Unit 2: The Geosphere

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

Unit Overview

The Geosphere

Unit 2 explores how the different components of the geosphere interact to create various plate boundaries and potential hazards (earthquakes and volcanoes). The unit also explores how the process of erosion influences the rock cycle and what the main differences are between rocks and minerals. The unit concludes with how human activity has affected the carbon cycle.

STAGE 1 – DESIRED RESULTS

2020 New Jersey Student Learning Standards for Science

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
HS-ESS2-1	Develop a model to illustrate how Earth's internal and surface processes operate at a different spatial and temporal scales to form continental and ocean-floor features
HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause other changes to Earth systems
HS-ESS2-3	Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection
HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's system result in changes in climate
HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes
HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere

HS-ESS2-7	Construct an argument based on evidence about the simultaneous co-evolution of Earth's system and life on Earth
HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity
HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios
HS-ESS3-3	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity
HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activates on natural systems
HS-ESS3-5	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems
HS-ESS3-6	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity

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 is the rock cycle and what does it create?

How have humans affected the carbon cycle?

What is the composition of the Earth?

What evidence can be found to show the Earth has changed over time and explain how this evidence formed?

How do rocks differ from minerals?

What is the difference between absolute and relative fossil dating – what are the advantages and disadvantages of both?

How do different plates interact with each other?

What is the relationship between earthquakes and volcanoes and the boundaries they occur?

How do plate boundaries affect Earth's topography?

Why are minerals important to our health and our economy?

How can volcanic activity affect the Earth's surface?

Enduring Understanding

Enduring understanding of the geosphere and how rocks are created and altered via the rock cycle. Students will also have an understanding of the mechanisms behind plate tectonics, the

features it creates, and the potential hazards; finally, how human activity has affected the global and local carbon cycles.

Students Will Know…

The following vocabulary terms/concepts:

- Uniformitarianism
- Rock Cycle
- Sedimentary Rock
- Metamorphic Rock
- Igneous Rock
- Coarse/Fine Grained
- Extrusive/Intrusive
- Batholith
- Bowen's Reaction Series
- Foliation
- Mineralogy
- Crystal Shape
- Luster, Color, Streak, Habit, Strength, Cleavage
- Feldspar
- Mafic
- Mohs Scale
- Carbon Cycle
- Emissions
- Fossils
- Absolute Dating
- Relative Dating
- Fossil Succession
- Index Fossil
- Superposition
- Original Horizontality
- Cross-Cutting Relationships
- Inclusions
- Unconformity
- Isotopes
- Precambrian
- Paleozoic
- Mesozoic
- Cenozoic
- Disconformity
- Nonconformity
- Deposition
- Subduction Zone
- Continental Plate
- Oceanic Plate

- Convection Current
- Continental Drift
- Seafloor Spreading
- Divergent Boundary
- Convergent Boundary
- Anticline
- Syncline
- Monocline
- Thrust Fault
- Normal Fault
- Decompression Melting
- Crust, Lithosphere, Asthenosphere, Mantle, Outer/Inner Core
- Rift Valley
- Mid-Atlantic Ocean Ridge
- Pangea
- Elastic Rebound
- Strike-Slip/Transform Fault
- Magnetic Field
- Tectonic Earthquake
- Epicenter
- Seismic Waves
- P/S Waves
- Seismograph
- Liquefaction
- Richter Scale
- Shield Volcano
- Cinder Cone Volcano
- Composite Volcano
- Magma
- Lava
- Viscosity
- Pyroclastic Flow
- Hot Spot
- Dormant
- Active
- Vent
- Caldera
- Ring of Fire
- Explosive Eruption
- Nonexplosive Eruption
- Confining Pressure
- Compressional Stress
- Tensional Stress

- Shear Stress
- Orogeny
- Isostasy
- Chemical Weathering
- Physical (Mechanical) Weathering
- Erosion
- Exfoliation
- Talus
- Regolith
- Runoff
- Soil Horizon
- A Horizon
- B Horizon
- C Horizon

Predictable Misconceptions:

- Rocks form via different mechanisms – there can be variations within each type of mechanism
- The major differences between rocks and minerals
- Fossils can form in a variety of conditions and environments
- The location of a volcano and the type of magma determines the eruption type
- There are different mechanisms that erode materials

Students Will Be Able To…

- Explain the difference between a rock and a mineral
- Understand the different stages of the rock cycle and the types and characteristics of the rocks that are created
- Understand the different types of plate boundaries and provide examples
- Explain the process of plate tectonics – how the plates move, the rate at which they move, and the evidence behind it
- Discuss how the plate boundary determines the different type of volcano or earthquake that can potentially occur
- Describe the process that occurs in creating fossils
- Understand the carbon cycle and explain how human activity has affected it
- Provide evidence for why the Earth is not growing in size even though new ocean seafloor is being created at the Mid-Atlantic Ocean Ridge
- Understand the mechanisms behind volcanic eruption and earthquakes and the scales used to measure them

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

- The Geosphere
    - The rock cycle
    - Plate tectonics

- Erosion and deposition
- Fossils and dating
- The carbon cycle

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 Materials
- National Aeronautics and Space Administration (NASA) Materials
- United States Geological Survey (USGS) Materials
- Delaware Geological Survey (DGS) Materials
- NJDEP – Geological and Water Survey (NJDEP-GWS) Materials
- Woods Hole Oceanographic Institute (WHOI) Materials
- Bureau of Ocean Energy Management (BOEM) Materials
- American Geophysical Union (AGU) Materials
- Rutgers University Department of Earth and Planetary Science (RUDEPS) Material