Fairfield Public Schools
Science Curriculum

Draft Units

Grade 6

Grade 6 Science: Description

Grade 6 Science is the study of Earth Science. It is concerned with the relationship between Earth's systems and all living things. An understanding of these concepts is essential for individuals to make informed choices with regard to the environment and advancing scientific technology. Some of the topics covered are: Space Systems, Earth's Systems, Weather & Climate, and Human Impact.

Standards for this course are taken from the *Next Generation Science Standards* and are of three types:

Disciplinary Core Ideas(DCI): Shown as content objectives, these standards define what students should know about the most essential ideas in the major science disciplines. The focus is on a limited number of core ideas in science and engineering both within and across the disciplines to avoid the shallow coverage of a large number of topics and to allow more time for teachers and students to explore each idea in greater depth. The reduction of the sheer sum of details to be mastered is intended to give time for students to engage in scientific investigations and argumentation and to achieve depth of understanding of the core ideas presented.

Science and Engineering Practices(SEP): These standards enable students to apply the content in the DCI's and the skills of practicing scientists and engineers to explain phenomena and solve real world problems. Engaging in the practices of science helps students understand how scientific knowledge develops; such direct involvement gives them an appreciation of the wide range of approaches that are used to investigate, model, and explain the world. Engaging in the practices of engineering likewise helps students understand the work of engineers, as well as the links between engineering and science.

Cross-cutting Concepts(CCC): These standards provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. These broad concepts tie together the influence of engineering, technology, and science on society and the natural world.

http://www.nextgenscience.org/next-generation-science-standards

Grade 6 Science: Overview

Course Essential Questions
● How do scientists use scientific inquiry in search for knowledge? ● What is the Earth's role in the solar system and universe? ● What evidence do we have about the history of the Earth? ● How do Earth's major systems interact? ● How and why is Earth constantly changing? ● What impacts do humans have on the Earth? ● How is the engineering process used to develop questions and solutions to problems?

Course: Year-at-a Glance

Unit	Title	Unit Essential Questions
Intro	Scientific Inquiry	● How do scientists use scientific inquiry in search of knowledge?
1	Space Systems	● How does gravity affect our solar system and the universe? ● What processes and information do scientists use to determine the size and distances of things in our solar system? ● What causes the patterns we see on Earth – lunar, seasons, and eclipses?
2	History of Earth	● What evidence do we have to explain how processes inside and outside the Earth have changed it over time? ● How can we use that evidence to support our hypotheses about the Earth's 4.6 billion year old history?
3	Earth's Systems	● Why are Earth's resources distributed differently around the world? ● Why do some parts of the world have more water than others?
4	Weather and Climate	● How do the properties and movements of water shape Earth's surface and affect its systems? ● What regulates weather and climate?
5	Human Impacts	● How can we use the information we have to develop ways to predict future catastrophes and to help mitigate them? ● How can we minimize the negative impacts to the Earth as we use the natural resources that we need? ● Why do engineers use more than one possible solution and how do they evaluate which is best?

CROSS CUTTING CONCEPTS

Patterns: Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

Cause and effect: Mechanism and explanation. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.

Scale, proportion, and quantity. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.

Systems and system models. Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.

Energy and matter: Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

Structure and function. The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

Stability and change. For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Space Systems

Overview

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. Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. Earth and its solar system are part of the Milky Way Galaxy, which is one of many galaxies in the universe. This model of the solar system can explain eclipses of the sun and the 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.

Unit Content Objectives

At the conclusion of this unit, students will be able to:

- Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
- Develop and use a model to describe the role of gravity in the motions (movement) within galaxies and the solar system.
- Analyze and interpret data to determine scale properties of objects in the solar system.

Unit Essential Questions

- How does gravity affect our solar system and the universe?
- What processes and information do scientists use to determine the size and distances of things in our solar system?
- What causes the patterns we see on Earth – lunar, seasons, and eclipses?

Crosscutting Concepts

- Patterns
- Scale, Proportion, and Quantity
- Systems and System Models

NGSS Unit Standards

DISCIPLINARY CORE IDEAS (DCI):

ESS1.A: The Universe and Its Stars

♣ Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1)

♣ Earth and its solar system are part of the Milky Way Galaxy, which is one of many galaxies in the universe. (MS-ESS1-2)

ESS1.B: Earth and the Solar System

♣ 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. (MS-ESS1- 2),(MS-ESS1-3)

♣ This model of the solar system can explain eclipses of the sun and the 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. (MS-ESS1- 1)

♣ The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)

SCIENCE AND ENGINEERING PRACTICES (SEP):

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- ♣ Develop and use a model to describe phenomena. (MS-ESS1-1),(MS-ESS1-2)

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

♣ Analyze and interpret data to determine similarities and differences in findings. (MSESS1-3)

Corresponding CT Core Standards:

ELA/Literacy – RST.6-8.1, RST 6.8.7, SL 8.5

Mathematics –MP.2, MP.4, 6.RPA.1. 7.RPA.26.EE.B.6, 7.EE.B.4

History of Earth

Overview
The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. 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. Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations

Unit Content Objectives
At the conclusion of this unit, students will be able to: ● 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. ● Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. ● Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. ● Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Unit Essential Questions
● What evidence do we have to explain how processes inside and outside the Earth have changed it over time? ● How can we use that evidence to support our hypotheses about the Earth's 4.6 billion year old history?

Crosscutting Concepts
● Patterns

- Scale Proportion and Quantity

NGSS Unit Standards

DISCIPLINARY CORE IDEAS (DCI):

ESS1.C: The History of Planet Earth

♣ The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1- 4)

♣ Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C GBE) (secondary to MS-ESS2-3)

ESS2.A: Earth's Materials and Systems

♣ The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2)

ESS2.B: Plate Tectonics and Large-Scale System Interactions

♣ Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)

ESS2.C: The Roles of Water in Earth's Surface Processes

♣ Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. (MS-ESS2-2)

SCIENCE AND ENGINEERING PRACTICES (SEP):

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

♣ Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

♣ Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MSESS1-4),(MS-ESS2-2)

Corresponding CT Core Standards:
ELA/Literacy – RST.6-8.1, RST 6-8.2, RST 6.8.7, WHST 6-8.2, SL 8.5
Mathematics –MP.2, 6.EE.B.6, 7.EE.B.4

Earth's Systems

Overview

All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. 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. Global movements of water and its changes in form are propelled by sunlight and gravity.

Unit Content Objectives

At the conclusion of this unit, students will be able to:

- Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- 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.

Unit Essential Questions

- Why are Earth's resources distributed differently around the world?
- Why do some parts of the world have more water than others?

Crosscutting Concepts

- Cause and Effect
- Energy And Matter

- Stability and Change

NGSS Unit Standards

DISCIPLINARY CORE IDEAS (DCI):

ESS3.B: Natural Hazards

♣ Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS-ESS3-2)

ESS3.C: Human Impacts on Earth Systems

♣ Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3)

♣ 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. (MSESS3-3),(MS-ESS3-4)

SCIENCE AND ENGINEERING PRACTICES (SEP):

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

χ Develop and use a model to describe phenomena. (MS-ESS2-1)

χ Develop a model to describe unobservable mechanisms. (MS-ESS2-4)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

χ Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS3-1)

Corresponding CT Core Standards:

ELA/Literacy – RST.6-8.1, WHST.6-8.9, WHST.6-8.2, SL.8.5

Mathematics –6.EE.B.6, 7.EE.B.4

Weather and Climate

Overview

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. These patterns are so complex, that weather can only be predicted using probabilities.

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. Greenhouse gases in the atmosphere absorb and retain the energy radiated from land and ocean surfaces, thereby regulating Earth's average surface temperature and keeping it habitable.

Unit Content Objectives

At the conclusion of this unit, students will be able to:

- Collect data to provide evidence for how the motion and complex interactions of air masses results in changes in weather conditions.
- 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.
- Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Unit Essential Questions

- How do the properties and movements of water shape Earth's surface and affect its systems?
- What regulates weather and climate?

Crosscutting Concepts

- Cause and Effect
- Systems and System Models
- Stability and Change

NGSS Unit Standards

DISCIPLINARY CORE IDEAS (DCI):

ESS2.C: The Roles of Water in Earth's Surface Processes

χ The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5)

χ Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2- 6)

ESS2.D: Weather and Climate

χ 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. (MS-ESS2-6)

χ Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)

χ 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. (MS-ESS2-6)

ESS3.D: Global Climate Change

χ 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 of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)

SCIENCE AND ENGINEERING PRACTICES (SEP):

Asking Questions and Defining Problems

Asking questions and defining problems in 6–8 builds on K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.

χ Ask questions to identify and clarify evidence of an argument. (MS-ESS3-5)

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

χ Develop and use a model to describe phenomena. (MSESS2-6)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.

χ Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5)

Corresponding CT Core Standards:

ELA/Literacy – RST.6-8.1, RST.6-8.9, WHST.6-8.8, SL.8.5

Mathematics – MP.2, 6NS.C.5, 6.EE.B.6, 7.EE.B.4

Human Impacts

Overview

Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. However, changes to Earth's environments can have different impacts (negative and positive) for different living things. 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. 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.

Unit Content Objectives

At the conclusion of this unit, students will be able to:

- Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
- Develop a model to generate data for iterative (repeated) testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Unit Essential Questions

- How can we use the information we have to develop ways to predict future catastrophes and help to mitigate them?
- How can we minimize the negative impacts to the Earth as we use the resources that we need?
- Why do engineers use more than one possible solution and how do they evaluate which is best?

Crosscutting Concepts

- Patterns
- Cause and Effect

NGSS Unit Standards

DISCIPLINARY CORE IDEAS (DCI):

ESS1.A: The Universe and Its Stars

♣ Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1)

♣ Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2)

ESS1.B: Earth and the Solar System

♣ 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. (MS-ESS1- 2),(MS-ESS1-3)

♣ This model of the solar system can explain eclipses of the sun and the 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. (MS-ESS1- 1)

♣ The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)

SCIENCE AND ENGINEERING PRACTICES (SEP):

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

χ Analyze and interpret data to determine similarities and differences in findings. (MSESS3-2)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

χ Apply scientific principles to design an object, tool, process or system. (MS-ESS3-3)

Engaging in Argument from Evidence

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

χ Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-ESS3-4)

Corresponding CT Core Standards:
ELA/Literacy – RST.6-8.1, RST 6.8.7, WHST 6-8.1, WHST 6-8.7, WHST 6-8.8, WHST6-8.9
Mathematics –MP.2, 6.RPA.1. 7.RPA.2, 6.EE.B.6, 7.EE.B.4