

# Advanced Earth Science



## Course Overview

The K<sup>12</sup> Middle School Earth Science curriculum presents the fundamentals of geology, oceanography, meteorology, and astronomy. Students explore amazing landforms around the globe, the nature of the sea and air, the wonders of geological history, and recent discoveries about our universe.

The course opens with a focus on geology. Students learn the basics of mapping, and then begin a study of Earth's minerals and rocks. They learn about the materials of Earth's interior, and progress to the unifying theory of plate tectonics, which explains diverse phenomena such as earthquakes, volcanoes, and the movements of continents over time. They also consider the evidence

presented by the fossil record. In the last half of the course, students learn about oceans and the atmosphere, and then expand their study to our solar system, the stars, and the universe. Students will explore topics such as:

- Basics of mapping
- Earth's minerals and rocks
- Earth's interior
- Plate tectonics, earthquakes, volcanoes, and the movements of continents
- Geology and the fossil record
- Oceans and the atmosphere
- The solar system, stars, and universe

## Course Outline

### Mapping the Earth

If everything on Earth were the same, our planet would look like a big, smooth ball—uniform and not very interesting. Instead, Earth is like a giant jigsaw puzzle, made of many different parts, from the layers of rock beneath our feet to the atmosphere above our heads. Driven by energy, these puzzle pieces of Earth are always moving—the oceans, the mountains, and even the land we stand on. Learn what these various parts are, the kinds of energy that drive them, and how they fit together in the living planet we call home.

- Welcome to Earth Science
- Spheres of the Earth
- Map Essentials
- Cartography
- Laboratory: Map Projections

### Minerals

Find out what makes one mineral different from another and learn some simple tests to show what kinds of fascinating minerals make up common rocks. Discover, too, that almost half the earth's crust is made of one very important thing—oxygen.

- Identifying Minerals and Crystals
- Classification of Minerals
- Laboratory: Mineral Identification

### Rocks

Do you know where that big rock in your backyard came from? What about the little, flat rocks you skip across a lake? Why are rocks different colors? Why is one smooth

and another jagged? Learn how rocks are “born” and then how they’re “reborn.” Discover different types of rocks, how they’re made, what they’re made of, and how they’re constantly changing.

- Igneous Rocks
- Sedimentary Rocks
- Metamorphic Rocks
- Laboratory: Rocks in the Rock Cycle

### Earth's Interior

Our home planet is like a giant onion. Explore Earth's interior by peeling back each layer to uncover what lies beneath. Find out what the layers are made of, how they move and alter the landscape, and how scientists have used seismographs to learn about the mysteries of our planet's depths.

- Structure of the Earth's Interior
- Using Seismic Waves to Map the Earth's Interior
- Laboratory: Using a Seismograph in Earthquake Engineering

### Plate Tectonics

Scientists think that, from one supercontinent that broke apart into smaller continents hundreds of millions of years ago, the continents have been moving around ever since. Explore the forces driving this large-scale motion, and discover what happens when two continents meet on a collision course.

- Drifting Continents
- Seafloor Geography
- Plate Tectonics



- Divergent and Transform Plate Boundaries
- Convergent Plate Boundaries
- Folding and Faulting
- Laboratory: Convection and Plate Motion
- Laboratory: Plate Motion and Geography

## Forces Reshaping Earth's Surface

How can simple things—gusts of wind, drops of water—cause Earth's surface to change? How does a young river affect the land? What about an old river? How can rivers be “young” or “old”? What does a glacier do to the land? Explore the relentless processes of weathering, erosion, and mass wasting on Earth's landforms, and learn how they work together over time to change the way our planet looks.

- Weathering and Soil Formation
- Surface Water and Ground water
- Glaciers
- Laboratory: Desertification

## The Fossil Record

The past is still with us today, if you know how to look for it. More than a million living things have left traces of their bodies in the earth. Dig up some fossils and discover how things looked in the distant past, from ancient environments to long-ago animals and plants. Learn how to play detective and read the clues told by the walls of the Grand Canyon.

- Steno's Principles
- Fossil Succession and Uniformitarianism
- Geochronology: Dating the Past
- A Geologic Tour of North America
- Laboratory: Index Fossils and Paleoenvironments

## Oceans

If you could stand on the moon and look at the Earth, you'd see a big, blue ball. Why blue? Most of Earth's surface is water—lakes, seas, and deep oceans. Learn more about all the splashing, sloshing stuff that covers three-fourths of the planet. Explore tides, waves, thermoclines, and water temperatures. And find out about a phenomenon called El Niño and its effects on our world.

- Welcome to Earth Science, Semester 2
- Properties of Ocean Water
- Surface Currents
- Deep water Currents
- Ocean Waves and Tides
- Laboratory: Tidal Power: Benefits and Costs

## Weather and Climate

Snow usually falls quietly and softly, yet it has the power to bring down power lines and shatter tree branches. Rain can cause the land to bloom with flowers and crops, but it's also capable of washing away fields and trees. Winds can do everything from mussing up your hair to rearranging the face of a rugged cliff. Learn what weather really is—where it comes from, why it happens the way it does, and how constant changes in weather are part of what happens in the energy-filled outer shell of Earth known as the atmosphere.

- Daily Weather
- Air Masses and Fronts
- Weather Versus Climate
- Climate Control
- Ocean, Land, and Air: Water and Energy Budgets
- Laboratory: Changing Climates: Global Warming

## Renewable and Nonrenewable Resources

What happens to the soda can tossed into a recycling bin? Learn about the potential and perils associated with both renewable and nonrenewable resources.

- Energy Resources: Overview
- Nonrenewable Energy: Fossil Fuels, Part 1
- Nonrenewable Energy: Fossil Fuels, Part 2
- Nonrenewable Energy: Nuclear
- Laboratory: Consuming Fossil Fuels
- Renewable Energy: Hydroelectric Power
- Renewable Energy: Alternate Energy Resources
- Laboratory: Energy from Wind

## Project: Scientific Investigation

Become a scientist as you design and carry out your own experiment. Discover how the scientific process works, what makes it different from just guessing, and why it's the most powerful and successful way of figuring out how the forces of nature work.

- Scientific Process: Selecting a Research Topic
- Making a Hypothesis and Experimental Design
- Step-by-Step Experimenting
- Data Collection: Data Types
- Data Tables
- Data Analysis
- Conclusions and Lab Reports
- Writing a Bibliography and Making a Display
- Preparing for an Oral Presentation and Final Check
- Science Investigation Presentation



## Our Place in the Universe

What does a faraway star in the night sky have in common with our own blazing sun? What causes the sun to burn so brightly and with such heat? Explore comets, asteroids, meteorites, and asteroids. There is much to learn about the amazing universe—from a theory called the *big bang*, which explains how the entire universe was formed, to the reason why days are longer in summer and shorter in winter.

- Origin of the Solar System
- Star Qualities
- Sun Fusion
- Planets of the Solar System
- Stars
- Expanding Universe
- Laboratory: Earth Seasons, Moon Phases, and Eclipses

## Lesson Time and Scheduling

**Total lessons:** 96

**Lesson time:** 60 minutes; one or two 90 minute labs per unit

You might choose to split the lessons into smaller segments and take breaks as needed. The K<sup>12</sup> online lesson tracking system allows you to pick up wherever you left off in any given lesson

## Standard Curriculum Items

Wall Map Set (Science/History)

Graduated cylinder, 100 mL

Graduated cylinder, 500 mL

Pipe cleaners

Advanced Rock and Mineral Kit

Diffraction grating film

Stopwatch

Grape seeds

Latch magnet

Safety glasses

Magnifying glass

Centimeter gram cubes

Clay (four colors)

Fine sand

White tile

Advanced thermometer

NOTE: List subject to change.