



Clarifying the HS Science Content Expectations

Discipline Earth Science

Unit # 1 Name Organizing Principles of Earth Science

Big Idea(s) – What is the core concept?

Process, events and features on Earth result from energy transfer and movement of matter through interconnected Earth systems.

Standard(s)

E2 – Earth Systems

Content Statement(s)

E2.1 Earth Systems Overview

E3 – The Solid Earth

E3.3 Plate Tectonics Theory

E4 – The Fluid Earth

E5.3 Earth History and Geologic Time

Content Expectations (content statement clarification)

E2.1B – Analyze the interactions between the major systems (geosphere, atmosphere, hydrosphere, biosphere) that make up the Earth.

Clarification – Students will understand that interactions take the form of energy transfer and movement of matter.

E2.1C – Explain, using specific examples, how a change in one system affects other Earth systems.

Clarification – Students will be able explain using specific examples that the biogeochemical cycles of carbon and nitrogen illustrates how systems affect each other.

E2.3A – Explain how carbon exists in different forms such as limestone (rock), carbon dioxide (gas), carbonic acid (water), and animals (life within Earth systems) and how those forms can be beneficial or harmful to humans.

Clarification – none

E2.3c – Explain how the nitrogen cycle is part of the Earth system.

Clarification – none

E2.3d – Explain how carbon moves through the Earth system (including the geosphere) and how it may benefit (e.g., improve soils for agriculture) or harm (e.g., act as a pollutant) society.

Clarification – none

E3.3B – Explain why tectonic plates move using the concept of heat flowing through mantle convection, coupled with the cooling and sinking of aging ocean plates that results from their increased density.

Clarification – Students will understand that heat transfer in the geosphere drives plate movement. Plate tectonics is a result of the connection between processes in Earth's mantle and surface features which are in part expressions of the plates and plate boundaries.

Vocabulary – what vocabulary is needed for this unit?

atmosphere	hydrosphere	plate movements
biogeochemical cycles	lithosphere	plate tectonics theory
biosphere	mantle	subduction zones
carbon cycle	mantle convection	tectonic plates
chemical processes	mid-ocean ridges	transforming matter a/or energy
continental plates	mountain belts	upper mantle
core	mountain building	volcanoes
crust	nitrogen cycle	
Earth Systems Science	oceanic plates	
earthquakes	physical processes	
geosphere	plate boundaries	

Real World Context – what are the connections to the real world from this unit?

ex - Earth science is an umbrella term for the scientific disciplines of geology, meteorology, climatology, hydrology, oceanography, and astronomy.

Earth systems science has given an improved, interdisciplinary perspective to researchers in fields concerned with global change, such as climate change and geologic history.

Plate tectonics is the unifying theory of geology and helps explain all features and processes in the geosphere.

Large quantities of carbon dioxide can be taken in by the Earth's plants, algae, and also remain dissolved in ocean water. The carbon cycle is a biogeochemical cycle that quantifies the movement of carbon through the four major Earth systems. Carbon dioxide is a major greenhouse gas that makes Earth warm enough to sustain life as we know it. Human industrialization has dramatically increased the percentage of carbon dioxide in the atmosphere, making the Earth warmer and altering the climate system...

Instruments, Measurement and Representations

Diagrams depicting the interactions of Earth's major systems.

Diagrams of carbon cycle, nitrogen cycle, and water cycle.

Diagrams and models of the cross section of the Earth showing layers of the Earth, plates, and plate boundaries.

Samples of the different forms of carbon and nitrogen.

Global and regional maps showing tectonic plates.

Instructional Examples – student work

i. Inquiry

CE: E1.1A, E2.4B

Students investigate current environmental issues related to Earth science and generate research questions that would be important to pursue in their own community or region. (could be a type 3 paper☺)

ii. Reflection

CE: E1.2E

Students investigate the research questions Earth scientists pursue and how they relate to career paths within the Earth sciences.

iii. Enrichment

CE: E2.3A

Students develop games which will be used by younger students to help them understand the various ways carbon (or nitrogen) moves through the Earth systems.

iv. General

CE: E2.3A

Students carry out a series of lab explorations where they replicate or simulate a variety of conversions of carbon from one form to another (e.g., crushing shells and gluing them together like formation of limestone; pouring acid on limestone and testing the acidity or alkalinity of the liquid collected; bubble carbon dioxide through water and test the pH of the water; etc.)

v. Intervention

CE: E2.3A

Through class discussion, students build a diagram or concept map showing the various ways carbon moves through the Earth system. Have students copy the diagram in their notebooks.