Syllabus

High School Earth and Space Science, Semester A

Course Overview

Earth and space science is the study of the structure of our planet and Earth's role in the solar system and universe. This branch of science relies on observations, historical data, and physical evidence to describe the natural processes that occur around us and in distant space. Semester A begins with a discussion of the methods and tools that scientists use to study Earth and space science, including the scientific method, modeling, and mathematics. You'll look at theories for how the planets, solar system, and universe formed and explain the interactions between the Sun, Earth, and Moon. You'll also learn about the emergence of Earth's materials, atmosphere, and first life-forms, as well as the dating methods that help us piece together Earth's unique history.

Course Goals

By the end of this course, you will be able to do the following:

- Identify responsible and ethical practices used by Earth and space scientists.
- Apply the concepts of the scientific method to test a hypothesis.
- Effectively communicate scientific data and conclusions using models, reports, and graphs.
- Use coordinate systems to locate terrestrial and celestial objects.
- Create a model that conveys the size of the solar system and its planets.
- Build a conceptual model of how the universe may have initially formed based on evidence and dominant theories.
- Explain how the distribution of matter across the universe led to the formation of stars, galaxies, and terrestrial objects.
- Describe the Sun-Earth-Moon system.
- Compare the planets in terms of composition, structure, and behavior.
- Model how the early Earth separated into layers and how the atmosphere and oceans formed and stabilized.
- Explain how life on Earth was preserved in the fossil record.
- Apply dating methods to construct an accurate history of Earth's formation.
- Describe how each subsystem of Earth affects the other subsystems.

General Skills

To participate in this course, you should be able to do the following:

- Complete basic operations with word-processing software, such as Microsoft Word or Google Docs.
- Understand the basics of spreadsheet software, such as Microsoft Excel or Google spreadsheets, but prior computing experience is not necessary.
- Perform online research using various search engines and library databases.
- Communicate through email and participate in discussion boards.

For a complete list of general skills that are required for participation in online courses, refer to the Prerequisites section of the Student Orientation document, found at the beginning of this course.

Credit Value

High School Earth and Space Science A is a 0.5-credit course.

Course Materials

- computer with Internet connection and speakers or headphones
- Microsoft Word or equivalent
- Microsoft Excel or equivalent
- materials listed in Appendix B (Appendix C provides a detailed breakdown of these materials by activity.)

Course Pacing Guide

This course description and pacing guide is intended to help you stay on schedule with your work. Note that your course instructor may modify the schedule to meet the specific needs of your class.

Unit 1: Studying Earth and Space Science

Summary

In this unit, you'll explore some of the practices and tools used by Earth and space scientists. You'll describe the scientific method, which is effective in testing scientific claims. You'll also apply the steps of the scientific method in a hands-on experiment to test a hypothesis. Finally, you'll study how scientists communicate scientific data and conclusions with one another and with the public, and you'll learn the important roles that modeling and mathematics have in science.

Day	**Activity/***Objective*	Type
1 day: 1	**Syllabus and Student Orientation** *Review the Student Orientation and Course Syllabus at the beginning of this course.*	Course Orientation
3 days: 2–4	**Introduction to Earth and Space Science** *Identify responsible practices used by Earth and space scientists, and apply the physical tools they use.*	Lesson
3 days: 5–7	**The Scientific Method** *Describe the scientific method and explain why it is effective in testing scientific claims.*	Lesson
4 days: 8–11	**Testing Hypotheses** *Apply the concepts of the scientific method to test a hypothesis.*	Course Activity
4 days: 12–15	**Analyzing and Communicating Scientific Information** *Apply the tools used to effectively communicate scientific data and conclusions, including models, reports, and graphs.*	Lesson
5 days: 16–20	**Unit Activity and Discussion—Unit 1**	Unit Activity/ Discussion
1 day: 21	**Posttest—Unit 1**	Assessment

Unit 2: The Universe

Summary
You'll begin this unit by building a scale model that depicts the size of the solar system and the planets within it. Then you will analyze dominant theories about the formation of the universe to describe how stars, galaxies, and terrestrial objects came into being. In a related activity, you'll use coordinate systems to locate and compare celestial objects in space and terrestrial objects on Earth. You'll also create a model using real-time data to describe the oceans' tides and

learn how the patterns are linked to the Sun-Earth-Moon system. Near the end of the unit, you'll compare the planets in our solar system and explain their behavior using Kepler's and Newton's laws for planetary motion.

Day	**Activity/***Objective*	Type
4 days: 22–25	**The Hierarchy and Scale of the Universe** *Create a model that accurately conveys the organization and scale properties of the universe.*	Course Activity
4 days: 26–29	**The Formation of the Universe** *Create a conceptual model of how the universe may have initially formed from the big bang and explain the observational and experimental evidence that supports this theory.*	Lesson
3 days: 30–32	**Coordinate Systems** *Use coordinate systems to locate terrestrial and celestial objects.*	Course Activity
4 days: 33–36	**The Formation and Life Cycles of Celestial Objects** *Explain how the uneven distribution of matter across the universe after the big bang led to the formation of stars, galaxies, and terrestrial objects.*	Lesson
4 days: 37–40	**The Formation and Nature of the Solar System** *Compare objects in the solar system, including their formation and their gravitational interactions.*	Lesson
4 days: 41–44	**Tides** *Create a model for tidal motion based on scientific data and the structure of the Sun-Earth-Moon system.*	Course Activity
4 days: 45–48	**The Sun-Earth-Moon System** *Construct a model for the Sun-Earth-Moon system and use it to explain relevant phenomena.*	Lesson

Day	Activity/*Objective*	Type
4 days: 49–52	**The Planets** *Compare the planets in terms of composition, structure, and behavior and explain their behavior using Kepler's and Newton's laws for planetary motion.*	Lesson
5 days: 53–57	**Unit Activity and Discussion—Unit 2**	Unit Activity/ Discussion
1 day: 58	**Posttest—Unit 2**	Assessment

Unit 3: The Precambrian Earth

Summary
This unit begins with an activity that demonstrates how Earth's early oceans and life-forms coevolved with the atmosphere. You'll then study the emergence of the first life on Earth, how the layers of Earth formed, and how the fossil record has contributed to the historical timeline of Earth's development. You'll use a variety of dating methods to construct an accurate history of Earth, and you'll model Earth as an interaction of several subsystems (biosphere, atmosphere, hydrosphere, and geosphere) that exchange matter and energy.

Day	Activity/*Objective*	Type
4 days: 59–62	**The Formation of the Atmosphere and Oceans** *Model how Earth's atmosphere and oceans formed as the result of physical and chemical processes in the planet's interior.*	Course Activity
4 days: 63–66	**The Formation of Earth** *Model how the early Earth separated into layers and how the atmosphere and oceans formed and stabilized.*	Lesson

Day	**Activity/***Objective*	Type
4 days: 67–70	**The Coevolution of Life and Earth** *Explain how life on Earth was able to form and be preserved in the fossil record and model how the emergent biosphere affected other subsystems.*	Lesson
4 days: 71–74	**The Fossil Record** *Construct a history of the biosphere based on information from the fossil record.*	Course Activity
4 days: 75–78	**Determining Earth's History** *Apply a variety of dating methods to construct an accurate history of Earth.*	Lesson
4 days: 79–82	**Earth's Subsystems** *Model Earth as an interaction of several subsystems that exchange matter and energy.*	Lesson
5 days: 83–87	**Unit Activity and Discussion—Unit 3**	Unit Activity/ Discussion
1 day: 88	**Posttest—Unit 3**	Assessment
1 day: 89	**Semester Review**	
1 day: 90	**End-of-Semester Exam**	Assessment

Course Map

You will achieve course level objectives by completing each lesson's instruction, assignments, and assessments. For a detailed look at how the materials meet these objectives, review the course map for Semester A.

Appendix A: Safety Notes and Disclaimer

Each Course Activity and Unit Activity that includes a lab or experiment component will highlight key safety guidelines using the safety icon (), which appears directly in the activity. In addition to adhering to those guidelines, you must ensure that you follow these general safety practices:

- Work slowly and safely at all times, and abide by the safety notes and icons.
- Pay attention and be alert at all times. Limit any distractions.
- Keep your hands away from your nose, eyes, mouth, and other skin. Wash your hands before and after experiments.
- If you don't understand something, ask a teacher or an adult before proceeding.
- Wear the required protective gear.
- Adult supervision is required for all activities involving an experiment or lab component.
- Do not perform experiments that have not been approved. Follow the procedures.
- Follow good housekeeping practices. Keep your work area clean.
- Abide by all disposal instructions and icons to protect yourself and our planet.
- Report any problems or complications to an adult.

Note: *Edmentum assumes no liability for personal injury, death, property damage, equipment damage, or financial loss resulting from the instruction included in this course.*

Appendix B: Course Lab Materials (Semesters A and B)

Household Materials – Basic

The italicized materials listed below are available as a convenience in the *Edmentum Earth and Space Science Kit*

- paper or poster board (standard letter size: 8.5 inches x 11 inches)
- pen, pencil, or fine-tip marker
- scissors
- ruler with English and metric scales
- toilet paper
- paper towels
- plastic spoon
- plastic bowl
- rubber band
- aluminum foil
- string, fishing line, or dental floss (at least 2 meters or 6 feet)
- sticky notes, or paper and tape
- 2 soft rags
- squeezable water bottle with sport cap
- 2 large glass beakers, glasses, or jars (250 to 500 milliliters or 8 to 16 ounces)
- large, transparent glass or plastic container (such as a pitcher)
- small, transparent glass beaker or jar (such as a baby food jar)
- small glass or jar (250 milliliters or 6 to 8 ounces)
- measuring cup (able to measure ¼ cup)
- measuring spoons: 1 teaspoon and 1 tablespoon
- 2 one-gallon jugs or pitchers
- bucket or trash can
- water from a natural water source such as a pond, stream, or well
- tap water
- distilled water (at least 100 milliliters, or about 4 ounces)
- white vinegar (at least 100 milliliters, or about 4 ounces)
- baking soda
- dry bar of soap
- sand
- 2 rocks (at least 1.5 inches or 4 centimeters in size.)
- calculator (optional)

- *iron nail*

Household Materials – Less Common

The italicized materials listed below are available as a convenience in the *Edmentum Earth and Space Science Kit*

- stopwatch (could be a mobile app or on a computer)
- lamp with 150-watt incandescent bulb (or access to a sunny area)
- apron
- compass used to draw circles (optional)
- paintbrush, 1 inch or less in width
- plastic paint tray liner (or a stream table)
- 2 empty plastic soda bottles (2 liters each)
- modeling clay
- copper penny (dated 1982 or older)
- wooden blocks (approximately 2 inches thick)
- 4 to 5 toy building blocks or game pieces (anything that resembles a tiny model house)

- *disposable gloves*
- *safety goggles*
- *small magnet*
- *magnetic compass*
- *2 thermometers, continuous measurement; must measure up to 120° Fahrenheit (50° Celsius)*
- *2 cups dry plaster of Paris*
- *petroleum jelly*
- *food coloring*

Specialized Science Materials

All materials listed below are available in the *Edmentum Earth and Space Science Kit.*

- *scale with at least 0.1 gram accuracy*
- *magnifying hand lens*
- *graduated cylinder, 100 or 250 milliliters*
- *limestone chips (50 grams total)*
- *mineral kit (including apatite, calcite, fluorite, graphite, gypsum, magnetite, feldspar, microcline, pyrite, quartz, and talc)*
- *porcelain streak plate*
- *glass streak plate*
- *water quality test kit, including test strips for pH and total alkalinity, total hardness, nitrate/nitrite, nitrite-nitrogen, iron (Fe+2/Fe+3), copper (Cu+1/Cu+2), free and total chlorine*
- *4 2-ounce plastic jars* (may use clear, clean glass baby food jars)
- *a bivalve shell* (may use a "household" item to fossilize, such as a leaf or a chicken bone)
- *binoculars (optional)*

Appendix C: Lab Materials by Activity (Semester A)

The italicized materials listed below are available in the *Edmentum Earth and Space Science Kit.*

Unit	Activity Name	Task	Equipment List
1	Course Activity: Testing Hypotheses **** Special lab materials required. (Edmentum Earth and Space Science Kit or school-provided lab materials)***	Task: Disappearing Rocks	Italicized items may be found in the *Edmentum Earth and Space Science Kit's* bags labeled "Testing Hypotheses" and "Common Materials." • *limestone chips (50 grams total)* • *4 small plastic jars* (may use clear, clean glass baby food jars) • *scale with at least 0.1 gram accuracy* • *graduated cylinder, 100 or 250 milliliters* • *disposable gloves* • *safety goggles* • 4 sticky notes or small pieces of paper and tape • white vinegar (at least 100 milliliters) • distilled water (at least 100 milliliters) • baking soda • small spoon • 2 soft rags • pen, pencil, or fine-tip marker
2	Course Activity: Hierarchy and Scale of the Universe	Task 1: Comparing and Scaling Planet Sizes	• 4 pieces of paper or poster board (8.5 inches x 11 inches) • scissors • pencil or pen • ruler • compass used to draw circles (optional) • calculator (optional)
		Task 2: Comparing and Scaling Planet Distances	• toilet paper • pencil or pen • an object and location to represent the Sun • calculator (optional) • large working space, such as a hallway

Unit	Activity Name	Task	Equipment List
2	Course Activity: Coordinate Systems	Task 1: Terrestrial Coordinate Systems	none
		Task 2: Celestial Coordinate Systems	Italicized items may be found in the *Edmentum Earth and Space Science Kit's* bag labeled "Common Materials." • *magnetic compass* • *binoculars (optional)*
3	Course Activity: The Formation of the Atmosphere and Oceans	Task 1: Evolution of the Atmosphere	Italicized items may be found in the *Edmentum Earth and Space Science Kit's* bag labeled "Common Materials." • *2 thermometers to take continuous measurements for 30 minutes; must measure up to 120°Fahrenheit (50°Celsius)* • *disposable gloves* • *safety goggles* • stopwatch (could be a mobile app or on a computer) • measuring cup (able to measure ¼ cup) • measuring spoon: 1 tablespoon • small glass or jar (250 milliliters or 6 to 8 ounces) • 2 empty plastic soda bottles, 2 liters each • baking soda (1 tablespoon) • white vinegar (1/4 cup) • lamp with 150-watt incandescent bulb (or access to a sunny area) • 3 sticky notes • apron

Unit	Activity Name	Task	Equipment List
3	Course Activity: The Fossil Record	Task 1: Fossil Formation	Italicized items may be found in the *Edmentum Earth and Space Science Kit's* bag labeled "The Fossil Record." • *dry plaster of Paris (about 2 cups)* • *petroleum jelly (enough to coat the object being fossilized)* • *a bivalve shell* (may use a "household" item to fossilize, such as a leaf or a chicken bone.) • paintbrush, 1 inch or less in width • plastic bowl • small plastic spoon • ruler with English and metric scales • tap water (about 2/3 cup) • enough modeling clay to make a 12-centimeter circle that's about 3 centimeters deep