*Unit 2 Climate, Waves, Tides & Currents

Content Area: **Science**
Course(s): **Marine Environmental Science**
Time Period: **September**
Length: **22 blocks**
Status: **Published**

Performance Expectations (Transfer Skills)

PS1-4	Use mathematical representations to support a claim regarding relationships among the frequency, wa
PS3-1	Create a computational model to calculate the change in the energy of one component in a system wh flows in and out of the system are known.
PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy i
PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wa
PS4-5	Communicate technical information about how some technological devices use the principles of wave capture information and energy.
LS2-2	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surf
ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks th
ESS2-3	Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal co
ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in

Enduring Understandings

-Matter cycles and energy flows in abiotic marine systems

-Abiotic processes often follow natural patterns that can be used to make preditions.

-Human impact can sometimes affect and alter natural patterns.

Essential Questions

-To what extent is weather impacted by humans?

-If energy is neither created nor destroyed, where does it go?

Disciplinary Core Ideas (Content)

ESS1.B: Earth and the Solar System

- Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. *(secondary to HS-ESS2-4)*

ESS2.A: Earth Materials and Systems

- Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HS-ESS2-2)

- Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior. (HS-ESS2-3)
- The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. (HS-ESS2-4)

ESS2.B: Plate Tectonics and Large-Scale System Interactions

- The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection. (HS-ESS2-3)

ESS2.D: Weather and Climate

- The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. (HS-ESS2-2)(HS-ESS2-4)
- Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (HS-ESS2-4)

LS2.A: Interdependent Relationships in Ecosystems

- Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.

PS4.A: Wave Properties

- The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing.

PS3.D: Energy in Chemical Processes

- Solar cells are human-made devices that likewise capture the sun's energy and produce electrical energy. *(secondary)*

PS4.A: Wave Properties

- Information can be digitized (e.g., a picture stored as the values of an array of pixels); in this form, it can be stored reliably in computer memory and sent over long distances as a series of wave pulses.

PS4.B: Electromagnetic Radiation

- Photoelectric materials emit electrons when they absorb light of a high-enough frequency.

PS4.C: Information Technologies and Instrumentation

- Multiple technologies based on the understanding of waves and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them.

PS3.A: Definitions of Energy

- At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy.

PS3.D: Energy in Chemical Processes

- Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment.

ETS1.A: Defining and Delimiting an Engineering Problem

- Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. *(secondary)*

PS3.A: Definitions of Energy

- Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms.

PS3.B: Conservation of Energy and Energy Transfer

- Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system.

- Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems.
- Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior.
- The availability of energy limits what can occur in any system.

PS4.A: Wave Properties

- The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing.

Science & Engineering Practices (Skills)

The eight science and engineering practices should be integrated in to learning opportunities where appropriate.

1. Asking questions (for science) and defining problems (for engineering)

2. Developing and using models

3. Planning and carrying out investigations

4. Analyzing and interpreting data

5. Using mathematics and computational thinking

6. Constructing explanations (for science) and designing solutions (for engineering)

7. Engaging in argument from evidence

8. Obtaining, evaluating, and communicating information

Crosscutting Concepts (Themes that transcend all Science)

Energy and Matter

- Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. (HS-LS2-4)

Stability and Change

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-ESS2-7)

Resources

Pearson Text

Lesson 8. Seasons of Change (PS4-5)

Lesson 9. The Sea Surface: The Great Energy Distributor (PS3-3)

Lesson 10: Energy and the Ocean (LS2-2, ESS2-3)

Lesson 11:Weather Climate the Ocean (ESS2-4, ESS2-2)

Lesson 23: The Oceans Waves (PS4-1)

Lesson 24: A Time for Tides (PS4-1)

Lesson 33: Changing Climate (PS1-4, PS3-1, LS2-2)

Assessments

Formative Evidence:

- Knowledge acquisition will be assessed for via
  - Pre-assessment
  - Informal discussion
  - Quizzes with reflections
  - Conferences with summary sheets
- Feedback on skills, practices, & progress toward attaining the level of mastery needed to complete the performance task will be provided via
  - Conferences with summary sheets
  - Peer feedback forms

- Self assessments and reflections

Standards

SCI.9-12.5.3	Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems.
SCI.9-12.CCC.7.1	students understand much of science deals with constructing explanations of how things change and how they remain stable. They quantify and model changes in systems over very short or very long periods of time. They see some changes are irreversible, and negative feedback can stabilize a system, while positive feedback can destabilize it. They recognize systems can be designed for greater or lesser stability.
SCI.9-12.SEP.5.b	Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
SCI.9-12.SEP.7.d	Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.