Unit 3: Plate Tectonics 

Storyline: Once the Earth formed it began to cool. Differentiated layers formed due to different densities of Earth's materials. Dense metals of Iron and Nickel formed the Earth's core while less dense silicates formed the mantle and outer crust. Evidence for the Earth's layers come from seismograph recordings of P and S-waves that travel through the Earth after an earthquake. Once the Earth cooled and the layers formed, Plate Tectonics started forming the land and ocean features such as mountain ranges, ocean trenches, mid-oceanic ridges, trenches, and islands. Evidence of plate tectonics can be found on the ocean floor by evaluating the age of the ocean floor and magnetic field reversal patterns as well as earthquakes patterns at oceanic trenches. Plate tectonics is caused by the convection of the mantle driven by Earth's internal heat.

Phenomenon

1: Seismic waves do not travel in a straight line through the Earth.
2: The continents of the Earth have moved slowly throughout Earth's History

Estimated Time: 4 Weeks (20 45-min Lessons)

Standards

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-ESS2-1 Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features
HS-ESS2-3- Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

Cross-Cutting Concepts

Patterns Empirical evidence is needed to identify patterns.
Stability and Change Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.
Energy and Matter Energy drives the cycling of matter within and between systems

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise.

Practices

Engaging in Argument from Evidence
Developing and Using Models
Scientific Knowledge is Based on Empirical Evidence

Big Question

How did Earth's major continental and ocean landform form?

Suggested Lesson Sequence with Essential Questions

Phenomenon 1: Seismic waves do not travel in a straight line through the Earth.

Lesson 1: What happens to Energy released from an Earthquake?
Lesson 2: Using evidence from seismic waves, what is the internal structure of the Earth? 3 45- min lessons
Lesson 3: How is the Earth's interior structured
Lesson 4: Create a model of Earth's Internal Structure SUMMATIVE

Phenomenon 2: The continents of the Earth have moved slowly throughout Earth's History

Lesson 1: What is Pangea and what evidence do we have to support it?
Lesson 2: Identifying Plate Boundaries
Lesson 2: Evidence from the seafloor I (Magnetic reversals and age of seafloor, Mid-oceanic ridges) and Seafloor spreading
Lesson 3: Evidence from seafloor II Subduction zones
Lesson 4: Evidence from the continent-Mountain ranges, Cratons
Lesson 5: Earth's Internal Heat and Convection in the mantle
Lesson 6: Writing your Claims, Evidence, and Reasoning for the movement of Earth's plates.

Assessment

Create a model for Earth's Internal Structure (Layers of the Earth)
Claims, Evidence, Reasoning movement of Earth's Plates

OpenSource Textbook CK-12 Lessons

Phenomenon 1

7.6 Earthquakes
7.16 Earthquakes Magnitude Scales
7.11 Seismic Waves
7.14 Measuring Earthquake Magnitude
3.11 Earth's Layers
3.14 Earth's Core

Phenomenon 2

6.1 Continental Drift
6.2 Wegener and the Continental Drift Hypothesis
6.7 Earth's Tectonic Plates
3.12 Earth's Crust
6.3 Magnetic Polarity Evidence for Continental Drift
6.4 Bathymetric Evidence for Seafloor Spreading
6.5 Magnetic Evidence for Seafloor Spreading
6.6 Seafloor Spreading Hypothesis

6.8 Divergent Plate Boundaries in the Oceans
6.9 Divergent Plate Boundaries
6.11 Ocean Continent Convergent Plate Boundaries
6.12 Ocean Ocean Convergent Plate Boundaries
6.13 Continent Continent Convergent Plate Boundaries
3.15 Lithosphere and Asthenosphere
3.13 Earth's Mantle

Standards, Cross-Cutting Concepts, and Practices from https://www.nextgenscience.org/