Earth Science (4807) Course Overview Curriculum Document

Course Description

This full-year course introduces students to the study of Earth and its place in the universe. The course leads students toward a clear understanding of the inner workings of Earth's systems by examining the relationships between geology, oceanography, meteorology, and astronomy. As students refine and expand their understanding of Earth science, they will apply their knowledge in investigations that require them to ask questions and explore the world around them. Throughout the course, students will also solve problems, reason abstractly, and learn to think critically.

Credits	Prerequisites
1	None
Board Approved	**Revised**
November 2019	August 2022

Required Assessments

District-wide, standards-based common summative assessments

Textbooks/Resources

Heithaus, M. R., & Passow, M. J. (2018). *HMH Science Dimensions Earth & Space Science*. Orlando, FL: Houghton Mifflin Harcourt Publishing Company. ISBN: 978-0-544-86181-7

Course Essential Understandings

As a result of successfully completing this course, students will understand that:

- Models derived from cosmic background radiation and observations of star and galaxy movement have led to the current understanding of the universe's origin.
- The analysis of models and interpretation of data has been used to explain celestial phenomena throughout history
- Rock and fossil observations in combination with radioactive dating techniques have been used to construct a geologic time scale.
- Various lines of evidence can be used to develop a model of the Earth's interior, an understanding of Earth's internal processes, and how this evidence explains the movement of the continental plates.
- Earth's systems are connected by investigating the rock and water cycles and how these cycles affect erosional processes.
- Salinity, temperature, and density drive ocean circulation which results in climate modification and bioproductivity.
- There is a fundamental difference between weather and climate. By observing air mass and pressure system models and data students will learn how the interplay between atmospheric variables contributes to weather events.

Course Relevance Questions

- What is the Universe and what is Earth's place in it?
- How do interactions between the Earth's lithosphere, atmosphere, biosphere and hydrosphere lead to changes on Earth's surface that support the environments we live in?

Unit Overviews

Unit Name	Unit Description	Unit Relevance Question	Instructional Standards	Assessed Standards
Unit #1 - Origin of the Universe	The Big Bang theory encompasses our current understanding of the origin of the universe. This theory, widely supported by scientists, states that all of the matter that formed Earth, all of the materials that formed the stars and galaxies, and all of the building blocks for everything in the Universe were once contained in a tiny singularity. Through observations and analysis of models, in this unit students will develop an understanding of evidence (cosmic background radiation and red shift) that has led scientists to their current understanding of the universe's origin. Students will also use models to construct their own understanding of the patterns and relationships we observe in the cosmos. Students will also be able to communicate scientific ideas about how stars, over their life cycle, produce elements and how composition and initial mass relate to the process of stellar evolution.	• How do astronomers interpret lines of evidence to support a theory that explains the formation and history of the universe? • How do scientists study objects in space that are at vast distances from Earth? • What types of evidence enable scientists to make inferences about the sizes, temperatures and distances of stars? • How are scientific inquiry and engineering design interrelated in the field of astronomy? • How might new instruments and tools help astronomers expand their knowledge of the universe? • How do composition and size determine the evolutionary sequence of a star?	HS-ESS1-1, SEP 1, SEP 2, CC 3; HS-ESS1-2, SEP 6, CC 5; HS-ESS1-3, SEP 6, SEP 7, SEP 8, CC 5	HS-ESS1-1, SEP 1, SEP 2, CC 3; HS-ESS1-2, SEP 6, CC 5; HS-ESS1-3, SEP 6, SEP 7, SEP 8, CC 5
Unit #2 - Our Solar System & Earth-Sun-Moon Relationships	What humans see and experience from Earth is largely explained by the Earth's relative motion and position. Throughout human history, our models of celestial phenomena have evolved substantially based on our collective observations and interpretations. Great thinkers such as Galileo, Copernicus, Kepler and Newton have used models as a way to demonstrate their understanding of what we observe from Earth and promote discussion about our Earth's position and motion relative to the rest of our solar system and the universe. In this unit, students will explore simulators, 3D models,	• How can we use our understanding of physical laws and the behavior of objects to understand Earth's formation and history in the solar system? • How do planets form? • What are the characteristics of Earth-like planets?	HS-ESS1-4, SEP 5, C 3; HS-ESS1-6, SEP 6, CC 7 HS-ESS2-4, SEP 2, CC 2	HS-ESS1-4, SEP 5, C 3; HS-ESS1-6, SEP 6, CC 7 HS-ESS2-4, SEP 2, CC 2

	and data in order to develop an understanding of celestial phenomena. Students will use models to construct their own understanding of how the Sun and the rest of our solar system was formed and properties of celestial objects. Students will then use their understanding to create models that help explain concepts such as the apparent path of constellations and the Sun, seasons, and the phases of the Moon.	• What is the relationship between the sun, moon and the Earth? • How do objects in the solar system move?		
Unit #3 - Geologic History	The Earth's geologic time scale tells a story about the inception of life and the rise and fall of species, showing life is fragile in the face of gradual and sudden changes to the environment. In this unit, students will learn how rock and fossil observations in combination with radioactive dating techniques have been used to construct a geologic time scale.	• What evidence do scientists use to learn about geologic and evolutionary events in Earth's history ? • What are some of the major geologic and evolutionary events that have taken place throughout Earth's history? • How old is the Earth?	HS-ESS1-6, SEP 6, CC 7; HS-ESS2-7, SEP 7, CC 7	HS-ESS1-6, SEP 6, CC 7; HS-ESS2-7, SEP 7, CC 7
Unit #4 - Earth's Processes and Landforms	Examining the relationship between the Earth's interior and exterior systems is a key part of understanding how the Earth has developed over its history. Students will begin to make connections as they gather evidence to develop a model of the Earth's interior, its internal processes, and resulting continental plate movements. Understanding the Earth's internal structure and processes will allow students to explain the occurrence of earthquakes and formation of surface features such as young mountains and volcanoes. Students will continue developing the skill of writing explanations when they assemble evidence from the unit to explain how and why the continents moved over time.	• How do we know the structure of Earth's interior? • What evidence supports the claim that Earth's surface is made up of slabs of rock that are moving relative to each other? • How does the flow of energy from Earth's interior affect its surface? • How do plate motions affect people? • What geologic landforms are associated with various plate boundaries?	HS-ESS1-5, SEP 7 CC 1 HS-ESS2-1, SEP 2 CC 7 HS-ESS2-3, SEP 2 CC 5 HS-ESS3-1 , SEP 6 CC 2	HS-ESS1-5, SEP 7 CC 1 HS-ESS2-1, SEP 2 CC 7 HS-ESS2-3, SEP 2 CC 5 HS-ESS3-1 , SEP 6 CC 2
Unit #5 - Deposition and Erosion	For nearly five billion years, the Earth's surface has been constantly built up and broken down by processes taking place above and below the Earth's surface, resulting in the wide range of beautiful and complex landscapes we see today. In this unit, students will continue to make connections between the Earth's systems when they study interactions between the lithosphere, atmosphere, hydrosphere, and biosphere by investigating the rock cycle, water cycle and the erosional processes of streams, wind, and mass movement.	• How do scientists study the interactions and flow of matter and energy within and between Earth's spheres? • What are the primary characteristics used to distinguish minerals? • What mineral and rock sources may be economical for mining? • What processes change rock from one type to another? In what ways do these processes involve inputs and outputs of matter and energy? • How do Earth's external and internal processes affect features on Earth's surface? • What processes lead to the development of different landscape features, such as coasts, margins and basins?	HS-ESS2-2, SEP 4 CC 7 HS-ESS2-5, SEP 3, CC 6; HS-ESS3-2, SEP 7, CC 1 HS-ESS3-1 , SEP 6 CC 2	HS-ESS2-2, SEP 4 CC 7 HS-ESS2-5, SEP 3, CC 6; HS-ESS3-2, SEP 7, CC 1 HS-ESS3-1 , SEP 6 CC 2
Unit #6 - Ocean Circulation	In this unit, students explore the role of ocean circulation in climate modification and bioproductivity. The activities require students to interpret the effect of horizontal and vertical seawater movement on heat distribution, carbon dioxide dissolution, and nutrient availability. Students will use their new knowledge to predict how those parameters may change as a result of major shifts in ocean circulation associated with global climate change. Students will also focus on quantitative investigations into the origin/evolution of coastal landforms and the physical processes responsible for their creation and modification.	• How have the shape and configuration of continents and ocean basins changed through time? • What are the three main zones of the open ocean? • What causes the differential heating of the Earth and what are their roles creating global circulation patterns? • What distinguishes wind-driven (or surface) and density-driven (or deep) ocean currents? • How are deep and shallow water waves similar and different? • Why do tidal ranges and patterns vary on a spatial and temporal scale? • How do waves affect coastlines? • What structures can be built to protect a shoreline?	HS-ESS2-4, SEP 2, CC 2 HS-ESS3-6, SEP 5 CC 4	HS-ESS2-4, SEP 2, CC 2 HS-ESS3-6, SEP 5, CC 4
Unit #7 - Weather and Climate	In this unit, students will communicate an understanding of the fundamental differences between weather and climate and observe models and analyze data to learn how the interplay between atmospheric variables such as temperature, air pressure, and moisture leads to the typical and sometimes extreme weather events that humans experience. Analyzing climate and weather data to make predictions is a key part of this unit and students' understanding of how weather patterns can help us predict future weather events. Students will be able to identify major causes and consequences of climate change as well as critically consider the	• What factors affect climate on Earth? • How does solar energy flow from the sun to Earth, within Earth's spheres, and between Earth's spheres? • How do changes in Earth's atmosphere, weather and climate affect other systems on Earth?	HS-ESS2-4, SEP 2, CC 2 HS-ESS2-6, SEP 2, CC 5 HS-ESS3-1, SEP 6, CC 2 HS-ESS3-5, SEP 4, CC 7	HS-ESS2-4, SEP 2, CC 2 HS-ESS2-6, SEP 2, CC 5 HS-ESS3-1, SEP 6, CC 2 HS-ESS3-5, SEP 4, CC 7

	impact of climate change on the everyday life of people.	• What are important atmospheric conditions (variables) to monitor when studying weather? • How do these conditions vary in the atmosphere? • What causes the jet stream? • What are the characteristics of and causes for the different types of severe weather? • What are the different ways we can represent and analyze weather conditions? • What effects does climate and weather phenomena have on people living in different regions? • How are water's unique properties important with atmospheric and oceanic circulation?		