Warren Township Schools
Science Curriculum

Grade 6
Space Systems

NGSS Performance Expectations

Students who demonstrate understanding can:

MS-ESS1-1. Develop and use a model of the Earth-sun-moon system to describe the cyclical patterns of lunar phases, eclipses of the sun and moon and seasons.

DCI: ESS1.A The Universe and Its Stars	**Student Learning Objectives**	**Suggested Assessments**
• Patterns of the apparent motion of the sun, the moon and stars in the sky can be observed, described, predicted and explained with models.	• Demonstrate their current knowledge of Sun-Earth-Moon System using simple models • Examine the diameters of the Sun, Earth, and Moon, and their relative distances from each other • Compare the relative distances between two objects based on their apparent and true diameters • Design an investigation to gather evidence of the sun's apparent path across the sky • Explain how the moon's appearance changes through a revolution in its orbit from the earth's perspective • Relate the length and angle of shadows to the apparent position of the Sun in the sky • Use a model to describe a scale of the SEM system	From Earth in Space • Reflection Questions • Vocabulary • Formative assessment of moon phases • Student Sheet for calculations • Teacher Observation From Uncovering student ideas in Astronomy • Is the Earth really round? (page 5) • Where do People Live (page 11) • Falling through the Earth (page 15) • Pizza Sun (page 55) • How Far away is the Sun (page 62) • Sizing up the Moon (page 95) Teacher Created: • Group Inquiry Discussion • Collaborative learning rubric • Close Reading • Really? Reading Strategy
DCI: ESS1.B Earth and the Solar System	**Student Learning Objectives**	**Suggested Assessments**
• This model of the solar system can explain eclipses of the sun and moon. Earth's spin axis is fixed in direction over the short term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.	• Model winter and summer shadows and compare the Sun's apparent position in the sky during each season • Simulate Earth's rotation and relate it to the Sun's apparent daily motion across the sky	From Earth in Space • Reflection Questions • Vocabulary • Teacher Observation: Illustrate positions of SEM to explain moon phases, eclipses, seasons

	• Create a working definition for the word "rotation" • Model Earth's orbit • Compare the sunrise and sunset times at different latitudes throughout the year • Relate changes in the apparent height of the Sun and the length of daylight hours to Earth's seasons • Use evidence of global variations in day length to create models that explain seasons • Model and explain how an object's motion from one observer's view may be different from a different observer's view • Demonstrate that the Moon reflects the Sun's light as it orbits Earth • Track, model, and illustrate the phases of the Moon as seen from Earth • Make predictions about the Moon's appearance on the basis of observed patterns • Analyze moonphase data to explain how the relative positions of the Sun-Earth-Moon cause the Moon's appearance to change • Model shadows cast by the Moon and Earth • Predict why an eclipse does not occur every month during a full or new moon • Evaluate the conditions under which the Moon and Earth's shadows cause eclipses • Examine data on eclipses to formulate explanation for frequency and patterns • Describe the phases during which lunar and solar eclipses occur • Demonstrate why an eclipse does not occur every month during a full or new moon • Analyze solar and lunar eclipse data and compare it to phase data	From Uncovering student ideas in Astronomy Pre-Assessment of concepts from grades 3-5 • What causes night and day? (page 21) • The Two Rs (page 27) • Where did the Sun go? (page 33) Pre-Assessment of concepts from grades 3-5 • Shorter Days in Winter Page 69 • Why is it warmer in Summer? Page 79 • Is the Sun a Star? Formative Assessments: • Sunrise to Sunset (page 43) • No Shadow (page 47) • What's moving? (page 51) • Maybe? Shorter days in winter (page 69) Teacher Created: • CER Construct explanations of causes of day/night, moon phases and/or seasons based on new information and evidence collected • Support claim with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topics or text, using credible sources • I2 strategy for data analysis • Group Inquiry Discussion/Collaborative learning rubric • Close Reading • Really? Reading Strategy SEM test, Lunar quiz (brainpop); eclipse quiz (performance and written)

Science and Engineering Practices	Crosscutting Concepts

Warren Township Schools
Science Curriculum

• Developing and Using Models
• Analyzing and Interpreting Data
	• Patterns
	• Scale, Proportions and Quantity
	• Systems and System Models
	
	Connections to Nature of Science
	• Interdependence of Science, Engineering and Technology
	  ○ Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems.
	Connections to Nature of Science
	• Scientific Knowledge Assumes an Order and Consistency in Natural Systems
	  ○ Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1)

Available Resources

Everyday Earth and Space Mysteries Sunrise/Sunset from page 71; Where are the Acorns? page 137
Inquiries: 2.1, 2.2, 3.1, 3.3, 3.4, 4.1, 4.2, 4.3, 5.1, 5.2,
Smartboards: Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6
Textbook Pages: Earth in Space 12-73,
Red Book, Prentice Hall Astronomy
SEM Boards with shadow sticks
Save Fred communication skills
Drawing models
Shadow song
Google Earth day /night map
Globe and flashlight
Video clip: seasons at the poles
Calvin and Hobbes cartoon
Are you smarter than a Harvard graduate?: Private Universe clip
Moon Phase Song
Study Guide for SEM
Scale model using balloons
Spaghetti and meatballs;
Crime and Puzzlement
Shadow photo project
Claim Evidence Reasoning; first attempt; using evidence (candy eating)
http://phet.colorado.edu/en/simulations
https://www.brainpop.com/

Warren Township Schools
Science Curriculum

Unit Summary

Students examine the Earth's place in relation to the solar system, the Milky Way galaxy, and the universe. There is a strong emphasis on a systems approach and using models of the solar system to explain the cyclical patterns of eclipses, tides, and seasons. There is also a strong connection to engineering through the instruments and technologies that have allowed us to explore the objects in our solar system and obtain the data that support the theories explaining the formation and evolution of the universe. The crosscutting concepts of patterns, scale, proportion, and quantity and systems models provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in developing and using models and analyzing and interpreting data. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Prior Knowledge and Skills

- Students will be expected to have a basic understanding of Earth's structure and place in the solar system and the ability to make observations, use measurement tools and keep accurate records.
- Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.
- Seasonal patterns of sunrise and sunset can be observed, described, and predicted.

Anticipated instructional days for unit: 25 days

Technology, Differentiation and Assessment Strategies: https://docs.google.com/document/d/1KITFsbhtE1NLWTV9D2MLB0_MBHYxbq-ISfwl6uBTtic/edit

Warren Township Schools
Science Curriculum

Grade 6
Space Systems

NGSS Performance Expectations

Students who demonstrate understanding can:

MS-ESS1-2 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system

MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system

DCI: ESS1.A: The Universe and Its Stars	**Student Learning Objectives**	**Suggested Assessments**
• Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.	• Students will collaborate in teams to familiarize themselves with the big questions that faced cosmology through the twentieth century • Students will recognize that science is ongoing, with technologies driving new discoveries • Students will discover and trace the broad history of discovery that has led scientists to their current understanding of the nature of the Universe	From Uncovering student ideas in Astronomy Pre-Assessment of concepts from grades 3-5 • Shooting Star, page 185. • Where are the stars? Formative Assessments: • Where are the Stars in Orion? Page 193 • What are Stars Made of? Page 203 • What Happens to Stars when they Die? Page 209 • Do Stars Change? Page 215 • What is the Milky Way? Page 227 • Expanding universe, page 233 • Is the Big Bang “Just a Theory”? Page 239
DCI: ESS1.B: Earth and the Solar system	**Student Learning Objectives**	**Suggested Assessments**
• The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.	• Create a model of the solar system from a set of scaled items • Use scale models to explore the relative diameters of and distances between the nine planets and the Sun • Compare Earth’s size and distance from the Sun relative to other planets	From Uncovering student ideas in Astronomy Pre-Assessment of concepts from grades 3-5 • Shooting Star, page 185. • Where are the stars? Formative Assessments: • How do Planets orbit the sun? Page 153 • Where do you find Gravity? Page 171

Warren Township Schools
Science Curriculum

	• Generalize how size of the planets changes with distance from the Sun • Order the planets in size and distance from the Sun • Classify photographs of planets, moon, and asteroids on the basis of their surface features • Review photos showing planetary surface features on Earth; then consider whether the processes that formed these features exist on other planets and moons • Investigate wind erosion, water erosion, tectonics, and volcanism and their effects • Analyze photographs of planetary surface features and determine how each was formed • Report and describe the tectonic and erosional processes that exist on the inner planets	• Gravity in other planetary systems page 177 Teacher Created: • CER Construct explanations of causes of day/night, moon phases and/or seasons based on new information and evidence collected • Support claim with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topics or text, using credible sources • I2 strategy for data analysis • Group Inquiry Discussion/Collaborative learning rubric • Close Reading • Really? Reading Strategy
• The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them • The solar system appears to have formed from a disk of dust and gas drawn together by gravity	• Analyze patterns in planetary motion • Observe the motion of a marble when acted upon by different forces • Investigate the effect of a pulling force on the orbital period of a sphere • Relate the observed behavior of a marble and sphere to the motion of moons and planets • Predict what would happen to an orbiting object if gravity were increased, decreased or taken away	• Inquiry 15 observations • Inquiry 15 reflection questions • Heavy Thoughts Close Reading • Really? Reading Strategy

Science and Engineering Practices	Crosscutting Concepts
• Developing and Using Models • Analyzing and Interpreting Data	• Scale, Proportions and Quantity • Systems and System Models ***Connections to Engineering, Technology and Applications of Science*** • Interdependence of Science, Engineering and Technology ○ Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries

	○ have led to the development of entire industries and engineered systems. (MS-ESS1-3) ***Connections to Nature of Science*** ● Scientific Knowledge Assumes an Order and Consistency in Natural Systems ○ Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-2)

Available Resources
Inquiries: 11.1, 11.3, 15.1, 15.2, 15.3, 15.4 (Earth in Space)
Smartboards: Lesson 11, Lesson 15
Textbook Pages: (Earth in Space) 146-159, 160-173, 174-17,. 216-243
3D Glasses
Space Encyclopedia, National Geographic Kids
Everyday Earth and Space Mysteries
https://phet.colorado.edu/en/simulation/gravity-force-lab
Red Book, Prentice Hall Astronomy
Starry Night CD-Rom
Materials for Lesson 15
“Heavy Thoughts” pages 226-230
Video Clips, Greatest Discoveries with Bill Nye
http://spaceplace.nasa.gov/lisa-g-waves/en/
http://cosmictimes.gsfc.nasa.gov/teachers/downloads/lessons/all_years/CosmicTimes_Jigsaw.pdf
http://phet.colorado.edu/en/simulations
https://www.brainpop.com/

Unit Summary
In this unit, students investigate the scale of the solar system, an exercise that helps prepare them for understanding phenomena within the system. Students conduct investigations of gravity, orbital motion, and tides that result from gravitational forces. Throughout the unit, students are challenged to model these phenomena and recognize that their models need to be compared with empirical data.

This unit is broken down into three sub-ideas: the universe and its stars, Earth and the solar system, and the history of planet Earth. Students examine the Earth's place in relation to the solar system, the Milky Way galaxy, and the universe. There is a strong emphasis on a systems approach and using models of the solar system to explain the cyclical patterns of eclipses, tides, and seasons. There is also a strong connection to engineering through the instruments and technologies that have allowed us to explore the objects in our solar system and obtain the data that support the theories explaining the formation and evolution of the universe. Students examine geosciences data in order to understand the processes and events in Earth's history. The crosscutting concepts of patterns, scale, proportion, and quantity and systems models provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in developing and using models and analyzing and interpreting data. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Warren Township Schools
Science Curriculum

Prior Knowledge and Skills

- Students will be expected to have a basic understanding of Earth's structure and place in the solar system and the ability to make observations, use measurement tools and keep accurate records.
- Pushes and pulls can have different strengths and directions.
- Pushing or pulling on an object can change the speed or direction of the object's motion and can start or stop it.
- When objects touch or collide, they push on one another and can change motion.
- A bigger push or pull causes things speed up or slow down more quickly.
- Each force acts on one particular object and has both strength and a direction.
- An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object.
- Forces that do not sum to zero can cause changes in the object's speed or direction of motion.
- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it.
- Objects in contact exert forces on each other. Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.

Anticipated instructional days for unit: 25 days

Technology, Differentiation and Assessment Strategies: https://docs.google.com/document/d/1KITFsbhtE1NLWTV9D2MLB0_MBHYxbq-ISfwl6uBTtic/edit

Warren Township Schools
Science Curriculum

Grade 6
History of Earth

NGSS Performance Expectations

Students who demonstrate understanding can:

MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales

MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of past plate motions

MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6 billion-year-old history

DCI: ESS2.A: Earth's Materials and Systems	Student Learning Objectives	Suggested Assessments
• The planet's systems interact over scales that range from microscopic to global in size and they operate over fractions of seconds to billions of years. These interactions have shaped Earth's history and will determine its future.	• Use models to simulate the movement of lithospheric plates as they collide, separate, and slide past each other • Identify movement in the earth's mantle as one cause of plate movement, earthquakes and volcanoes • Review photos of planetary surface features on Earth then consider whether the processes that formed these features exist on other planets and moons	• Teacher Observation • Reflection Questions Teacher Created: • CER Construct explanations of causes of plate tectonics based on new information and evidence collected • Support claim with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topics or text, using credible sources • I2 strategy for data analysis • Group Inquiry Discussion / Collaborative learning rubric • Close Reading • Really? Reading Strategy
DCI: ESS2.B:Plate Tectonics and Large-Scale	Student Learning Objectives	Suggested Assessments

Warren Township Schools
Science Curriculum

System Interactions		
• Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided and spread apart.	• Use a globe and a map to find evidence of plate movement to identify landforms -- such as mid-ocean ridges, mountains and trenches -- that result from plate movement	• Dynamic Earth webquest • Reflection Questions • Support claim with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topics or text, using credible sources • I2 strategy for data analysis • Group Inquiry Discussion / Collaborative learning rubric • Close Reading • Really? Reading Strategy
DCI: ESS1.C: The History of Planet Earth	**Student Learning Objectives**	**Suggested Assessments**
• Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches.	• Describe processes that produce convergent, divergent, and transform plate boundaries	• Dynamic Earth webquest • Support claim with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topics or text, using credible sources • I2 strategy for data analysis • Group Inquiry Discussion / Collaborative learning rubric • Close Reading • Really? Reading Strategy
DCI: ESS1.C:The History of the Planet Earth	**Student Learning Objectives**	**Suggested Assessments**
• The geologic time scale interpreted from rock strata and the fossil record provide only relative dates, not an absolute scale.	• Interpret a model of a rock layer sequence to establish oldest and youngest, geological events and changing life forms	• Pangaea puzzle Teacher Created: • CER Construct explanations of causes of day/night, moon phases and/or seasons based on new information and evidence collected • Support claim with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topics or text, using credible sources • I2 strategy for data analysis • Group Inquiry Discussion / Collaborative learning rubric

Warren Township Schools
Science Curriculum

		• Close Reading • Really? Reading Strategy

Science and Engineering Practices	Crosscutting Concepts
• Constructing Explanations and Designing Solutions • Analyzing and Interpreting Data	• Scale, Proportion and Quantity • Patterns ***Connections to the Nature of Science*** **Scientific Knowledge is Open to Revision in Light of New Evidence** • Science findings are frequently revised and/or reinterpreted based on new evidence.

Available Resources
Textbook Pages:Lesson 15 Catastrophic Events
Inquiries: 15.1, 15.2, 15.3, 15.4
Smartboards: Lesson 15
Explorelearning Plate tectonics:
Dynamic Earth
http://phet.colorado.edu/en/simulations
https://www.brainpop.com/
Gondawana land posters (1 to share for all classes)
Explorelearning Building Pangaea gizmo: Use evidence from fossils, rocks, and glaciers to refine your map.
Glencoe virtual lab, how are materials from the Earth broken down?
Geologists reconstruct the order in which layers were deposited by their relative position (which ones are on top of which). We call this a "relative dating" because we don't know the exact date and time of the event, but only what happened before or after it.
Sedimentary puzzle

Unit Summary

In this unit, students will look for patterns in earthquake data. Plate motion and the structure of earth are introduced in the context of plate tectonics, and students use engaging hands-on activities to examine the earth's internal structure and investigate the interactions between plates and the movement along faults as a cause of earthquakes. Students use computer simulations to move the Earth's crust at various locations to observe the effects of the motion of the tectonic plates, including volcanic eruption and create understandings about the major types of plate boundaries and their locations on Earth. Students examine geoscience data in order to understand processes and events in Earth's history. Important crosscutting concepts in this unit are scale, proportion, and quantity, stability and change, and patterns in relation to the different ways geologic processes operate over geologic time. An important aspect of the history of Earth is that geologic events and conditions have affected the evolution of life, but different life forms have also played important roles in altering Earth's systems.

Warren Township Schools
Science Curriculum

In this unit, students are introduced to the concepts of geologic time. Using the arrangement of index fossils and rock layers, students will determine the geologic history of a region. Students will learn how rocks are formed, weathered, eroded, and reformed as they move from Earth's surface to locations deep within the crust. The world is full of cycles in which materials are formed, transformed, and then broken down again to be reused. These include the carbon cycle, the nitrogen cycle, the water cycle, and the rock cycle.

Prior Knowledge and Skills

- Students will be expected to have a basic understanding of Earth's structure, geology and geography and the ability to make observations, use measurement tools and keep accurate records.
- The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water feature areas of Earth.

Anticipated instructional days for unit: 24 days

Technology, Differentiation and Assessment Strategies: https://docs.google.com/document/d/1KITFsbhtE1NLWTV9D2MLB0_MBHYxbq-ISfwl6uBTtic/edit

Warren Township Schools
Science Curriculum

Grade 6
Earth Systems

NGSS Performance Expectations

Students who demonstrate understanding can:

MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process

MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by energy from the Sun and the force of gravity.

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

DCI: ESS2.A: Earth's Materials and Systems	**Student Learning Objectives**	**Suggested Assessments**
• All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the Sun and Earth's hot interior. The energy that flows and matter that cycles produces chemical and physical changes in Earth's materials and living organisms.	• Use a flow indicator to model convection currents in the mantle • Identify movement in the earth's mantle as one cause of plate movement, earthquakes, and volcanoes • Explain how convection currents in the air create sea breezes and land breezes • Relate the movement of energy within a convection model to the formation of land breezes, sea breezes and tornadoes	From our team • CER Construct explanations of causes of convection based on new information and evidence collected • Support claim with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topics or text, using credible sources • I2 strategy for data analysis • Group Inquiry Discussion / Collaborative learning rubric • Close Reading • Really? Reading Strategy • Explanation CER
DCI: ESS2.C: The Roles of Water in Earth's Surface Processes	**Student Learning Objectives**	**Suggested Assessments**
• Water's movements -- both on the land and underground -- cause weathering and erosion,	• Investigate the effects of water erosion • Analyze photographs of planetary surface	Teacher Created:

Warren Township Schools
Science Curriculum

which change the land's surface features and create underground formations. ● Global movements of water and its changes in form are propelled by sunlight and gravity	features and determine how each was formed ● Draw a model of the rock cycle that demonstrates the mechanisms behind how each family of rock can eventually become a different kind of rock ● Examine the mechanisms that drive erosion	● CER Construct explanations of causes of landforms based on new information and evidence collected ● Support claim with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topics or text, using credible sources ● I2 strategy for data analysis ● Group Inquiry Discussion / Collaborative learning rubric ● Close Reading ● Really? Reading Strategy ● Explanation CER
DCI: ESS3.A: Natural Resources	**Student Learning Objectives**	**Suggested Assessments**
● Humans depend on Earth's land, ocean, atmosphere and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.	● Model and explain how extraction of resources and restoration of environment are factors in mining	● Group Inquiry Discussion / Collaborative learning rubric

Science and Engineering Practices	Crosscutting Concepts
● Developing and using models ● Constructing Explanations and designing solutions	● Cause and Effect ● Stability and Change ● Energy and Matter Connections to Engineering, Technology and Applications of Science ○ Influence of Engineering, Technology and Science on Society and the Natural World ■ All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative for the health of people and the natural environment.

Warren Township Schools
Science Curriculum

Available Resources (Catastrophic Events)
Inquiries: 16.1; 5.1
Smartboards: Lesson 16; Lesson 5
Textbook Pages: Lesson 16; Lesson 5
Explorelearning Gizmo Rock cycle: Play the role of a piece of rock moving through the rock cycle
http://phet.colorado.edu/en/simulations
https://www.brainpop.com/

Unit Summary

Students understand how Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems. Students investigate the controlling properties of important materials and construct explanations based on the analysis of real geoscience data. Students are expected to demonstrate proficiency in analyzing and interpreting data and constructing explanations. They are also expected to use these practices to demonstrate understanding of the core idea.

Prior Knowledge and Skills
Students will be expected to have a basic understanding of Earth's surface and the ability to make observations, use measurement tools and keep accurate records.

Anticipated instructional days for unit: 6 days
Technology, Differentiation and Assessment Strategies: https://docs.google.com/document/d/1KITFsbhtE1NLWTV9D2MLB0_MBHYxbq-ISfwl6uBTtic/edit

Grade 6
Weather and Climate

NGSS Performance Expectations

Students who demonstrate understanding can:

MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Warren Township Schools
Science Curriculum

DCI: ESS2.C: The Roles of Water in Earth's Surface Processes	Student Learning Objectives	Suggested Assessments
• The complex patterns of the changes and movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. • Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.	• Examine a diagram of water and cycle, label and explain the transfer of energy • Investigate the effect of heat energy on the way the water moves • Create a working definition for the word "vortex" • Control the path of a drop of water as it travels through the water cycle. Many alternatives are presented at each stage. Determine how the water moves from one location to another, and learn how water resources are distributed in these location	water cycle form/quiz storm webquest weatherbug quick quiz Teacher Created: • CER Construct explanations of causes of storms based on new information and evidence collected • Support claim with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topics or text, using credible sources • I2 strategy for data analysis • Group Inquiry Discussion / Collaborative learning rubric • Close Reading • Really? Reading Strategy
DCI: ESS2.D: Weather and Climate	**Student Learning Objectives**	**Suggested Assessments**

Warren Township Schools
Science Curriculum

• Weather and Climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. • Because these patterns are so complex, weather can only be predicted probabilistically. • The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time and globally redistributing it through ocean currents.	• Observe and describe the effect of surface temperature on the movement of air above the surface • Explain what happens to energy from the sun when it reaches the earth • Relate the movement of energy within a convection model to the formation of land breezes, sea breezes and tornadoes • Identify the characteristics of air masses over bodies of water and land • Label global winds on a map and explain how the westerlies affect weather in NJ • Identify the characteristics of air masses over bodies of water and land • Develop definition of the term “stable air mass” and “unstable air mass” • Investigate the effect of wind on surface currents • Locate some of the major ocean currents • Illustrate ocean currents on a map and analyze how they affect climate • Model and describe how water evaporates and condenses and how these processes play a part in cloud formation • Model and describe the air pressure conditions under which clouds form • Investigate what happens to two air masses when they meet • Analyze the movement of two converging air masses with different temperature and humidity conditions • Relate the movement of energy within a convection model to the formation of land breezes, sea breezes and tornadoes • Explain how winds form • Explain how convection currents in the air create sea and land breezes • Investigate the effect of surface temperature of the air above the surface • Observe daily weather conditions in a coastal region. Measure temperatures and wind speeds at any location and use this	Teacher Created: • CER Construct explanations of causes of ocean currents based on new information and evidence collected • Support claim with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topics or text, using credible sources • I2 strategy for data analysis • Group Inquiry Discussion / Collaborative learning rubric • Close Reading • Really? Reading Strategy

Warren Township Schools
Science Curriculum

	data to map convection currents that form during the day and night. Explain the origin of land breezes and sea breezes	
DCI: ESS3.D: Global Climate Change	**Student Learning Objectives**	**Suggested Assessments**
• Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding human behavior, and on applying that knowledge wisely in decisions and activities.	• Compare the atmosphere of Venus, Earth and Mars • Analyze the causes of changes in the Earth's atmosphere • Ask questions about proposed solutions • Use a model to explore how much emissions might need to be decreased to stop further warming	• Group Inquiry Discussion / Collaborative learning rubric

Science and Engineering Practices	Crosscutting Concepts
• Planning and carrying out investigations • Developing and using models • Asking questions and defining problems	• Cause and Effect • Systems and System Models • Stability and change

Available Resources
Inquiries: 3.1, 4.1, 4.2, 5.1, 6.1, 7.1
Smartboards: Lesson 3, 4, 5, 6, 7,
Textbook Pages: Catastrophic Events Lesson 3, 4, 5, 6, 7 SG p.26-41, p.42-53 p. 54-67; p.68-79; p. 81-90
Water bin from Inquiry 13.1 in Earth in Space
Clever Catch Weather Ball
Red book Weather and Climate "*Water in the Atmosphere"* pages 55-65
Weather at 5 Forecasting video
"The Truth About Air" on pages 76-77
Video Clip, Understanding Weather
Red Book, Weather and Climate *"Heat Transfer"*
"*Weather Fronts*" on page 63
"*Trouble in Tornado Alley*" on pages 64-67

Warren Township Schools
Science Curriculum

Explorelearning Gizmo: Water Cycle and phases of water
Explorelearning Gizmo: sea breezes
http://phet.colorado.edu/en/simulations
https://www.brainpop.com/

Unit Summary

Students start by sharing what they already know about natural catastrophic events and list questions they have about them. The weather and climate unit is based on the principle that the earth is a complex system with interrelated components of earth, air, water, and organisms that affect the whole. Atmospheric events and ocean processes have a dramatic impact on earth's surfaces and inhabitants. Students will experiment with factors that determine daily weather and influences that produce different climate zones and climate changes. Students will investigate heat and the natural processes that underlie storms. Students will investigate, graph, analyze, and manipulate variables to understand airflow. Students will then use what they have learned and apply it to a more global investigation as they apply their observations to weather maps and draw conclusions about the conditions under which clouds and storms form and move. The first part ends with students investigating ocean currents and their effect on global weather patterns.

Students will make sense of how Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems. A systems approach is also important here, examining the feedbacks between systems as energy from the Sun is transferred between systems and circulates through the ocean and atmosphere. The crosscutting concepts of cause and effect, systems and system models, and energy and matter are called out as frameworks for understanding the disciplinary core ideas. In this unit, students are expected to demonstrate proficiency in developing and using models and planning and carrying out investigations as they make sense of the disciplinary core ideas. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Prior Knowledge and Skills

- Students will be expected to have a basic understanding of Earth's structure and place in the solar system and the ability to make observations, use measurement tools and keep accurate records.
- Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.
- Maps show where things are located. One can map the shapes and kinds of land and water in any area.
- Wind and water can change the shape of the land.
- Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.
- Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.
- Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.
- Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

Anticipated instructional days for unit: 19 days

Technology, Differentiation and Assessment Strategies: https://docs.google.com/document/d/1KITFsbhtE1NLWTV9D2MLB0_MBHYxbq-ISfwl6uBTtic/edit

Warren Township Schools
Science Curriculum

Grade 6
Human Impacts

NGSS Performance Expectations

Students who demonstrate understanding can:

MS-ESS3-2. **Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects**

MS-ESS3-3 **Apply scientific principles to design a method of monitoring and minimizing a human impact on the environment**

MS-ESS3-4. **Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's Systems**

DCI: ESS3.B: Natural Hazards	Student Learning Objectives	Suggested Assessments
• Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces, can help forecast the locations and likelihoods of future events.	• Locate areas where most earthquakes • occur • Plot the locations of volcanoes around the world • Form an argument about the safest places to live	• Group Inquiry Discussion / Collaborative learning rubric • CER Construct explanations of causes of earthquakes based on new information and evidence collected • Support claim with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topics or text, using credible sources

Warren Township Schools
Science Curriculum

		• I2 strategy for data analysis
DCI: ESS3.C: Human Impacts on Earth Systems	**Student Learning Objectives**	**Suggested Assessments**
• Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. Changes to Earth's environments can have different impacts (negative and positive) for different living things.	• Locate areas where most hurricanes occur • Analyze the effects of rising sea levels • Investigate the effects of different environmental and structural factors on a building's ability to withstand an earthquake	• CER Construct explanations of hurricane frequency and strength based on new information and evidence collected • Group Inquiry Discussion / Collaborative learning rubric
• Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	• Analyze how competition for natural resources affects the quantity and quality of resources available	• Group Inquiry Discussion / Collaborative learning rubric

Science and Engineering Practices	Crosscutting Concepts
• Analyzing and Interpreting Data • Constructing Explanations and Designing Solutions • Engaging in Argument from Evidence	• Patterns • Cause and Effect Connections to Engineering, Technology and Applications of Science • Influence of Science, Engineering and Technology on Society and the Natural World ○ All human activity draws on natural resources and has both short and long term consequences, positive as well as negative, for the health of people and the natural environment. ○ The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors such as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. Connections to Nature of Science • Science addresses questions about the Natural world ○ Scientific knowledge can describe the consequences of

	actions but does not necessarily prescribe the decisions that society takes.

Available Resources

Concord, https://concord.org/stem-resources/what-future-earths-climate
Modeling Earth's Climate http://static.nsta.org/files/tst1207_38.pdf
Explore Learning Gizmo Greenhouse effect:
NYTimes safest places to live
Quake It, Don't Shake It,
http://phet.colorado.edu/en/simulations
https://www.brainpop.com/

Unit Summary

Students construct an understanding of the ways that human activities affect Earth's systems. Students use practices to understand the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts on the development of these resources. Students also understand that the distribution of these resources is uneven due to past and current geosciences processes or removal by humans. The crosscutting concepts of patterns, cause and effect, and stability and change are called out as organizing concepts for these disciplinary core ideas. In this unit of study students are expected to demonstrate proficiency in asking questions, analyzing and interpreting data, constructing explanations, and designing solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas. Students analyze and interpret data and design solutions to build on their understanding of the ways that human activities affect Earth's systems. The emphasis of this unit is the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts of these uses. The crosscutting concepts of cause and effect and the influence of science, engineering, and technology on society and the natural world are called out as organizing concepts for these disciplinary core ideas.

In Quake It, Don't Shake It students investigate the effects of different environmental and structural factors on a building's ability to withstand an earthquake. The lab encourages students to think about earthquakes and earthquake preparation, and can serve as a springboard for a discussion of earthquake magnitude and intensity, seismic waves, and aspects of civil engineering related to earthquake-proofing. Students define a problem by precisely specifying criteria and constraints for solutions as well as potential impacts on society and the natural environment; systematically evaluate alternative solutions; analyze data from tests of different solutions; combining the best ideas into an improved solution; and develop and iteratively test and improve their model to reach an optimal solution. In this unit of study students are expected to demonstrate proficiency in analyzing and interpreting data and designing solutions.

This unit culminates in a research project that focuses on the risks associated with catastrophic events from social and personal perspectives. Students work in groups to gather information about a particular event, organize their findings, and present to the class at the end of the module. Groups examine the impact on society and individuals, and the lessons that people have learned from the event that can help reduce the risks associated with similar events in the future. Students are encouraged to use a variety of print, audiovisual, and on-line resources in their research.

Prior Knowledge and Skills
Students will be expected to have a basic understanding of Earth's surface and the ability to make observations, use measurement tools and keep accurate records.

Anticipated instructional days for unit: 25 days

Technology, Differentiation and Assessment Strategies: https://docs.google.com/document/d/1KITFsbhtE1NLWTV9D2MLB0_MBHYxbq-ISfwl6uBTtic/edit

Warren Township Schools
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Grade 6
Engineering Design

NGSS Performance Expectations

Students who demonstrate understanding can:

MS-ETS1-1 **Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**

MS-ETS1-2. **Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**

MS-ETS1-3 **Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**

MS-ETS1-4. **Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**

ETS1.A **Defining and Delimiting Engineering Problems**	**Student Learning Objectives**	**Suggested Assessments**
• The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.	• Describe everyday examples of ways people try to cause or prevent heating and cooling by conduction, convection and radiation • Give examples of materials that serve well for mechanisms of conduction, convection and radiation	• Have each group make a brief class presentation, presenting data graphs and summarizing the performances of their warming and cooling devices. Require the presentations to indicate the temperature gains/losses compared to the control cans, explain the design decisions made in the creation of their warming and cooling devices or arrangements, and explain how they tried to take advantage of conduction, convection and radiation, or how they tried to nullify them. • The performance of the devices or situations students design in order to keep one can of water warm while cooling the

		other can of water provides a means of assessing their abilities to understand and apply the ideas of conduction, convection and radiation. If the water in a team's "warm" can did not stay several degrees warmer than the water in the control cans, or if the water in their "cool" can did not reach a temperature several degrees lower than that of the control can, the students involved might benefit from further discussion of the concepts and how they can be applied to practical problems.
ETS1.B Developing Possible Solutions	**Student Learning Objectives**	**Suggested Assessments**
• A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. • Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. • Models of all kinds are important for testing solutions.	• Research and construct a passive solar home model which uses energy in the most efficient way and present their design to their peers	**Rubric**
ETS1.C Optimizing the Design Solutions	**Student Learning Objectives**	**Suggested Assessments**
• Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. • The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.	• Evaluate the passive solar home models of your own team and others	**Rubric**

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Science and Engineering Practices	Crosscutting Concepts

• Asking Questions and Defining Problems.
• Developing and Using Models
• Analyzing and Interpreting Data
• Engaging in Argument from Evidence
	• Influence of Science, Engineering and Technology on Society and the Natural World
	  ○ All human activity draws on natural resources and has both short and long term consequences, positive as well as negative, for the health of people and the natural environment.
	  ○ The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors such as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.

Available Resources

Hot can Cold can
Solar house

Unit Summary
Students apply the concepts of conduction, convection and radiation as they work in teams to solve two challenges. One problem requires that they maintain the warm temperature of one soda can filled with water at approximately human body temperature, and the other problem is to cause an identical soda can of warm water to cool as much as possible during the same 30-minute time period. Students design their engineering solutions using only common everyday materials, and test their devices by recording the water temperatures in their two soda cans every five minutes.

Prior Knowledge and Skills
- A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions.
- Asking questions, making observations, and gathering information are helpful in thinking about problems.
- Before beginning to design a solution, it is important to clearly understand the problem.
- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.
- Because there is always more than one possible solution to a problem, it is useful to compare and test designs
- People also use a variety of devices to communicate (send and receive information) over long distances.

Anticipated instructional days for unit: 25 days

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