and travel directly towards the Sun in a straight line. At each step or "observation point," students monitor their distance traveled and their altitude above Earth.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 1.1a Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3c Scientific Connections and Applications · S4a Scientific Thinking · S5b-d, S5f Scientific Tools and Technologies · S6a-c, S6e Scientific Communication · S7a-b, S7d-e

Resources	· GEMS: The Real Reasons for Seasons: *A Trip to the Sun* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *The Sun* (sciLINKS Number: HSTE 465) · Sunburst: A Field Trip to the Sky: *Build a Scale Model of the Earth and Sun* · Sunburst: Sun-Earth-Moon: Student Guide · TOPS Learning Systems : The Earth, Moon, and Sun · Brindel Fradin, D. The Planet Hunters · Challoner, J. The Atlas of Space · Eyewitness Science: Time & Space · Levy, D. H. Stars & Planets · Time Life: Understanding Science & Nature: Space & Planets · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Espacio y Planetas · Stott, C. Eyewitness Books: Space Exploration
Mathematics Connections	· Read and write numbers through trillions. · Construct scale drawings. · Construct two- and three-dimensional figures. · Explore the concept of rates (distance, time). · Conversion of metric and English units for distance.
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Solar System: *Sun, Earth, and Moon* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *The Sun* (sciLINKS Number: HSTE 465) · Sunburst: Field Trip to the Sky: *Sun Lab* · Windows on Science Laser Disc: Earth Science Volume 2: Starring…the Sun: *What Is the Sun; How Does the Sun Work*
Literacy Connections	· Summarize observations and findings in a lab notebook. · Write a fictional account of a journey from the Sun to the Earth.
Key Idea	· *Other **stars** are like the sun, but so far away that they look like points of light. **Distances** between stars are vast compared to distances within our **solar system**.*
NYS MST Standards	· Performance Indicator 1.1: Explain daily, monthly, and seasonal changes on Earth
Performance Tasks	· Students develop an understanding of the concept of a unit known as the light-year by comparing the time it would take for light from a distant object to reach Earth given the fact that light travels at a constant speed of 300,000 kilometers/second or 186,000 miles/second. For example, it takes about seven minutes for light from the Sun to reach Earth and it takes about 4 years for light from Alpha Centauri to reach Earth. Students compare these times with the known distances. · Students construct a three-dimensional model of a constellation to scale. · Students use various light bulbs of different colors (red, white, blue, and yellow), and wattage to represent stars of varying intensities. By using a radiometer to represent a planet and meter stick to measure the distance between the "planet" and the star (the bulb), students determine the "life zone distance," or zone in which life could exist for each bulb.

NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 1.1b Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3c Scientific Connections and Applications · S4a Scientific Thinking · S5b-d, S5f Scientific Tools and Technologies · S6a-c, S6e Scientific Communication · S7a-b, S7d-e
Resources	· AIMS: Out of This World: *Distance To the Stars; Star to Star* · GEMS: Messages From Space: *Somewhere in the Milky Way; Life Zones* · GEMS: The Real Reasons for Seasons: *Trip to the Sun* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Constellations* (sciLINKS Number: HSTE 440) · Apfel, N. H. Orion the Hunter · Brindel Fradin, D. The Planet Hunters · Challoner, J. The Atlas of Space · Eyewitness Science: Time & Space · Levy, D. H. Stars & Planets · Time Life: Understanding Science & Nature: Space & Planets · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Espacio y Planetas · Stott, C. Eyewitness Books: Space Exploration
Mathematics Connections	· Describe functions and generalize them by the use of rules or algebraic expressions. · Use metric measurement. · Explore the concept of rates (distance, time). · Construct two- and three-dimensional figures.
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Stars and Galaxies: *Stars* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Constellations* (sciLINKS Number: HSTE 440) · Windows on Science Laser Disc: Earth Science Volume 2: Star Light, Galaxy Bright: *Pictures in the Night Sky; Our Own Galaxy; Light-Years; Other Galactic "Stars"*
Literacy Connections	· Write a fictional account of the journey to a constellation including the three-dimensional aspects of star clusters that appear two-dimensional from the perspective of Earth.

Key Idea	· *The **Sun** and the **planets** that revolve around it are the major bodies in the **solar system**. Other members include **comets, moons,** and **asteroids.** The shape of Earth, the other planets, and stars is nearly spherical. Earth's orbit is nearly circular.*
NYS MST Standards	· Performance Indicator 1.1: Explain daily, monthly, and seasonal changes on Earth.
Performance Tasks	· Students build a scale model of planetary sizes and distances in the Solar System. · Students compare the shape of the Earth's orbit and orbits of the other planets with the shape of a circle. Students draw ellipses using two focal points to model the elliptical orbits of the planets. · Students study the planets in our Solar System by researching the characteristics of a planet and making a travel brochure for that planet. · Students use planetary data and scale conversions to construct diagrams that show the relative sizes of planets. The relative distances within the solar system will be shown by plotting the locations of the planets from the sun on adding machine tape.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 1.1c Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3c Scientific Connections and Applications · S4a Scientific Thinking · S5b-d, S5f Scientific Tools and Technologies · S6a-c, S6e Scientific Communication · S7a-b, S7d-e

Resources	· AIMS: Out of This World: *Can You Planet?; Planetary Facts; Spacing Out the System; Size It Up: Round and Round* · GEMS: Messages From Space: *Our Neighborhood in the Milky Way; Touring the Solar System; Putting the Planets in their Places* · GEMS: The Real Reasons for Seasons: *What Shape is Earth's Orbit.* · Sunburst: A Field Trip to the Sky: *Extension Activity: Ellipses* · Sunburst: Sun-Earth-Moon: Student Guide · TOPS Learning System: The Planets and Stars · National Science Teachers Association: Project Earth Science: Astronomy · Prentice Hall: Science Explorer: Astronomy: *Try This: A Loopy Ellipse* · Apfel, N. H. Orion the Hunter · Brindel Fradin, D. The Planet Hunters · Challoner, J. The Atlas of Space · Eyewitness Science: Time & Space · Levy, D. H. Stars & Planets L. Clocks and Rythms · Time Life: Understanding Science & Nature: Space & Planets · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Espacio y Planetas · Stott, C. Eyewitness Books: Space Exploration
Mathematics Connections	· Construct two- and three-dimensional figures. · Construct ellipses with various distances between foci. · Explore the concept of rates (distance, time).
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Solar System: *The Planets* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *The Planets* (sciLINKS Number: HSTE 455); *The Sun* (sciLINKS Number: HSTE 465); *Comets, Asteroids, and Meteoroids* (sciLINKS Number: HSTE500) · Windows on Science Laser Disc: Earth Science Volume 2: Planets and Space Exploration: *Formation of Our Solar System; The Inner Solar System; Model Solar System;*
Literacy Connections	· Write a travel brochure to a planet.
Key Idea	· *Every object exerts **gravitational force** on every other object. This force depends on how much **mass** the objects have and on how far apart they are.*
NYS MST Standards	· Performance Indicator 1.1: Explain daily, monthly, and seasonal changes on Earth
Performance Tasks	· Students examine data that compares the weight of an object or themselves on different planets and infer the relationship between mass and gravitational force. · Students research the effects of reduced gravitational force on humans.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 Standard 4: The Physical Setting · Major Understanding 5.2a Process Skills Based on Standard 4 · General Skills: 1, 4

NYC Performance Standards	Earth and Space Sciences Concepts · S3c Scientific Connections and Applications · S4a Scientific Thinking · S5b-d, S5f Scientific Tools and Technologies · S6d Scientific Communication · S7a-b, S7d-e
Resources	· AIMS: Out of This World: *Weight In Space; Galactic Games* · GEMS: Earth, Moon, and Stars: *The Earth's Shape and Gravity* · Brindel Fradin, D. The Planet Hunters · Challoner, J. The Atlas of Space · Eyewitness Science: Time & Space · Levy, D. H. Stars & Planets · Time Life: Understanding Science & Nature: Space & Planets · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Espacio y Planetas · Stott, C. Eyewitness Books: Space Exploration
Mathematics Connections	· Describe functions and generalize them by the use of rules and algebraic expressions. · Evaluate algebraic expressions. · Interpret and use conversion tables.
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: Newton's Laws of Motion (sciLINKS Number: HSTP145) · Windows on Science Laser Disc: Physical Science Volumes 2 & 3: Motion and Forces: *Gravity; Weight; Relative Weights*
Literacy Connections	· Write a fictional and/or informational account of coping with gravity on other planets.
Key Idea	· ***Gravity** is the **force** that keeps planets in **orbit** around the Sun and governs the rest of the **motion** in the Solar System. Gravity is one of the forces acting on orbiting objects and projectiles.*
NYS MST Standards	· Performance Indicator 1.1: Explain daily, monthly, and seasonal changes on Earth

Performance Tasks	· Students explore how a planet's distance form the sun affects it period of revolution using a model: a one-hole rubber stopper for the planet, 1.5 meters of string, a weight, and a plastic tube. Students thread the string through the hole in the stopper and tie it off; then thread the plastic tube onto the string and attach the weights to the end. Students hold the plastic tube in their hand up over their head and practice swinging the stopper around at a constant speed, being careful that they are at a safe distance from other people and objects in the room. Students write a hypothesis to explain the relationship between the planet's distance from the sun (length of the string) and its period of revolution. Students then pull the string so the stopper is 20 cm from the end of the plastic tube and swing the stopper just fast enough to keep it moving. A partner times how long it takes for the stopper to make 10 revolutions. Students divide by 10 to find the period of revolution and repeat this procedure two more times. Students then calculate the average period of revolution. Students then repeat the three trials using 40 and 60 cm of string. Students explain what happened to the force of gravity and the period of revolution as the string was lengthened. Students use the model to explain the period of revolution for the planets in the Solar System. · Students research the properties of satellites in circular and elliptical orbits to determine some of the laws that govern the motion of a satellite around its primary body.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 5.2a Process Skills Based on Standard 4 · General Skills: 1, 4
NYC Performance Standards	Earth and Space Sciences Concepts · S3c Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· Prentice Hall: Astronomy: *Speeding Around the Sun* · Brindel Fradin, D. The Planet Hunters · Challoner, J. The Atlas of Space · Eyewitness Science: Time & Space · Levy, D. H. Stars & Planets · Time Life: Understanding Science & Nature: Space & Planets · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Espacio y Planetas · Stott, C. Eyewitness Books: Space Exploration

Mathematics Connections	· Explore methods of collecting and organizing data. · Develop an understanding of statistical ideas such as mean, median and mode to analyze data. · Describe functions and generalize them by the use of rules and algebraic expressions. · Explore the concept of rates (distance, time).
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *Kepler's Laws* (sciLINKS Number: HSTE 460); Newton's Laws of Motion (sciLINKS Number: HSTP145) · Windows on Science Laser Disc: Physical Science Volumes 2 & 3: Motion and Forces: *Circular Motion; Putting It All Together*
Literacy Connections	· Prepare a lab report incorporating narrative procedure and informational writing. · Describe how life would be without gravity.
Inquiry Activity	· Design and conduct an experiment to explore the relationship between the mass of a planet and its period of revolution.
Key Idea	· *The **apparent motions** of the Sun, Moon, planets, and stars across the sky can be explained by **Earth's rotation** and **revolution**.*
NYS MST Standards	· Performance Indicator 1.1: Explain daily, monthly, and seasonal changes on Earth.
Performance Tasks	· Students brainstorm and develop a list describing the apparent motions they have observed of the Sun, Moon, and stars across the sky. For example the Sun "rises in the East and sets in the West" and sometimes the moon appears higher in the sky than at other times. · Students use shadows to study the apparent motion of the sun. For example, students place an object in the center of a piece of oaktag, leaving more room toward the top, which they should label "N" for North. Students place their shadow charts in a sunny location, orient their shadow charts toward the North, and at several times during the day, they mark where the tip of the shadow falls. The shadow-casting object should remain upright and stationary. Students should also record the time each measurement was made. To analyze the data, students draw a line from the point where the shadow-casting object was placed out to each of the shadow length marks. Students determine during which part of the day the shadows were shortest and longest and why, based on the position of the Sun. In addition, students use the height of the object and the length of the shadow to estimate the altitude of the Sun in degrees. (Draw the triangle to scale using the shadow length as the base of the triangle and the height of shadow-casting object as the triangle's height; then measure the base angle using a protractor or use trigonometric functions to obtain the angular measure.).
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 1.1h Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4, 7

NYC Performance Standards	Earth and Space Sciences Concepts · S3c Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· GEMS: Earth, Moon, Stars: *Ancient Models of the World* · GEMS: Moons of Jupiter: *Tracking Jupiter's Moons* · Sunburst: A Field Trip to the Sky: *The Path of the Sun; One Time Around: The Illuminated Globe, Calculating the Middle of the Day, Using a Shadow Chart to Find Noon "Sun Time"; Calculating the Altitude of the Sun During the Day* · Sunburst: Sun-Earth-Moon: Student Guide · Brindel Fradin, D. The Planet Hunters · Challoner, J. The Atlas of Space · Eyewitness Science: Time & Space · Levy, D. H. Stars & Planets Time Life: Understanding Science & Nature: Space & Planets · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Espacio y Planetas · Stott, C. Eyewitness Books: Space Exploration
Mathematics Connections	· Make and use metric measurements. · Make and use angular measurements. · Describe functions and generalize them by the use of rules and algebraic expressions. · Evaluate algebraic expressions. · Explore the concept of rates (distance, time).
Technology Connections	· Use a digital camera to photograph shadows. · Sunburst: A Field Trip to the Sky: *Sun Lab*
Literacy Connections	· Prepare a lab report incorporating informational and narrative procedure writing. · Students draw and write a fictional or mythical explanation for how the Sun sets in the western part of the sky and travels to the East during the night.
Key Idea	· *Earth's **rotation** causes the length of one day to be approximately 24 hours. This rotation causes the Sun and Moon to appear to rise along the eastern horizon and set along the western horizon. Earth's **revolution** around the Sun defines the length of the year as 365 1/4 days.*
NYS MST Standards	· Performance Indicator 1.1: Explain daily, monthly, and seasonal changes on Earth.

Performance Tasks	· Working in pairs, students construct a model of the Earth and its axis using clay and a pencil or chopstick. Students make a clay ball 2 1/2 " in diameter, then push the pencil through the center of the clay to represent the Earth's axis. Students use a marker or tape to identify one of the protruding axes as the North Pole. Students etch an arrow into the clay to indicate the counterclockwise direction of the Earth's rotation. Students also etch the Equator. After simulating Earth's rotation in a counter clockwise direction several times, students use their models to construct a tabletop model of Earth's revolution. A lamp is placed in the center of a table and labels for each month are placed around the table (counterclockwise). Using toilet paper rolls as holders, or other suitable tubes, students place the Earth models in the tube so that they tilt at a 23° angle. The month of December is used as the starting point, and one of the student's Earth models is placed with the North Pole axis facing out (directly away from the lamp) at this location. Using 12 students, one standing at each month's position, the students pass the Earth model around the circle in a counterclockwise direction, always keeping the axis pointed toward its December position. After students complete one orbit, they are challenged to rotate the Earth model (also counterclockwise) as they pass it to the next student. Once all students have had an opportunity to participate in the simulation, twelve of the students' models are used to complete the tabletop model. One is placed at each month's position at the correct tilt.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 1.1h Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4, 7
NYC Performance Standards	Earth and Space Sciences Concepts · S3c Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6d Scientific Communication · S7a-e

Resources	· GEMS: The Real Reasons for Seasons: *Sun-Earth Survey; Days and Nights Around the World* · Sunburst: A Field Trip to the Sky: *The Spinning Earth; Revolution* · Sunburst: Sun-Earth-Moon: Student Guide · Brindel Fradin, D. The Planet Hunters · Challoner, J. The Atlas of Space · Eyewitness Science: Time & Space · Levy, D. H. Stars & Planets · Time Life: Understanding Science & Nature: Space & Planets · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Espacio y Planetas
Mathematics Connections	· Construct two- and three-dimensional figures. · Explore the concept of rates (distance, time). · Read and interpret graphs.
Technology Connections	· National Aeronautics Space Association (NASA): http://spacelink.nasa.gov/ · National Geographic Society: NGS PictureShow CD-ROM: Solar System: *Sun, Earth, and Moon* · Sunburst: A Field Trip to the Sky: *Sun Lab*
Literacy Connections	· Summarize their observations and findings in a lab notebook. · Write a narrative describing what it would be like to have a birthday on February 29th (leap year).
Key Idea	· *The **tilt** of the Earth's **axis of rotation** and the **revolution** of Earth around the Sun cause **seasons** on Earth. The **length of daylight** varies depending on **latitude** and **season**.*
NYS MST Standards	· Performance Indicator 1.1: Explain daily, monthly, and seasonal changes on Earth.
Performance Tasks	· Students investigate the different heating effects of sunlight as a function of the angle of incidence of the sun's rays. Students explain why it is hotter at the equator than the poles. For example, students position a lamp with a 100 W bulb and reflector shield facing down at a height of 30 cm. Students make three 5 cm square pockets out of black construction paper and place them over the bulb ends of three thermometers. Students position the thermometers at angles of 0º, 45º, and 90º directly below the lamp, turn the lamp on for 15 minutes, recording the temperature every minute. · Students observe the tabletop model developed in the previous activity to determine what portion of each globe is illuminated during each month and infer how that might affect the seasons. · Students record and graph the amount of daylight hours based upon local newspaper or weather station reports for time of sunrise and sunset on a daily basis. This can be done for a period of one to two months to show how the length of daylight varies or for the entire school year to encompass seasonal changes. Students infer how the length of daylight influences seasonal changes. · To illustrate seasonal change, students will draw the path of the Sun at each season using plastic hemispheres and external protractors.

NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 1.1i Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4, 7
NYC Performance Standards	Earth and Space Sciences Concepts · S3c Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6d Scientific Communication · S7a-e
Resources	· AIMS: Down to Earth: *Hot Spot* · GEMS: The Real Reasons for Seasons: *Tilted Earth; Angle of Sunlight/Seasons Unraveled* · Glencoe: Earth Science: *Explore Activity: Determine What Causes the Seasons* · Glencoe: Earth Science Laboratory Manual: *Radiant Energy and Climate* · Prentice Hall: Science Explorer: Weather And Climate: *Sunny Rays And Angles* · Sunburst: A Field Trip to the Sky: *Activity: Graph of Daylight Hours; Directness of Sunlight* · Sunburst: Sun-Earth-Moon: Student Guide · Brindel Fradin, D. The Planet Hunters · Challoner, J. The Atlas of Space · Eyewitness Science: Time & Space · Levy, D. H. Stars & Planets · Time Life: Understanding Science & Nature: Space & Planets · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Espacio y Planetas · Stott, C. Eyewitness Books: Space Exploration
Mathematics Connections	· Explore methods of collecting and organizing data. · Construct line graphs to demonstrate data that has been collected. · Explore the concept of rates (distance, time).
Technology Connections	· Sunburst: A Field Trip to the Sky: *Sun Lab: Sunlight Hours Where You Live; Sunlight Where You Live; The Sun at Tulúm; Season Switch Season Zones*
Literacy Connections	· Prepare a lab report incorporating informational and narrative procedure writing.

Key Idea	· ***Moons*** *are seen by* ***reflected light****. Our Moon* ***orbits*** *Earth, while Earth orbits the Sun. The* ***Moon's phases*** *as observed from Earth are the result of seeing different portions of the lighted area of the Moon's surface. The Moon's phases repeat in a cyclic pattern in about one month.*
NYS MST Standards	· Performance Indicator 1.1: Explain daily, monthly, and seasonal changes on Earth.
Performance Tasks	· Students diagram or photograph the moon throughout a month of phases and predict the occurrence and duration of subsequent phases. Students identify each phase. · Students use simple instruments (astrolabe) to plot the location of the moon in the sky from one night to the next. · Students determine the times of moonrise and moonset from newspaper reports for a several weeks to determine the pattern. Students use their knowledge of the pattern to predict moonrise and moonset; then test their predictions.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 · Key Idea 2: S2.1 Standard 4: The Physical Setting · Major Understanding 1.1g Standard 6: Interconnectedness: Common Themes: Models · Key Idea 2: 2.1 - 2.3 Process Skills Based on Standard 4 · General Skills: 1, 4, 7 · Physical Setting Skills: 5, 6
NYC Performance Standards	Earth and Space Sciences Concepts · S3c Scientific Connections and Applications · S4a Scientific Thinking · S5a-f Scientific Tools and Technologies · S6a-e Scientific Communication · S7a-e
Resources	· AIMS: Out of This World: *The Moon Shines Bright* · GEMS: Earth, Moon, and Stars: *Observing the Moon; Modeling Moon Phases and Eclipses* · Prentice Hall: Science Explorer: Astronomy: *A "Moonth" of Phases* · Sunburst: Sun-Earth-Moon: Student Guide · Brindel Fradin, D. The Planet Hunters · Challoner, J. The Atlas of Space · Eyewitness Science: Time & Space · Levy, D. H. Stars & Planets · Time Life: Understanding Science & Nature: Space & Planets · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Espacio y Planetas · Stott, C. Eyewitness Books: Space Exploration

Mathematics Connections	· Explore methods of collecting and organizing data. · Make and use angular measurements. · Describe functions and generalize them by the use of rules or algebraic expressions. · Evaluate algebraic expressions. · Explore the concept of rates (distance, time).
Technology Connections	· National Geographic Society: NGS PictureShow CD-ROM: Solar System: *Sun, Earth, and Moon* · National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *The Earth's Moon* (sciLINKS Number: HSTE 490) · Sunburst: A Field Trip to the Sky: *Moon Lab: How Long Is a Moonth?; How Long is the Moon Above the Horizon; Observing Lunar Phases* · Windows on Science Laser Disc: Earth Science Volume 2: Moonscapes: *Mission to the Moons; A Visit to Earth's Moon*
Literacy Connections	· Students explain how we are able to see the Moon and why the part of the Moon that is visible each night changes in a lab notebook.
Key Idea	· *Most objects in the solar system are in **regular** and **predictable motion**. These motions explain such phenomena as **eclipses, tides, meteor showers,** and **comets**.*
NYS MST Standards	· Performance Indicator 1.1: Explain daily, monthly, and seasonal changes on Earth.
Performance Tasks	· Students form 4-member research teams. Each member of the team researches one of the above phenomena. On the assigned day(s) each "expert" teaches the rest of the group about the phenomenon that was researched, being sure to indicate how the regular and predictable motion of objects in the Solar System explains the phenomenon.
NYS MST Standards	Standard 1: Analysis, Inquiry, and Design: Scientific Inquiry · Key Idea 1: S1.1 - S1.4 Standard 4: The Physical Setting · Major Understanding 1.1e Process Skills Based on Standard 4 · General Skills: 4, 7
NYC Performance Standards	Earth and Space Sciences Concepts · S3c Scientific Connections and Applications · S4a Scientific Thinking · S5a-c, S5f Scientific Tools and Technologies · S6d Scientific Communication · S7a-e

Resources	· AIMS: Pieces and Patterns: A Patchwork in Math and Science: *Sun Watchers; Me and My Shadow* · Sunburst: Sun-Earth-Moon: Student Guide · Brindel Fradin, D. The Planet Hunters · Challoner, J. The Atlas of Space · Eyewitness Science: Time & Space · Levy, D. H. Stars & Planets · Time Life: Understanding Science & Nature: Space & Planets · Time Life: Enciclopedia Ilustrada de Sciencia y Naturaleza: Espacio y Planetas · Stott, C. Eyewitness Books: Space Exploration
Mathematics Connections	· Use numbers in real-world situations. · Explore the concept of rates (distance, time).
Technology Connections	· National Science Teachers Association: www.scilinks.org: sciLINKS Topic: *The Earth's Moon* (sciLINKS Number: HSTE 490Comets, Asteroids, and Meteroids (sciLINKS Number: HSTE500); · Sunburst: A Field Trip to the Sky: *What Causes a Solar Eclipse: When Will a Solar Eclipse Occur; The Moon Causes Tides: High and Low Tides; Types of Tides: High and Low Tides* · Windows on Science Laser Disc: Earth Science Volume 2: Starring the Sun: *Prominences, Flares, and Eclipses*
Literacy Connections	· Prepare presentation handouts.

Appendix A: Core Materials List Per Class: Grade 8

Description	Quantity
Compound Microscope with 4x, 10x, and 40x Objectives	10
Triple Beam Balance	10
Calculators	10
Alcohol Lamp	10
Goggles	35
Thermometer, Metal Back, -40 °C to 110 °C	30
Spring Scales, 500g/5N	20
Mass Set	10
Stopwatch	10
Meter Stick	10
Half Meter Stick	10
Measuring Tapes	16
Lamps	10
Thermometers, Metal Back -40°C—110°C	36
Metric Rulers, 30cm	36
Scissors	36
Forceps, Fine Tip, 115 mm	10
Compass, Magnetic, Pocket	10
Compass with Pencil	10
Protractor, Plastic	36
Ring Stand	10
Ring Clamps	10
Wire Gauze, Square	10
Igneous Rock, Sample Set (approximately 15 samples)	12
Metamorphic Rock, Sample Set (approximately 15 samples)	12
Sedimentary Rock, Sample Set (approximately 15 samples)	12
Mineral Sets, hardness (9-10 samples)	12
Mineral Test Kits	12
Fossil kits (approximately 8 samples)	12
External Protractors	12
Hemisphere, Clear Plastic	12
Globes	8
Map, Weather	8
Map, US	8
Map, World with Time Zones	8
Conduction Kits	8
Nichrome Wire	8
pH Paper, Vials	8
Litmus Paper, Red and Blue, Vials	8 each
Beaker Clamp	8
Beaker, Pyrex, Low form: 100 mL	12
250 mL	12
400 mL	12
600 mL	12
Measuring Cup, Plastic, 8 ounce	10

Appendix A: Core Materials List Per Class: Grade 8

Description	Quantity
Graduated Cylinder: 10 mL	12
100 mL	12
250 mL	12
Plastic Dropper Pipettes	1 box
Magnet, Bar with Marked Poles, 3”	10
Funnel, Plastic, 3.25”	10
Pencil, Marking	16
Flashlight	16
Rock, Granite	16
Rock, Granite, Crushed	500 mL
Sand, Course	20 L
Sand, Fine	15 L
Soil	10 L
Gravel	10 L
Barometer, Aneroid or Mercury	1
Demonstration size rock samples: Conglomerate	2
Gneiss	2
Granite	2
Limestone	2
Marble	2
Obsidian	2
Pumice	2
Sandstone	2
Shale	2
Slate	2
Basalt	2
Demonstration size mineral samples: Galena	2
Calcite	2
Quartz	2
Magnetite	2
Pyrite	2
Talc	2
Mica	2
Sulfur	2
Depression slides	2 boxes
Salol (Phenyl Salicylate)	
Plaster of Paris	2 boxes
Yarn	1 skein
Crayons	12 boxes
Clay (4 colors)	12 boxes
Hand lenses	36
Sugar cubes	1 box
Graph paper	500 sheets
Construction paper (black)	36 sheets
Solar cells	12
Aluminum foil	2 boxes

Appendix A: Core Materials List Per Class: Grade 8

Description	Quantity
Hot plates	8
Craft sticks	1 box
Food coloring	4, 4-packs
Scissors (safety)	36
Contour Model kit	10
Thumbtacks	100
Table Salt	2 boxes
LaMotte Environmental Test Kits for: Water	8 kits
Air	8 kits
Soil	8 kits
Construction Paper (multi-colored)	100 sheets
Balloons	100
Clear Plastic shoebox-size containers	10
Gallon-size jar with screw top	10
Metal cans – approx. 16 oz.	10
Student barometers	10
Student psychrometers	20
Rain gauges	10
Anemometers	10
Wind vanes	10
2-liter soda bottles	36
Food cans (empty)	12
Masking tape (3/4 inch)	3 rolls

Appendix D: New York City Performance Standards in Science

Overview of the Middle Level Performance Standards (pp. 66-67)

S1. Physical Sciences Concepts

S1a: Demonstrates understanding of properties and changes of properties in matter

S1b: Demonstrates understanding of position and motion and forces.

S1c: Demonstrates understanding of transfer of energy and the nature of a chemical reaction.

S2. Life Sciences Concepts

S2a: Demonstrates understanding of structure and function in living systems.

S2b: Demonstrates understanding of reproduction and heredity and the role of genes and environment on trait expression.

S2c: Demonstrates understanding of regulation and behavior and response to environmental stimuli.

S2d: Demonstrates understanding of populations and ecosystems and the effects of resources and energy transfer on populations.

S2e: Demonstrates understanding of evolution, diversity, and adaptation of organisms.

S3. Earth and Space Sciences Concepts

S3a: Demonstrates understanding of structure of the Earth System.

S3b: Demonstrates understanding of Earth's history.

S3c: Demonstrates understanding of Earth in the Solar System.

S3d: Demonstrates understanding of natural resource management.

S4. Scientific Connections and Applications

S4a: Demonstrates understanding of big ideas and unifying concepts.

S4b: Demonstrates understanding of the designed world.

S4c: Demonstrates understanding of health.

S4d: Demonstrates understanding of impact of technology.

S4e: Demonstrates understanding of impact of science.

Appendix D: New York City Performance Standards in Science (continued)

Overview of the Middle Level Performance Standards

S5. Scientific Thinking

S5a: Frames questions to distinguish cause and effect; and identifies or controls variables.
S5b: Uses concepts from Science Standards 1 to 4 to explain a variety of observations and phenomena.
S5c: Use evidence from reliable sources to develop descriptions, explanations, and models.
S5d: Proposes, recognizes, analyzes, considers, and critiques alternative explanations; and distinguishes between fact and opinion.
S5e: Identifies problems; proposes and implements solutions; and evaluates the accuracy, design, and outcomes of investigations.
S5f: Works individually and in teams to collect and share information and ideas.

S6. Scientific Tools and Technologies

S6a: Uses technology and tools to observe and measure objects, organisms, and phenomena, directly, indirectly, and remotely.
S6b: Records and stores data using a variety of formats.

S6c: Collects and analyzes data using concepts and techniques in Mathematics Standard 4.
S6d: Acquires information from multiple sources.

S6e: Recognizes sources of bias in data.

S7. Scientific Communication

S7a: Represents data and results in multiple ways.

S7b: Argues from evidence.

S7c: Critiques published materials.

S7d: Explains a scientific concept or procedure to other students.

S7e: Communicates in a form suited to the purpose and the audience.

S8. Scientific Investigation

S8a: Demonstrates scientific competence by completing a controlled experiment.

S8b: Demonstrates scientific competence by completing fieldwork.

S8c: Demonstrates scientific competence by completing a design.

S8d: Demonstrates scientific competence by completing secondary research.

Appendix E
NYS Intermediate Level Science Core Curriculum