Unit 04: Physical Oceanography: Waves, Tides, Currents, & Weather's Influence

Content Area: **Science**
Course(s):
Time Period: **Marking Period 1**
Length: **3 weeks**
Status: **Published**

Brief Summary of Unit

Students will learn the causes of waves, tides, and currents. They will also learn the characteristics of each and the ways they can vary and change. Students will explore and learn about severe weather patterns that affect many different fisheries, how weather is affected by ocean currents, and how these processes are impacted by climate change.

June 2024

Essential Questions

Essential Questions:

How do physical oceanographic factors shape our coastlines and what are these factors?

How do physical oceanographic factors affect our weather patterns?

Why are coastal tidal cycles variable throughout the world and what influences do they have on marine life?

What are the major currents of the world, how are they created, what effects do they have?

Enduring Understandings:

Global weather is a direct function of oceanic and geologic processes.

Tides and ocean currents are influenced by different forces.

Tides and ocean currents significantly impact biological and weather processes in the ocean.

Students Will Know / Students Will Be Able To

Students will know what causes tidal changes and identify the different types of tides.

Students will know the parts of an ocean wave and their influence on coastlines.

Students will know the major ocean currents of the world and their general directional flow patterns.

Students will know the properties of seawater and how it affects ocean dynamics.

Students will be skilled at determining how regional climates are regulated by ocean currents.

Students will be skilled at concepts of physical oceanography by defining the following key terms: wavelength, wave period, wave frequency, fetch, Coriolis Effect, El Nino, and upwelling.

Learning Plan

Meaningful participation in guided question/answer sessions, individual/group discussions, demonstrating an understanding of the purpose of the unit lesson(s), key terms, and concepts.

Preview the essential questions, provide answers, and connect to learning throughout the unit.

Google Slides Presentation: Waves & Tides

Activity: Calculating Wave Properties of Tsunami Waves

Activity: Analyzing Tidal Elevations from a Tide Table

Activity: Comparing Various Tidal Changes

Google Slides Presentation: Currents

Coriolis Activity - Labeling Earth's currents and world weather effects.

Experiment: Determining the Salinity of Seawater

Experiment: Characteristics & Properties of Seawater

Google Slides Presentation: El Nino with built-in activities.

Optional Video: Chasing El Nino - worksheet and discussion

Reflect on previous knowledge of water density and apply learned knowledge to currents.

Exploring El Nino and Severe Weather Events: How Climate change has impacted ocean circulation and damage from hurricanes. Students will research the regularity and severity of major storms over time and use an online simulator to observe the changes climate change can have on El Nino events and ocean circulation

Evidence / Performance Tasks

Formative Assessments:

Worksheets

Do Nows

Exit Tickets

Class Discussions

Complete daily classwork and regular homework assignments related to the identification of concepts learned in the natural setting, vocabulary, problem solving, and critical thinking.

Assessment on how tides are caused by the gravitational pull of the moon and the sun & how certain tides form when the moon and sun are in certain positions in reference to earth.

Quizzes

Summative:

Evaluation of acquired knowledge and competency in learned topics through quizzes, tests.

Unit test on El Nino & La Nina weather phenomena cycles and how it affects global ocean currents and other effects on earth.

Bench Marks:

Benchmark assessment on how the major currents of the world are largely responsible for local weather patterns.

Benchmark assessment on how salinity and temperature affects the density of seawater.

Midterm and Final Exams

Alternative:

Create a demonstration of a property of water, create a research paper on how certain plants and animals are adapted to tides and salinity, read a current event article related to El Nino or La Nina.

Materials

Textbook, *Essentials of Oceanography (13th Ed.), Trujillo and Thurman and ancillary materials*

Earth Science, Merrill, and ancillary resource materials

Earth Science, Prentice-Hall, and ancillary resource materials

quantitative/qualitative lab equipment for activities, experiments

related oceanography maps, ocean current charts

Informational & interactive Website: noaa.gov

Standards

L.SS.11–12.1	Demonstrate command of the system and structure of the English language when writing or speaking.
S.ID.A	Summarize, represent, and interpret data on a single count or measurement variable
P.3	Consider the environmental, social and economic impacts of decisions.
9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
L.KL.11–12.2	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
S.ID.B	Summarize, represent, and interpret data on two categorical and quantitative variables
	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
L.VL.11–12.3	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, including technical meanings, choosing flexibly from a range of strategies.
S.ID.C	Interpret linear models
L.VI.11–12.4	Demonstrate understanding of figurative language, word relationships, and nuances in word meanings, including connotative meanings.
S.IC.A	Understand and evaluate random processes underlying statistical experiments
RL.CR.11–12.1	Accurately cite strong and thorough textual evidence and make relevant connections to strongly support a comprehensive analysis of multiple aspects of what a literary text says explicitly and inferentially, as well as interpretations of the text; this may include determining where the text leaves matters uncertain.
S.IC.B	Make inferences and justify conclusions from sample surveys, experiments, and observational studies

RI.CR.11–12.1	Accurately cite a range of thorough textual evidence and make relevant connections to strongly support a comprehensive analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text.
S.CP.A	Understand independence and conditional probability and use them to interpret data
	Digital tools such as artificial intelligence, image enhancement and analysis, and sophisticated computer modeling and simulation create new types of information that may have profound effects on society. These new types of information must be evaluated carefully.
	In order for members of our society to participate productively, information needs to be shared accurately and ethically.
W.AW.11–12.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
W.IW.11–12.2	Write informative/explanatory texts (including the narration of historical events, scientific procedures/experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
	Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.
	Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.
HS-PS1-5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
W.NW.11–12.3	Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.
SL.PE.11–12.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
SL.II.11–12.2	Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.
SL.PI.11–12.4	Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
HS-PS3-4	Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
HS-LS2-2	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2-3	Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
HS-LS2-4	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the

	environment and biodiversity.
HS-LS4-2	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
HS-LS4-3	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
HS-ESS1-6	Apply scientific reasoning and evidence from ancient Earth 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 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 changes to other 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 systems 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-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems 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 climate change have influenced human activity.
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 activities on climate change and other 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 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 (i.e., climate change).

Suggested Strategies for Modification

https://docs.google.com/spreadsheets/d/1BoXlgGboaurkHWyNqQpnIzl77z6Lb7Dg_ExD7n7FQJw/edit?usp=sharing

Additional modifications may be made based on individual needs of students as stated in student IEP (Individualized Education Program) documentation and as observed by the teacher:

Student directed research/presentation (power point, skit, demonstration) - Recent Scientific Contributions.

Design your own lab experiment

modified tests

cooperative learning groups

one-to-one instruction and assistance

additional time on task

alternative outcome options

individualized student assessment

preferential seating

handouts of class materials

guided notes

visual aides

computer web search