6.4 Plate Tectonics

Content Area: **Science**
Course(s):
Time Period: **Marking Period 3**
Length: **6 weeks**
Status: **Published**

Course Pacing Guide

Unit	MP/Trimester	Weeks
Intro to MS Science and Light	1	5
Thermal Energy	1	8
Weather and Climate	2	9
Plate Tectonics	2, 3	6
Natural Hazards	3, 4	6
Cells and Systems	4	8

Unit Overview

In this unit, students are presented with Himalayan earthquake data that shifted Mt. Everest suddenly to the southwest direction. Students also discover that Mt. Everest is steadily moving to the northeast ever year and getting taller as well. Students wonder what could cause an entire mountain to move - all the time in one direction and backwards during an earthquake. Students investigate other locations that are known to have earthquakes and they notice landforms, such as mountains and ridges that correspond to the earthquake patterns. They read tests, explore earthquake and landform patterns using a data visualization tool and study GPS data at these locations. They realize the land in these places is moving in different directions, leaving students to wonder how the surface of the Earth could move. Students develop an Earth model and study mantle convection motion to explain how Earth's surface could move from processes below the surface. From this, students develop models to explain different ways plates collide and spread apart, ultimately explaining how Mt. Everest could move all the time in one direction, and also suddenly, in a backward motion, during an earthquake. Students find out that climbers on Mt. Everest found evidence of marine fossils near the top of the mountain. Using ideas from plate tectonics and uplift, along with ideas about how fossils form, how they are uplifted and how they are exposed through weathering and erosion, students develop a time series model that traces a marine fossil from an ancient sea bed to the top of the world's highest peak. Students explain how ancient rock layers and fossils were exposed over time by weathering and erosion.

Enduring Understandings

- Rock formations and the fossils they contain are used to establish relative ages of major events in Earth’s history.
- The geologic time scale interpreted from rock strata provides a way to organize Earth’s history.

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.
- Energy drives the process that results in the cycling of Earth's materials.
- The processes of melting, crystallization, weathering, deformation, and sedimentation act together to form minerals and rocks through the cycling of Earth's materials.
- All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems.
- Energy flowing and matter cycling within and among the planet's systems derive from the sun and Earth's hot interior.
- Geoscience processes have changed Earth's surface at varying time and spatial scales.
- Geoscience processes shape local geographic features.
- The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years.
- Interactions among Earth's systems have shaped Earth's history and will determine its future.
- Tectonic processes continually generate new sea floor at ridges and destroy old sea floor at trenches.
- Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.
- The distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of past plate motions.
- Similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches) provide evidence of past plate motions.

Essential Questions

- How are patterns in earthquakes similar or different in locations around the world?
- Why do earthquakes happen in specific patterns around the world?
- What are plates?
- What is below Earth's plates?
- How are the plates moving?
- How much have the plates moved near Mt. Everest?
- How does plate movement explain movement at Mt. Everest and other places in the world?
- Why do volcanoes form in some plaaces?
- How do the mantle and plates interact to explain earthquakes and landforms at locations on Earth's surface?
- How could a fossil get to the top of Mt. Everest?
- How do fossils form?
- Why is there so little ancient seafloor left on the top of Mt. Everest?
- How did a marine fossil get to the top of Mt. Everest?

New Jersey Student Learning Standards (No CCS)

SCI.MS-ESS1-4	Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
SCI.MS-ESS2-3	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
SCI.MS-ESS2-2	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
SCI.MS-ESS3-1	Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
SCI.MS-ESS2-1	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

Interdisciplinary Connections

LA.RI.6.1	Cite textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.
LA.RI.6.7	Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.
LA.RI.6.9	Compare, contrast and reflect on (e.g., practical knowledge, historical/cultural context, and background knowledge) one author's presentation of events with that of another (e.g., a memoir written by and a biography on the same person).
LA.W.6.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
MA.6.EE.B.6	Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

Technology Standards

TECH.8.1.8.A.2	Create a document (e.g., newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.
TECH.8.1.8.A.CS2	Select and use applications effectively and productively.

21st Century Themes/Careers

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.

CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Instructional Strategies & Learning Activities

- Developing a Driving Question Board and Ideas for Investigation
- Creating an initial model
- Using Seismic Explorer Simulator (data visualization tool)
- Analyzing graphical displays of earthquake and topographic data
- Integrating quantitative scientific information in written text with data in an earthquake vivsualization
- Analyzing and interpreting GPS data to provide evidence for patterns in speed and direction of plate movements
- Developing models to represent structure, composition and temperature patterns found in Earth's plates
- Critically reading scientific text
- Revising model to represent what is below the surface of Earth
- Applying mathematical concepts (rates, ratio, proportion) to measure and calculate how far two points on Earth's plates moved over certain amounts of time
- Use graphical, cross-section displays of large earthquake data to identify patterns
- Construct an explanation using models

Differentiated Instruction

Examples may include:

- Curriculum Mapping
- Inquiry/Problem-Based Learning
- Learning preferences integration (visual, auditory, kinesthetic)
- Sentence & Discussion Stems
- Tiered Learning Targets
- Meaningful Student Voice & Choice
- Relationship-Building & Team-Building
- Self-Directed Learning
- Mastery Learning (feedback toward goal)
- Grouping
- Rubrics
- Learning Menus
- Jigsaws
- Flipped Classroom
- Assessment Design & Backwards Planning

Formative Assessments

Include, but are not limited to:

- Scientist Circle
- Science notebooks
- Quick Writes & Checks for Understanding
- Claim, Evidence, Reasoning (CER)
- Lab Investigations
- Plate Boundary Presentations

Summative Assessment

Students will complete two summative assessments, at the mid-point and at the end of this unit.
The mid-point assessment asks students to transfer their understanding of the interactions at plate boundaries to an expanded scenario to make predictions about the patterns of landforms and earthquakes at a plate boundary. The end-of-unit summative assessment gives students the opportunity to use the three dimensions to make sense of a different phenomenon. This task focuses on a comparison of two mountainous regions in the US to compare rates of erosion and uplift and the impact on mountains and the application of ideas to explain how fossils can be found on the side of a cliff in the Rocky Mountains.

Benchmark Assessments

- Fall/Winter LinkIt Assessments

Resources & Technology

- Student access to computers/ipads for research and recording
- Digital projector for presentations

BOE Approved Texts

N/A

Closure

Individual classes and lessons will end with a closure activity that reinforces what students figured out during class, and helps navigate toward next steps.
Closure activities may include:

- Scientists' Circle
- Post-it reflection
- Google form exit ticket
- Group performance reflection
- Science notebook jot

ELL

- Alternate Responses
- Advance Notes
- Extended Time
- Teacher Modeling
- Simplified Written and Verbal Instructions
- Frequent Breaks
- Google Translate

Special Education

Accomodations will be made in accordance with students' IEPs. The following list provides examples:

- Shorten assignments to focus on mastery of key concepts.
- Substitute alternatives for written assignments (clay models, posters, panoramas, collections, etc.)
- Keep workspaces clear of unrelated materials.
- Provide a computer for written work.
- Seat the student close to the teacher or a positive role model.
- Provide an unobstructed view of the chalkboard, teacher, movie screen, etc.
- Keep extra supplies of classroom materials (pencils, books) on hand.
- Maintain adequate space between desks.
- Give directions in small steps and in as few words as possible.
- Number and sequence the steps in a task.
- Have student repeat the directions for a task.
- Provide visual aids.
- Go over directions orally.
- Allow the student to complete an independent project as an alternative test.
- Show a model of the end product of directions (e.g., a completed math problem or finished quiz).

- Stand near the student when giving directions or presenting a lesson.
- Mark the correct answers rather than the incorrect ones.
- Use a pass-fail or an alternative grading system when the student is assessed on his or her own growth.

504

Examples of accommodations in 504 plans include but are not limited to:

- preferential seating
- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits

At Risk

Examples may include:

- Have student restate information
- Provision of notes or outlines
- Concrete examples
- Assistance in maintaining uncluttered space
- Weekly home-school communication tools (notebook, daily log, phone calls or email messages)
- Peer or scribe note-taking
- Use of manipulatives
- Follow a routine/schedule
- Teach time management skills
- Verbal and visual cues regarding directions and staying on task
- Adjusted assignment timelines
- Visual daily schedule
- Immediate feedback
- Work-in-progress check
- Pace long-term projects
- Film or video supplements in place of reading text
- Cue/model expected behavior
- Use de-escalating strategies
- Use peer supports and mentoring
- Have parent sign homework/behavior chart
- Chart progress and maintain data

Gifted and Talented

Examples may include:

- Offer choice
- Speak to Student Interests
- Allow G/T students to work together
- Tiered learning
- Focus on effort and practice
- Encourage risk taking