SCI113: Earth Science

This course for students who have been introduced to Earth and Life Science topics in middle school focuses on topics in geology, oceanography, astronomy, weather, and climate. Students use a combination of online instruction, hands-on laboratory activities, reference book study, and collaborative activities with virtual classmates. This course prepares students to take college courses in any Earth Science areas.

COURSE LENGTH: Two semesters

MATERIALS: Earth Science: A Reference Guide; materials for laboratory experiments

PREREQUISITES: K12 middle school Life Science, or equivalent

SEMESTER ONE

Unit 1: Earth Science and Systems
Earth Science is one of the most fascinating topics in all the sciences, and students learn about its place among the sciences in this unit. Students explore what Earth science is, learn about its breadth and history, and study the contributions of earth scientists to the betterment of life for all of us. Students also study aspects of scientific methods and use those methods in a laboratory setting.

- Semester Introduction
- Why Study Earth Science?
- Historical Contributions in Earth Science 1
- Historical Contributions in Earth Science 2
- Spheres as Earth Systems
- Laboratory: Topographical Maps
- Earth Systems and Interactions
- Laboratory: Modeling Earth Science Processes 1
- Laboratory: Modeling Earth Science Processes 2

Unit 2: Dynamic Earth
Students confront Earth as a dynamic planet; in many ways, it is more active than any other planet in our solar system. The core idea of plate tectonics, its effect on Earth’s history, and its current geological activity helps students make sense of our world. Knowledge of the origin and distribution of volcanoes and earthquakes helps students make even greater sense of Earth’s dynamic nature.

- Introduction to Plate Tectonics
- Pangaea and Continental Drift
- Moving Plates
- Plate Boundaries 1
- Plate Boundaries 2
- Plate Tectonics: Historical Perspective
- Where Earthquakes and Volcanoes Occur
- Structure of Earth’s Interior
- Laboratory: Island Chain Formation
- How Earthquakes Happen
- Locating Earthquakes
• Earthquakes and Waves
• Laboratory: Earthquake Epicenter
• How Volcanoes Form
• Volcanic Zones
• Mountain Building
• Impact of Geologic Events

Unit 3: Composition of the Earth
Study of the minerals and rocks that comprise Earth is students’ most tangible way to engage in the nature of the Earth’s structure. In this unit, students tackle the nature of rocks, their origin, distribution, and transformation. After establishing a firm basis of Earth materials, students confront weathering and erosion and the development and change in Earth’s landforms.

• Minerals on Earth
• Mineral Properties
• Valuable Minerals
• Crystal Structures
• Rocks and Their Mineral Composition
• Three Kinds of Rocks
• Laboratory: Rocks and Minerals 1
• Laboratory: Rocks and Minerals 2
• Rock Origins 1
• Rock Origins 2
• The Rock Cycle
• Earth Materials Change
• Weathering and Erosion
• Land Use and Its Effects

Unit 4: Geological History
The history of Earth is told in its rocks—how the planet was formed and what changes it has gone through. Students study changes that have taken place in Earth’s long history, examining geological time and the changes in living things over time. Students also begin an investigation of rocks and minerals.

• Earth’s History
• Earth’s History and Change
• The Fossil Record
• Age of Geologic Features
• Earth’s History Written in Rocks
• Laboratory: Interpreting Geologic History, Day 1
• Laboratory: Interpreting Geologic History, Day 2

Unit 5: Earth’s Atmosphere
The structure of our atmosphere has a profound effect on Earth and its living things. In this unit, students first develop a firm basis for understanding how the sun’s energy is the basis for many of the characteristics of our atmosphere. Knowledge of how the sun’s energy is used provides the basis for understanding wind and global circulation of air. As in other units, student understanding of facts stems from their mastery of the “big ideas” of Earth Science.

• Layers in the Atmosphere
• Composition of the Atmosphere
• History of the Earth’s Atmosphere
• Laboratory: Barometer 1
• Laboratory: Barometer 2
• The Sun and Energy
• Solar Radiation
• Temperature and Air Pressure
• Air Circulation Patterns 1
• Air Circulation Patterns 2
• Air Movement and Weather
• Wind and Human Activity
• Laboratory: Energy Absorption/Reflection 1
• Laboratory: Energy Absorption/Reflection 2

Unit 6: Weather 1
The origin of weather and its effects on Earth systems and on human life are the focus of student learning in this unit. Students explore what it means to gather weather data and work with weather maps. They learn the factors that influence weather, cloud formation, and storm development. They also learn the level of risk of severe weather and how to prepare for dangerous weather.

• What Makes the Weather?
• Gathering Weather Data
• Weather Maps
• Laboratory: Weather Map Interpretation 1
• Laboratory: Weather Map Interpretation 2
• Cloud Formation
• How Storms Develop
• Determining Level of Risk
• Preparing for Severe Weather

Unit 7: Semester Review and Test
• Semester Review
• Semester Test

SEMESTER TWO
Unit 1: Weather 2
The difference between climate and weather is the focus of learning in this unit. Students examine climatic zones, cloud formation, and relative humidity. Students explore the different biomes on Earth and the results that the greenhouse effect will have on Earth’s environment. Students confront the issue of climate change.

• Semester Introduction
• Climate vs. Weather
• What Influences the Weather?
• Comparing the Weather
• Laboratory: Cloud Formation
• Laboratory: Relative Humidity
• Biomes on Earth
Unit 2: Oceans
The oceans of the world give our Earth a unique characteristic among planets in our solar system. In this unit, students explore Earth’s water, learn about the properties of ocean water, and see how the physical and biological characteristics of oceans make our planet unique.

- Oceans of the World
- Chemistry of the Oceans
- Physical Properties of Seawater
- Ocean Dynamics
- Laboratory: Ocean Water Density 1
- Laboratory: Ocean Water Density 2
- Ocean Currents
- Ocean Floor
- Ocean Conditions and Life
- Marine Life Zones
- Laboratory: Ocean Floor Sediments 1
- Laboratory: Ocean Floor Sediments 2
- Marine Organisms
- Marine Resources

Unit 3: Cycles on Earth
The materials that make up Earth are continuously being recycled. Important nutrients for living things, as well as the components of rock and minerals, are circulated through Earth systems over time. Students examine these nutrient cycles, paying particular attention to nitrogen, carbon, oxygen, and water. The concept of a dynamic and ever-changing Earth is reinforced in this unit.

- Biogeochemical Cycles
- Nitrogen Cycle
- Carbon Cycle
- Life and the Carbon Cycle
- Laboratory: Dissolved Oxygen 1
- Laboratory: Dissolved Oxygen 2
- Water Cycle
- How Humans Alter Cycles
Unit 4: Astronomy
By this point in the Earth Science curriculum, students have a firm basis for understanding Earth and its characteristics. Students now look at Earth in the broader context of its place in the solar system, the Milky Way, and the universe. Building on the “big ideas” of astronomy, students develop a strong central basis for understanding Earth within the larger context of space.

- The Sun
- Solar Phenomena
- The Earth–Moon–Sun System
- Laboratory: Solar Energy
- Solar and Lunar Eclipses
- The Moon’s Influence
- Earth Movement and Seasons
- Laboratory: Earth, Moon, Sun Motion
- Laboratory: Sunrise and Sunset
- Origin of the Solar System
- Gravitational Forces in the Solar System
- Features of the Solar System
- The Planets
- Planetary Impact
- Electromagnetic Spectrum
- Light: A Tool for Astronomy
- Distances in Space
- Life Cycle of a Star
- Color and Brightness of Stars
- Date about Stars
- What’s a Galaxy?
- Searching for Objects in Space
- The Big Bang Theory

Unit 5: Earth’s Resources
With all that students have learned about Earth, they are able now to confront some practical aspects of Earth and how humans use its resources. Where are we headed with regard to those resources needed to sustain modern society? What is and what should be our relationship to fossil fuels, water resources, and issues regarding changes in human populations?

- Earth’s Natural Resources
- Renewable vs. Nonrenewable Resources
- Mineral Resources
- Locating Resources
- Managing Resources
- Using Resources Wisely
- Environmental Issues
- Laboratory: Air Pollution Watch
- Water Resources
- Humans and the Environment
- Conservation
- Population Growth
- Population Changes

**Unit 6: Semester Review and Test**
- Semester Review
- Semester Test