Unit 1: Formation of the Earth and the Solar System

Content Area: **Science**
Course(s): **The Earth, Solar System, and Beyond**
Time Period: **First Marking Period**
Length: **Three – Four Weeks**
Status: **Published**

Unit Overview

Formation of the Earth and the Solar System

Science is central to the lives of all informed citizens. Our science education program must prepare our students to have the knowledge to become informed consumers and responsible citizens in the local, national, and global community. Linden students must learn how to effectively collect, thoroughly analyze, and competently discuss various scientific topics. Skills learned through scientific education serve students across disciplines as it provides the learner with the ability to think critically and analyze information and make information (data) – based decisions.

The most recent standards are based on learning progressions that provide students with opportunities to investigate core ideas in science in increasingly complex ways over time. Target goals for the curriculum are designed to help students know and use scientific explanations of the natural and designed world; to understand the nature and development of scientific knowledge and technological capabilities; and to participate productively in scientific and engineering practices.

Unit 1 explores how major structures within the solar system were formed, their current orbits and how they interact with each other; as well as, how the Sun creates and transfers energy to the Earth. The unit also explores the compositionally different layers of the Earth and ways in which those layers interact to help establish and maintain the Earth's magnetic field.

2020 New Jersey Student Learning Standards for Science

HS-ESS1-1	Develop a model based on evidence to illustrate the life span of the Sun and the role of nuclear fusion in the Sun's core to release energy that eventually reaches Earth in the form of radiation
HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe
HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements

HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system
HS-ESS1-5	Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks
HS-ESS1-6	Apply scientific reasoning and evidence from ancient Earth's materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history

Science and Engineering Practices

- Asking questions (for science) and defining problems (for engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Crosscutting Concepts

Earth and Space Science

- Patterns
- Cause and effect: Mechanism and explanation
- Scale, proportion, and quantity
- Systems and systems models
- Energy and matter: Flows, cycles, and conservation
- Structure and function
- Stability and change

Disciplinary Core Ideas

Earth and Space Sciences

- ESS1.A: The Universe and Its Stars
- ESS1.B: Earth and the Solar System
- ESS1.C: The History of the Planet
- ESS2.B: Plate Tectonics and Large-Scale System Interactions
- ESS2.A: Earth Materials and Systems
- ESS2.D: Weather and Climate
- ESS3.A: Natural Resources
- ESS3.B: Natural Hazards
- ESS3.C: Human Impacts on Earth Systems

- ESS3.D: Global Climate Change

Engineering, Technology, and Application of Science

- ETS1.B: Developing Possible Solutions

Essential Questions

What predictable, observable patterns occur as a result of the interaction between the planets and moons?

How does the Earth's rotation and revolution affect life on the planet?

How does the current model of our solar system differ from past models?

How do objects in the solar system interact?

What makes our solar system a system?

What role does gravity play in our solar system?

What accounts for day and night, seasons, months, years, and tides?

How can studying the solar system lead to a better understanding of the Earth?

How does the Sun's energy affect Earth and the rest of the solar system?

How does the position of the Earth, Moon, and Sun affect each other?

How does the Sun produce energy?

What are the layers of the Earth?

What is the importance of Earth's magnetic field?

What creates the Earth's magnetic field?

Enduring Understanding

Enduring understanding of how the universe and the processes which caused our solar system to form, how these processes influenced our planetary composition, and how the Sun's energy is created and how it influences the Earth's magnetic field and ultimately life.

Students Will Know…

The following vocabulary terms/concepts:

- Supernova
- Nuclear Fusion

- Nuclear Fission
- Electromagnetic Spectrum
- Continuous Spectrum
- Emission Spectrum
- Absorption Spectrum
- The Solar System
- Spectrum
- Doppler Shift
- Red Shift
- Star
- Binary Star
- Black Hole
- Corona
- Plasma
- Light Year
- Galaxy
- Constellation
- Dust Cloud Hypothesis
- Collision Hypothesis
- Nebular Theory
- Asteroids
- Comets
- Meteor
- Dwarf Planet
- Jovian Planet
- Rocky Planet
- Planetesimal
- Moons
- Kuiper Belt
- Aurora Australis
- Aurora Borealis
- Chromosphere
- Convection Zone
- Radiation Zone
- Solar Wind
- Sunspots
- Crust
- Lithosphere
- Asthenosphere
- Moho
- Mantle
- Outer Core

- Inner Core
- Density
- Temperature
- Pressure
- Magnetic North
- Magnetism

Predictable Misconceptions:

- The Earth did not form immediately after the creation of the universe
- Electrons travel in a fixed orbit
- Planets formed at the same time and are composed of the same material
- Energy from the Sun arrives immediately
- The solar system itself and objects within the solar system are stationary
- The Sun creates energy differently and with different intensity throughout its lifespan
- The Earth has a homogeneous composition
- The layers of the Earth do not influence Earth's magnetic field

Students Will Be Able To…

- Understand the sequence of events after the creation of the universe
- Discuss the concept of planetary coalescence
- Describe the major components of the solar system
- Identify orbital patterns of planets and moons
- Discuss how day/night, seasons, years, and tides are influenced by the rotation and revolution of the Earth
- Describe the difference between nuclear fusion and nuclear fission
- Identify what mechanisms create the Earth's magnetic field and its importance

STAGE 2 – EVIDENCE OF LEARNING

Formative Assessments

- Three-minute pause
- A-B-C Summaries (AlphaBoxes)
- Analogy Prompt
- Choral Response
- Debriefing
- Exit Ticket
- Hand Signals (red-yellow-green cards)
- Idea Spinner
- Index Card Summaries
- Fishbowl Discussions
- Journal Entry
- Misconception Check

- Observation
- One Minute Essay
- One Word Summary
- Portfolio Check
- Questions and Answers
- Self-Assessment
- Student Conference
- Think-Pair-Share
- Concept Maps

Authentic Assessments

Students will be able to:

- Follow laboratory procedures
- Complete chapter and unit laboratory experiments
- Complete Project-Based Learning (PBL) assignments
- Collect, graph, and analyze data
- Evaluate the validity of evidence
- Form evidence-based conclusions
- Complete assignments
- Develop and utilize models
- Cooperate in a large or small group setting
- Complete a written scientific journal
- Maintain class notes and vocabulary with a MacBook Air
- Complete Project Based Learning assessments
- Complete quizzes and tests

Benchmark Assessments

- Chapter and Unit Tests

Instructional Map

- 1st Marking Period
    - Formation of the universe and solar system
    - Planetary systems
    - The Sun's energy
    - Formation of the Earth and composition
    - Earth's magnetic field

Modification /Differentiation of Instruction

DI = ppt/air mac, cooperative learning (mixed ability)

ESL Students: speaking, reading, writing, peer tutoring

SPEDs: restating, reading aloud, guided questions, additional problems and teacher observation

- Rephrase, clarify, repeat directions
- Study guides

- Extended time on tests and assignments
- Modify tests and assignments
- Visual aides
- Word banks
- Calculator use
- Repeated drill and practice
- Teacher notes
- Preferential seating
- Oral directions
- Use of additional resource materials
- Break down assignments into smaller tasks (chunking assignments)

Academic Ability

- Struggling: Think-Pair-Share with gifted students
- Gifted: Think-Pair-Share with struggling students

Modification Strategies

- Cooperative Grouping
- Extended Time
- Frequent Breaks
- Highlighted Text
- Interactive Notebook
- Modified Text
- Oral Directions
- Peer Tutoring
- Preferential Seating
- Re-Direct
- Repeated Drill and Practice
- Shortened Assignment
- Teacher Notes
- Tutorials
- Use of Additional Reference Materials
- Use of Audio Resources

Differentiation Strategies

High Preparation

- Alternative Assessments
- Choice Boards
- Games and Tournaments
- Group Investigations
- Guided Reading
- Independent Research Projects

- Interest Groups
- Learning Contracts
- Leveled Rubrics
- Literature Circles
- Multiple Intelligence Options
- Multiple Texts
- Personal Agendas
- Project Based Learning (PBL)
- Stations and Centers
- Think-Tac-Toe
- Tiered Activities and Assignments
- Varying Graphic Organizers

Low Preparation

- Choice of Book/Activity
- Cubing Activities
- Exploration by Interest (using interest inventories)
- Flexible Grouping
- Goal Setting with Student
- Homework Options
- Jigsaw
- Mini Workshops to Re-teach or Extend Skills
- Open-ended Activities
- Think-Pair-Share by Readiness, Interest, or Learning Style
- Use of Collaboration
- Use of Reading Buddies
- Varied Journal Prompts
- Varied Product Choice
- Varied Supplemental Materials
- Work Alone/Together

Horizontal Integration – Interdisciplinary Connections

See Appendix

Vertical Integration – Discipline Mapping

Students will have been exposed to the Performance Expectations for Earth and Space Science, Life Science, Physical Science, and Engineering Design outlined in the New Jersey Student Learning Standards (NJSLS)/Next Generation Science Standards (NGSS) starting in first grade through The Earth, Solar System, and Beyond; which is offered in junior and senior year of high school. Science classes are designed around the Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts in the NJSLS/NGSS. Students in grade six study “Weather and Water”, “Diversity of Life” and “Waves”. These

lessons lead into grade seven where the students study “Planetary Science”, “Populations and Ecosystems”, “Gravity and Kinetic Energy”, and “Electromagnetic Force”. Grade Eight students study “Earth History”, “Chemical Interactions”, “Human Body Systems” and “Heredity and Adaptations”. The Earth, Solar System, and Beyond; being a half year course, will focus on having students gain a more complete understanding of the Performance Expectations outlined in NJSLS/NGSS, particularly Earth and Space Science and Engineering Design – while reinforcing Life Sciences and potentially Physical Science. Following The Earth, The Solar System, and Beyond students will take either Human Impact on the Environment, Zoology, Forensics, or Anatomy and Physiology.

Additional Materials

- Newsela Guided Reading
- National Aeronautical and Space Administration (NASA) Materials
- United States Geological Survey (USGS) Materials
- Rutgers University Department of Earth and Planetary Science (RUDEPS) Material