Washington Township School District

The mission of the Washington Township Public Schools *is to provide a safe, positive, and progressive educational environment that provides opportunity for all students to attain the knowledge and skills specified in the NJ Learning Standards at all grade levels, so as to ensure their full participation in an ever-changing world as responsible, self-directed and civic-minded citizens.*

Course Title:	CP Marine Biology

Grade Level(s):	HS 11th and 12th

Duration:	*Full Year:*	X	*Semester:*		*Marking Period:*	
Course Description:	In this course students will be exposed to the physical and biological factors to the world's ocean as well as methodology scientists use to study them and how human behavior both on land and at sea impact the physical and biological factors of the world's ocean and how the ocean impacts the Earth as a whole. During this course the students will study marine history, water, oceanography, life processes in the ocean, forms of life in the ocean, movement in the ocean, and human impact. As part of this course there will be a variety of activities, readings, multimedia presentations, laboratory investigations and dissections to fully immerse the students in the ocean.					
Grading Procedures:	Tests – 35% Lab Work – 25% Quizzes – 20% Homework/Classwork – 10% Project/Term Paper – 10% (one per MP)					
Primary Resources:	Next Generation Science Standards NGSS New Jersey Student Learning Standards NJSLS Schuster, G. & Marrero, M (2011). *Marine Science: The Dynamic Ocean.* Indianapolis, IN: Pearson Education					

Washington Township Principles for Effective Teaching and Learning

- Implementing a standards-based curriculum
- Facilitating a learner-centered environment
- Using academic target language and providing comprehensible instruction
- Adapting and using age-appropriate authentic materials
- Providing performance-based assessment experiences
- Infusing 21st century skills for College and Career Readiness in a global society

Designed by:	Karen Nowicki

Under the Direction of:	Dr. Patricia Hughes

Written: July 2017

Revised: _____

BOE Approval: _____

Unit Title: Introduction to Marine Science

Unit Description: In this unit, the students will be introduced to marine science, ecosystems, properties of water, history of the ocean and human interaction with the ocean and technology we use to study the ocean. They will conduct investigations and analyze data associated with marine ecosytems, marine history, and the variety of organisms that inhabit the ocean. They will also investigate the ways humans have utilized and studied the ocean throughtout our history.

Unit Duration: 6 weeks

Desired Results

Standard(s) (related to lessons within textbook):

Diving into Ocean Ecosystems - HS-LS2-3

Water on Earth - HS-ESS2-5, HS-PS1-5

More About Water - HS-ESS2-5, HS-PS1-3

The Ocean Over Time - HS-ESS3-1, HS-ESS3-4

Migrations in the Sea - HS-PS4-5, HS-PS4- 2

Indicators:

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

ESS2.C: The Roles of Water in Earth's Surface Processes

PS1.B: Chemical Reactions

PS1.A: Structure and Properties of Matter

ESS3.A: Natural Resources

ESS3.C: Human Impacts on Earth Systems

PS4.A: Wave Properties

Understandings:

Students will understand that…

- The ocean is not homogenous and oceanic ecosystems have a variety of abiotic and biotic factors determining their characteristics as well as human interaction
- Water has different densities based on different characteristics
- Water's unique properties affect marine organisms
- Salt water is created through natural processes
- Humans and the ocean have a long and varied history
- Organisms move around the ocean
- Humans use different technology to map organisms in the ocean

Essential Questions:

1. What is an ecosystem?
2. How are oceanic ecosystems different and impacted by humans?
3. How does temperature, pressure, and salinity affect water density?
4. How does water's unique properties create seawater?
5. How has the ocean changed over time?
6. How has the interaction between ocean and human changed over time?
7. How do organisms move in the ocean and how to do humans track them?

Assessment Evidence

Performance Tasks:

- Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
- Plan and investigate of the properties of water and its effects on Earth materials and surface processes.
- 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.

Other Evidence:

1. *Reading and Writing Assignments*
   Summer Assignment
   Animal Migration Plotting
   Fish Migration with COOL Classroom
   Ocean history Timeline
   Marine History Project
2. *Quizzes*
   Ecosystem Basics Quiz
   Water Quiz

• Plan and investigate to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. • Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. • Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. • Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.	Ocean History Quiz 3. *Laboratory Activities* Marine Ecosystems Activities Solutions and investigating surface tension labs Water Phase Change Lab Water Density Labs Marine Algae Observation 4. *Unit Tests* Ecosystem and Water Test Ocean History and Migrations Test

Benchmarks: Water Density Lab

Learning Plan

Learning Activities:

1. Diving Into Ocean Ecosystems
"Ocean World" episode of Blue Planet
Observation of Migration routes
Marine Ecosystem exploration activity
Ecosystem succession discussion of Whale Falls and Mangrove restoration projects
Ecosystem protection discussion of Marine Sanctuaries
Wrap Up using blackboard discussion board post for HW
Quiz
2. Water on Earth
Earth/Ocean Annimation video and discussion
Water Density Demonstration
Freezing, Melting, and Boiling Lab Activity
Atom, Molecule, Water Density Reading
Floating and Sinking Lab
Density and Marine Organisms Reading, Video and Dicsussion
Wrap Up using blackboard discussion board post for HW
3. More About Water
Water and Solutions Lab and Discussion
Water, Salt and Marine Organisms Reading
Osmoregulation reading and discussion
Investigating Surface Tension Lab
Wrap Up using blackboard discussion board post for HW
Quiz
4. Test – Ecosystems and Water
5. The Ocean Over Time
Marine History Project
Ocean History Time Line activity
Human Reliance on the Ocean Reading
Investigating Marine Algae in Consumer Products
Introduction to how scientists study the ocean reading/activity
Wrap Up using blackboard discussion board post for HW

6. Migrations in the Sea
Fish Migration COOL Classroom
Sea Turtle Tagging and Migration Video and Map Plotting Activity
Satellite Reading, Writing and Discussion
Wrap Up using blackboard discussion board post for HW
7. Test – Ocean History: Studying the ocean and migrations with technology

Resources: Text, online etools associated with text, blackboard, and laptops

Unit Learning Goal and Scale *(Level 2.0 reflects a minimal level of proficiency)*	
Standard(s): LS2.B: Cycles of Matter and Energy Transfer in Ecosystems: Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes.	
4.0	Students will be able to: • Model and explain how changes to matter or energy can affect the flow or cycling in ecosystems
3.0	Students will be able to: • Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions
2.0	Students will be able to: • Recognize or recall specific vocabulary: atoms, biomass, carbon, conserve, cycle, ecosystem, energy, flow, hydrogen, matter, molecule, nitrogen, organism, oxygen, store, transfer, trophic level • Describe how matter cycles and energy flows among organisms in an ecosystem
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ESS2.C: The Roles of Water in Earth's Surface Processes: The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.	
4.0	Students will be able to: • Determine how changes to conditions can affect water flow and impact on ocean and Earth's processes
3.0	Students will be able to: • Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
2.0	Students will be able to: • Recognize or recall specific vocabulary: advection, chemical, deposition, erosion, expansion, hydrologic cycle, interaction, moisture, property, solubility, system, transportation, and weathering • Describe how the properties of water affect Earth materials • Describe the relationship between the hydrologic and rock cycles
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): PS1.B: Chemical Reactions: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.	
4.0	Students will be able to: • Model and describe how changes to a reaction can affect ocean processes and marine life
3.0	Students will be able to: • 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.
2.0	Students will be able to: • Recognize and recall specific vocabulary: catalyst, data, energy, molecule, particle, rate, recombination of chemical elements, salinity, temperature, pressure, solubility, surface tension • Describe the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): PS1.A: Structure and Properties of Matter: The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.	
4.0	Students will be able to: • Model and describe the changes to water properties and ocean processes based on changes in salinity
3.0	Students will be able to: • Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
2.0	Students will be able to: • Recognize and recall vocabulary: atom, boiling point, ion, melting point, molecule, particle, strength, structure, surface tension, vapor pressure • Model the structures of various substances • Describe the relationship between particles
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ESS3.A: Natural Resources: Resource availability has guided the development of human society.	
4.0	Students will be able to: • Model how changes to ocean conditions, human activity, and resource abundance has changed over time and can continue to change
3.0	Students will be able to: • Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
2.0	Students will be able to: • Recognize and recall vocabulary: availability, climate, drought, erosion, flood, fresh water, human activity, hurricane, mass migration, population, sea level, severe weather, surface process, temperature, tsunami, volcanic eruption • Describe the relationship between the availability of natural resources, natural hazards, and changes in climate and human activity
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ESS3.C: Human Impacts on Earth Systems: Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.	
4.0	Students will be able to: • Model how scientific advancements has or will impact ocean processes
3.0	Students will be able to: • Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
2.0	Students will be able to: • Recognize and recall vocabulary: atmosphere, biomass, diversity, economic factor, empirical data, environmental factor, geoengineering, human activity, natural system, ozone, pollutant, resources • Summarize a technological solution for reducing the impact of human activities • Summarize the impacts of human activity on natural systems
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): 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.	
4.0	Students will be able to: • Model wave behavior and be able to accurately describe how waves move energy/information • Infer if any changes are made to wave properties how that can impact energy/information
3.0	Students will be able to: • Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
2.0	Students will be able to: • Recognize and recall vocabulary: communications technology, electricity, energy, information, solar cell, technical information, technological device, transmit, wave, wave behavior • Describe the use of waves and satellite technology to transmit and capture information and energy
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Unit Modifications for Special Population Students	
Advanced Learners	Enrichment Worksheets and Scenario Investigations
Struggling Learners	Use L1 Differentiated Instructional Support Explanations & Activities as guided by the textbook
English Language Learners	Use ELL Differentiated Instructional Support Explanations & Activities as guided by the textbook as well as any student specific ESL modification guidelines http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Learners with an IEP	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org
Learners with a 504	Refer to page four in the Parent and Educator Guide to

Section 504 to assist in the development of appropriate plans.	

Interdisciplinary Connections
Indicators: *Common Core Standards Connections* **ELA/Literacy** **RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. **RST.11-12.2** Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. **WHST.9-12.1** Write arguments focused on discipline-specific content. **WHST.9-12.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. **SL.11-12.5** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. **RST.11-12.8** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **RST-11.12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. **RST-11.12.8** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **WHST.11-12.8** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. **WHST.9-12.9** Draw evidence from informational texts to support analysis, reflection, and research. **RST.11-12.9** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **RST.9-10.8** Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. **RST.11-12.7** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **RST.11-12.9** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **Math** **MP.2** Reason abstractly and quantitatively. **MP.4** Model with mathematics. **HSN-Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN-Q.A.2** Define appropriate quantities for the purpose of descriptive modeling. **HSN-Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. **HSA-SSE.A.1** Interpret expressions that represent a quantity in terms of its context. **HSA-SSE.B.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. **HSA.CED.A.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. **HSN.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSA-CED.A.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. **HSF-IF.B.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. **HSS-ID.B.6** Represent data on two quantitative variables on a scatter plot, and describe how those variables are related. **HSS-ID.A.1** Represent data with plots on the real number line. **HSS-IC.A.1** Understand statistics as a process for making inferences about population parameters based on a random sample from that population. **HSS-IC.B.6** Evaluate reports based on data.

Integration of 21st Century Skills

Indicators:

The standards listed above and the performance tasks and activities that support them are infused with 21st Century Skills. The Level 3 skills listed in each of the Goals & Scales sections involve critical and creative thinking, communication and collaboration. The methods by which students attain these skills require that students practice multi-step problem solving, using technology to research and solve problems, and communicate results with their instructors and peers. The learning activities listed provide a mix of traditional classroom work and interactive, online experiences.

Science & Engineering Practices:

Asking Questions and Defining Problems
Using Mathematics and Computational Thinking
Analyzing and Interpreting Data
Developing and Using Models
Constructing Explanations and Designing Solutions
Obtaining, Evaluating and Communicating Information
Planning and Carrying Out Investigation

Cross-Cutting Connections:

Patterns
Cause and Effect
Energy and Matter
Stability and Change
Interdependence of Science, Engineering and Technology
Systems and System Models

Connections to Nature of Science:

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
Scientific Knowledge Assumes an Order and Consistency in Natural Systems
Influence of Science, Engineering, and Technology on Society and the Natural World

Unit Title: Oceanography

Unit Description: In this unit, the students will be introduced to chemical and physical processes that affect the ocean structure and chemical composition. Students will also investigate how these oceanographic principles affect organisms living in the ocean. Students will observe, investigate, and analyze physical characteristics and processes that make the ocean a diverse habitat for organisms.

Unit Duration: 7 weeks

Desired Results

Standard(s) (related to lessons within textbook):

Explore the Sea Floor - HS-PS4-5

The Formation of the Ocean - HS-ESS1-5, HS-ESS2-1, HSESS2-3,

Seasons of Change - HS-ESS2-1, HS-ESS2-4

The Sea Surface: The Great Heat Distributor - HS-PS3-2, HS-ESS2-4, HS-ESS2-5

Energy and the Ocean - HS-PS3-1, HS-PS3-2, HS-PS3-4

Weather, Climate and the Ocean - HS-ESS2-2

Voyage to the Deep - HS-ESS2-2

Indicators:

ESS1.C: The History of Planet Earth

ESS2.D: Weather and Climate

PS3.A: Definitions of Energy

ESS2.C: The Roles of Water in Earth's Surface Process

PS3.B: Conservation of Energy and Energy Transfer

PS3.D: Energy in Chemical Processes

PS4.A: Wave Properties

Understandings:

Students will understand that…

- The seafloor is varied
- Plate tectonics is responsible for forming the ocean
- Earth's rotation, air and water movement are responsible for seasons
- Ocean temperatures vary by location and season
- Ocean temperature is responsible for Earth's habitability
- Ocean temperature and water movement responsible for weather and climate
- Depth changes water chemistry

Essential Questions:

1. How did the ocean form?
2. How are plate tectonics responsible for seafloor formation?
3. How does earth's rotation and angle affect seasonality?
4. How does ocean temperature play a role in water movement, earth habitability, and organism distribution?
5. How does the ocean play a role in weather and climate?
6. How does depth change water conditions and organism distribution?

Assessment Evidence

Performance Tasks:

- Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
- 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.

Other Evidence:

1. *Reading and Writing Assignments*
   Ring of Fire video and questions
   El Nino mapping activity
   Ocean Helps Earth Support Life Laboratory Activity
   Analyzing Weather and Climate Data
   Exploring Evidence for Plate Tectonics
   Hurricanes and Oysters data analysis activity
   Sea Floor Spreading and Magnetic Anomalies Activity

• 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. • Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. • Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. • Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). • Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. • Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. • Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). • 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). • Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.	Superstorm Sandy Data analysis Sea Surface Temperature Map analysis *2.* *Quizzes* 3. *Laboratory Activities* Warm and Cold water convection currents Coriolis Effect Lab Modeling Changes in water temperature *4.* *Unit Tests* Seafloor and Formation of the Ocean Test Ocean Zones Test

Benchmarks: Coriolis Effect Lab

Learning Plan

Learning Activities:

1. Explore the Seafloor

Ring of Fire video and Qs

Build a Model of the Seafloor

Discussion of bathymetric imagery and how scienists study the sea floor

Wrap Up using blackboard discussion board post for HW

2. Formation of the Ocean

Discussion of Pangea

Plate Tectonics observations and discussion

Exploring Oceanic Evidence for Plate Tectonics
Mapping Magnetic Anamolies and Seafloor spreading data analysis
Wrap Up using blackboard discussion board post for HW
3. Seasons of Change
Modeling Sun's Rays and Seasons activities
Observing and identifying variation across the earth and how it relates to animal migration
Wrap Up using blackboard discussion board post for HW
4. Ocean Formation Test
5. Sea Surface: The Great Energy Distributor
SST Map Activities
El Nino Multimedia observation and discussion
Comparing Warm and Cold Water currents
AP Coriolis Effect Lab
Wrap Up using blackboard discussion board post for HW
6. Energy and the Ocean
Water's heat capacity discussion and lab
Connecting water/air movement and heat capacity to global climate patterns
Discussion of how energy transforms through ecosystems and how organisms rely on it
Wrap Up using blackboard discussion board post for HW
7. Weather, Climate, and Ocean
SST and Hurricane strength data analysis
Superstorm Sandy Data
Hurricanes and Oysters
Reading and discussion of features that affect the weather and climate
Wrap Up using blackboard discussion board post for HW
8. Voyage to the Deep
Volcanos of the Deep Video and Qs
Temperature, Pressure, Salinity, Density compared to Depth data plotting and analysis
Reading, data analysis and discussion of requirements for diving organisms through depth changes
Wrap Up using blackboard discussion board post for HW
9. Zonation in the Ocean Test

Resources: Text, online etools associated with text, blackboard, and laptops

Unit Learning Goal and Scale *(Level 2.0 reflects a minimal level of proficiency)*	
Standard(s): 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.	
4.0	Students will be able to: • Model wave behavior and be able to accurately describe how waves move energy/information • Infer if any changes are made to wave properties how that can impact energy/information
3.0	Students will be able to: • Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
2.0	Students will be able to: • Recognize and recall vocabulary: communications technology, electricity, energy, information, solar cell, technical information, technological device, transmit, wave, wave behavior • Describe the use of waves and satellite technology to transmit and capture information and energy
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ESS1.C: The History of Planet Earth: Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old.	
4.0	Students will be able to: • Model seafloor spreading • Model magnetic reversals and infer seafloor age
3.0	Students will be able to: • 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.
2.0	Students will be able to: • Recognize and recall vocabulary: age, ancient core, continental crust, crust plate movement, interaction, mid-ocean ridge, mountain building, ocean layer, oceanic crust, plate, plate boundary, plate collision, plate spreading, plate tectonics, sea-floor spreading • Summarize the theory of plate tectonics • Describe the relationship between movements of Earth's crust, rock age, and ocean formation/structure
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): 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.	
4.0	Students will be able to: • Describe and model how changes to human activity can cause positive and negative changes to Earth's climate and ocean processes • Determine how weather and climate changes impact ocean organisms
3.0	Students will be able to: • Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
2.0	Students will be able to: • Recognize and recall vocabulary: biosphere, circulation, climate change, distribution, Earth system, energy, flow, ice volume, orbit, precipitation, sea level, solar output, sea surface temperature, variation • Describe the flow of energy into and out of Earth systems • Describe the relationship between energy in Earth systems and changes in climate • Describe how changes in climate may occur over different lengths of time

1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): 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.	
4.0	Students will be able to: • Model the Ocean Conveyor Belt and how it effects both ocean and land systems
3.0	Students will be able to: • Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).
2.0	Students will be able to: • Recognize and recall vocabulary: conversion, energy, kinetic energy, macroscopic scale, molecular energy, motion, particle, position, thermal energy • Describe how energy results from the motion of particles • Describe how energy is stored in fields • Describe how the ocean moves energy around Earth
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ESS2.C: The Roles of Water in Earth's Surface Processes: The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.	
4.0	Students will be able to: • Determine how changes to conditions can affect water flow and impact on ocean and Earth's processes
3.0	Students will be able to: • Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
2.0	Students will be able to: • Recognize and recall vocabulary: advection, deposition, erosion, hydrologic cycle, interaction, rock cycle, solubility, system, transportation, weathering • Describe how the properties of water affect Earth materials
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): PS3.B: Conservation of Energy and Energy Transfer: Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems.	
4.0	Students will be able to: • Describe and model how changes to energy inputs can affect the ocean processes as well as life in the ocean
3.0	Students will be able to: • Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
2.0	Students will be able to: • Recognize and recall vocabulary: energy flow, gravitational field, kinetic energy, magnetic field, renewable energy, thermal energy • Describe how the energy in one system relates to a different system • Describe how energy changes and flow through earth's systems

1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): 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.	
4.0	Students will be able to: • Model how changes in ocean temperature are responsible for air and water movement
3.0	Students will be able to: • 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).
2.0	Students will be able to: • Recognize and recall vocabulary: closed system, energy change, energy distribution, second law of thermodynamics, thermal energy • Describe the key parts of the second law of thermodynamics • Describe how the second law of thermodynamics plays a role in the ocean as global temperature moderator
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ESS2.A: Earth Materials and Systems: Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.	
4.0	Students will be able to: • Determine how changes to ocean systems through human activity can impact ocean systems
3.0	Students will be able to: • Analyze geoscience data to make the claim that one change to the ocean's surface can create feedbacks that cause changes to other Earth systems
2.0	Students will be able to: • Recognize and recall vocabulary: atmospheric change, climate, erosion, glacial ice, global, feedback, surface system, temperature, transport • Describe how changes to the ocean surface results in changes to other Earth's systems
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Unit Modifications for Special Population Students	
Advanced Learners	Enrichment Worksheets and Scenario Investigations
Struggling Learners	Use L1 Differentiated Instructional Support Explanations & Activities as guided by the textbook
English Language Learners	Use ELL Differentiated Instructional Support Explanations & Activities as guided by the textbook as well as any student specific ESL modification guidelines http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Learners with an IEP	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include:

		• Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org
Learners with a 504	Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.	

Interdisciplinary Connections

Indicators: *Common Core Standards Connections*

ELA/Literacy

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

WST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

SL.11-12.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

RST-11.12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST-11.12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research.

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Math

MP.2 Reason abstractly and quantitatively.

MP.4 Model with mathematics.

HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.

HSA-SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

HSA-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

HSA-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

HSF-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

HSS-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how those variables are related.

HSS-ID.A.1 Represent data with plots on the real number line.

HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

HSS-IC.B.6 Evaluate reports based on data.

Integration of 21st Century Skills

Indicators:

The standards listed above and the performance tasks and activities that support them are infused with 21st Century Skills. The Level 3 skills listed in each of the Goals & Scales sections involve critical and creative thinking, communication and collaboration. The methods by which students attain these skills require that students practice multi-step problem solving, using technology to research and solve problems, and communicate results with their instructors and peers. The learning activities listed provide a mix of traditional classroom work and interactive, online experiences.

Science & Engineering Practices:

Asking Questions and Defining Problems
Using Mathematics and Computational Thinking
Analyzing and Interpreting Data
Developing and Using Models
Constructing Explanations and Designing Solutions
Obtaining, Evaluating and Communicating Information
Planning and Carrying Out Investigation

Cross-Cutting Connections:

Patterns
Cause and Effect
Energy and Matter
Stability and Change
Interdependence of Science, Engineering and Technology
Systems and System Models

Connections to Nature of Science:

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
Scientific Knowledge Assumes an Order and Consistency in Natural Systems
Influence of Science, Engineering, and Technology on Society and the Natural World

Unit Title: Life Processes in the Ocean

Unit Description: In this unit, the students will investigate how the chemical and physical processes previously discussed impact life in the ocean by looking at driving ecological interactions in ocean populations. Students will observe, investigate, and analyze the processes and interactions important for maintaining ecosystem biodiversity and health.

Unit Duration: 7 weeks

Desired Results

Standard(s) (related to lessons within textbook):

Photosynthesis in the Ocean - HS-LS1-5, HS-LS2-5, HS-ESS2-4, HS-ESS2-5.

Biodiversity in the Ocean - HS-LS1-1, HS-LS1-2

Marine Populations - HS-LS1-4, HS-LS2-1, HS-LS2-2, HS-LS2-6, HSLS2-8

Population Changes - HS-ESS2-7, HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-LS3-3, HS-LS2-2, HS-LS2-8

Food Webs in Action - HS-ESS2-6, HS-LS1-7, HS-LS2-3, HS-LS2-4

Indicators:

LS1.C: Organization for Matter and Energy Flow in Organisms

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

ESS2.C: The Roles of Water in Earth's Surface Processes

LS1.A: Structure and Function

LS1.B: Growth and Development of Organisms

LS2.A: Interdependent Relationships in Ecosystems

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

LS2.D: Social Interactions and Group Behavior

ESS2.E Biogeology

ESS2.D: Weather and Climate

LS4.A: Evidence of Common Ancestry and Diversity

LS4.B: Natural Selection

LS4.C: Adaptation

LS3.B: Variation of Traits

Understandings:

Students will understand that…

- Photosynthesis is important in the ocean
- Role biodiversity plays in aquatic ecosystems
- Population structure and change over time
- The Modern Synthesis
- Environmental and genetic factors play a role in evolution
- Natural selection is the mechanism for evolution
- Marine food webs
- Changes to food webs can cause a trophic cascade

Essential Questions:

1. What role does photosynthesis play in aquatic ecosystems?
2. What is biodiversity?
3. How do populations change over time?
4. What are food webs?
5. What are the biotic and abiotic factors that play a role in aquatic food webs?
6. What role does human impact play on food webs?

Assessment Evidence

Performance Tasks:

- Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

Other Evidence:

Reading and Writing Assignments

Analyzing Marine Population Characteristics

• Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. • Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. • Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. • Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. • Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. • Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. • Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. • Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. • 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. • Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce. • Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth. • Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. • 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. • 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. • Construct an explanation based on evidence for how natural selection leads to adaptation of populations.	Endangered Species Activities Marine Food Web Activities: Arctic, Estuary and Oceanic Shark Finning Videos and Discussion Discussion of Killer Whales and related trophic cascade in relation to sea otters and sea urchins Modeling changes over time in sea stars *Quizzes* Photosynthesis and Respiration Quiz Populations Quiz Food Webs Quiz *Laboratory Activities* Observing Photosynthesis Plankton Explorations *Unit Tests* Life Processes Test Populations and Interactions Test *Mid-Term*

• Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. • Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. • Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. • Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. • Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions • Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.	

Benchmarks: Food Web Project – Diagramming an oceanic food web, labeling with nutrient and energy flow

Mid-Term Exam

Learning Plan

Learning Activities:

1. Photosynthesis in the Ocean

Reading, Writing, and Discussion of photosynthesis
Carbon Cycle Activity
Chlorophyll sensing as a way to study photosynthetic activity in the ocean data analysis
Cellular Respiration activity and discussion
Wrap Up using blackboard discussion board post for HW
Quiz

2. Biodiversity in the Ocean

Biodiversity reading and discussion
Plankton: Tiny But Mighty Important activity
Field/Laboratory Investigation of Plankton
Wrap Up using blackboard discussion board post for HW

3. Test: Life Processes

3. Marine Populations

Data analysis and discussion of human population over time
Analyzing Marine populations – case studies investigating 3 different animal species
Data analysis of age strugture diagrams
Endangered species reading and discussion
Wrap Up using blackboard discussion board post for HW

4. Population Changes

Reading and discussion of cetacean evolutionary history
Modeling natural selection using sea star populations
Identifying and observing natural selection in action due to human impacts using invasive species

Wrap Up using blackboard discussion board post for HW
Quiz
5. Food Webs in Action
Open Ocean Food Web Activity
Tracing energy flow and nutrient cycling through food web activity and discussion
Analyzing changes to food webs based on human activity and discussion
Food Web Project
Wrap Up using blackboard discussion board post for HW
Quiz
6. Test: Populations and Interactions
7. Mid Term

Resources: Text, online etools associated with text, blackboard, and laptops

Unit Learning Goal and Scale *(Level 2.0 reflects a minimal level of proficiency)*	
Standard(s): LS1.C: Organization for Matter and Energy Flow in Organisms: The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen.	
4.0	Students will be able to: • Model and explain how changes to matter or energy can affect the flow or cycling in ecosystems
3.0	Students will be able to: • Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
2.0	Students will be able to: • Recognize and recall vocabulary: chemical energy, convey, input, light energy, mater, organism, output, photosynthesis, autotroph/producer, plant, stored energy, transfer • Describe how oceanic plants use photosynthesis • Describe inputs and outputs of photosynthesis
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS2.B: Cycles of Matter and Energy Transfer in Ecosystems: Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes.	
4.0	Students will be able to: • Model and describe how changes to the carbon cycle through human activity can affect ocean ecosystems
3.0	Students will be able to: • Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
2.0	Students will be able to: • Recognize and recall vocabulary: atmosphere, biosphere, aerobic, anaerobic, cycle, energy, environment, flow, matter, respiration • Describe how matter cycles and energy flows through an ecosystem
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): 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.	
4.0	Students will be able to: • Describe and model how changes to human activity can cause positive and negative changes to Earth's climate and ocean processes • Determine how weather and climate changes impact ocean organisms
3.0	Students will be able to: • Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
2.0	Students will be able to: • Recognize and recall vocabulary: biosphere, circulation, climate change, distribution, Earth system, energy, flow, ice volume, orbit, precipitation, sea level, solar output, sea surface temperature, variation • Describe the flow of energy into and out of Earth systems • Describe the relationship between energy in Earth systems and changes in climate • Describe how changes in climate may occur over different lengths of time
1.0	With help, partial success at level 2.0 content and level 3.0 content:

0.0	Even with help, no success

Standard(s): ESS2.C: The Roles of Water in Earth's Surface Processes: The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.	
4.0	Students will be able to: • Determine how changes to conditions can affect water flow and impact on ocean and Earth's processes
3.0	Students will be able to: • Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
2.0	Students will be able to: • Recognize and recall vocabulary: advection, deposition, erosion, hydrologic cycle, interaction, rock cycle, solubility, system, transportation, weathering • Describe how the properties of water affect Earth materials
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS1.A: Structure and Function: Systems of specialized cells within organisms help them perform the essential functions of life. Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.	
4.0	Students will be able to: • Describe changes to development based on changes to DNA/protein relationships causing life's variation • Catalog species by a variation of characteristics
3.0	Students will be able to: • Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
2.0	Students will be able to: • Recognize and recall specific vocabulary: cell, DNA, protein, essential, life function, specialized structure, system • Describe the relationship between DNA and structure of proteins
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS1.B: Growth and Development of Organisms: In multicellular organisms, individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.	
4.0	Students will be able to: • Determine organism complexity based on characteristics
3.0	Students will be able to: • Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
2.0	Students will be able to: • Recognize and recall vocabulary: animal, characteristic, plant, reproduction, reproductive strategy, age diagram, cellular differentiation, cellular division, mitosis, meiosis, sexual reproduction, asexual reproduction • Summarize the processes of cellular division
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): 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.	
4.0	Students will be able to: • Model and describe how changes to ocean ecosystems affects carrying capacities and food webs
3.0	Students will be able to: • Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
2.0	Students will be able to: • Recognize and recall vocabulary: carrying capacity, climate, competition, ecosystem, interdependent, population, relationship, resource, endangered species, keystone species, tropic levels, tropic cascade • Describe how various factors affect the carrying capacity of ecosystems • Describe a trophic cascade
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): 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.	
4.0	Students will be able to: • Describe how changes to biodiversity changes ecosystems
3.0	Students will be able to: • Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
2.0	Students will be able to: • Recognize and recall vocabulary: average, biodiversity, ecosystem, equilibrium, population, tropic level, trophic cascade • Describe how various factors affect the biodiversity and populations of ecosystems
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS2.D: Social Interactions and Group Behavior: Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives.	
4.0	Students will be able to: • Model different life strategies for ocean organisms
3.0	Students will be able to: • Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.
2.0	Students will be able to: • Recognize and recall vocabulary: group behavior, individual behaviors, outcome, reproduce, species, survive • Describe the relationship between marine animal behaviors, human interaction and survival
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ESS2.E Biogeology: The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.	
4.0	Students will be able to:

	• Describe how changes to ocean systems change ocean organisms
3.0	Students will be able to: • Construct an argument based on evidence about the simultaneous coevolution of ocean systems and life on Earth.
2.0	Students will be able to: • Recognize and recall vocabulary: atmosphere, biogeology, biosphere, coastline, coevolution, evolution, habitat, photosynthesis, weathering • Describe the relationship between geological and biological changes in an ocean system
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS4.A: Evidence of Common Ancestry and Diversity: Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence.	
4.0	Students will be able to: • Design taxonomic groupings for ocean organisms based on evidence
3.0	Students will be able to: • Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
2.0	Students will be able to: • Recognize and recall vocabulary: evolution, common ancestry, origin of life, phylogenetic, shared characteristic, similarity • Describe similarities in DNA sequences, anatomical structures and embryological development in various organisms • Describe the process of biological evolution
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS4.B: Natural Selection: Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals.	
4.0	Students will be able to: • Model how changes to environment can impact ocean organisms based on natural selection
3.0	Students will be able to: • 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.
2.0	Students will be able to: • Recognize and recall vocabulary: adaptation, behavior, Charles Darwin, Alfred Wallace, competition, environment, evolution, heritable, modern synthesis, genetic variation, mutation, reproductive success, sexual reproduction • Describe the physical and biological factors that are related to evolution
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS4.C: Adaptation: Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase

in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. Adaptation also means that the distribution of traits in a population can change when conditions change.	
4.0	Students will be able to: • Model how populations will change based on different selection conditions when applied
3.0	Students will be able to: • 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.
2.0	Students will be able to: • Recognize and recall vocabulary: distribution, abundance, heritable, reproductive success, trait, survival, heritable • Describe the relationship between advantageous heritable traits and survival of organisms
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS3.B: Variation of Traits: Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus, the variation and distribution of traits observed depends on both genetic and environmental factors.	
4.0	Students will be able to: • Extrapolate how changes in environment can change a gene pool and population
3.0	Students will be able to: • Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
2.0	Students will be able to: • Recognize and recall vocabulary: distribution, environmental, expression, factor, genetic, population, gene expression, variation • Describe the variation and distribution of expressed traits in populations
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Unit Modifications for Special Population Students	
Advanced Learners	Enrichment Worksheets and Scenario Investigations
Struggling Learners	Use L1 Differentiated Instructional Support Explanations & Activities as guided by the textbook
English Language Learners	Use ELL Differentiated Instructional Support Explanations & Activities as guided by the textbook as well as any student specific ESL modification guidelines http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Learners with an IEP	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete

		• Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org
Learners with a 504	Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.	

Interdisciplinary Connections
Indicators: *Common Core Standards Connections* **ELA/Literacy** **RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. **RST.11-12.2** Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. **WHST.9-12.1** Write arguments focused on discipline-specific content. **WHST.9-12.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. **SL.11-12.5** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. **RST.11-12.8** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **WST.11-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. **SL.11-12.4** Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. **RST.11-12.7** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **WHST.9-12.5** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. **RST-11.12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. **RST-11.12.8** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **WHST.11-12.8** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. **WHST.9-12.9** Draw evidence from informational texts to support analysis, reflection, and research. **RST.11-12.9** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **RST.9-10.8** Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. **RST.11-12.7** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Math

MP.2 Reason abstractly and quantitatively.
MP.4 Model with mathematics.
HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.
HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.
HSA-SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
HSA.CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.
HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
HSF-BF.A.1 Write a function that describes a relationship between two quantities.
HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.
HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
HSA-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
HSA-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
HSF-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
HSS-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how those variables are related.
HSS-ID.A.1 Represent data with plots on the real number line.
HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
HSS-IC.B.6 Evaluate reports based on data.

Integration of 21st Century Skills

Indicators:

The standards listed above and the performance tasks and activities that support them are infused with 21st Century Skills. The Level 3 skills listed in each of the Goals & Scales sections involve critical and creative thinking, communication and collaboration. The methods by which students attain these skills require that students practice multi-step problem solving, using technology to research and solve problems, and communicate results with their instructors and peers. The learning activities listed provide a mix of traditional classroom work and interactive, online experiences.

Science & Engineering Practices:

Asking Questions and Defining Problems
Using Mathematics and Computational Thinking
Analyzing and Interpreting Data
Developing and Using Models
Constructing Explanations and Designing Solutions
Obtaining, Evaluating and Communicating Information
Planning and Carrying Out Investigation

Cross-Cutting Connections:

Patterns
Cause and Effect
Energy and Matter
Stability and Change
Interdependence of Science, Engineering and Technology
Systems and System Models

Connections to Nature of Science:

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

Scientific Knowledge Assumes an Order and Consistency in Natural Systems
Influence of Science, Engineering, and Technology on Society and the Natural World

Unit Title: Life in the Ocean

Unit Description: In this unit, the students will investigate the variety of organisms in the ocean as well as the interactions between biotic factors in the ocean and the importance of these interconnected relationships. They will determine the evolutionary relationships between various organisms based on physical characteristics. They will observe, investigate, and analyze the similarities and differences between the different classifications of organisms in the ocean.

Unit Duration: 6 weeks

Desired Results

Standard(s) (related to lessons within textbook):

Introduction to Marine Invertebrates - HS-LS1-2

Biology of Fishes - HS-LS4-3, HS-LS1-1

Marine Reptiles and birds - HS-LS4-3

Marine Mammals - HS-LS1-4, HS-LS2-8

Relationships in the Sea - HS-LS2-8

Indicators:

LS1.A: Structure and Function

LS4.C: Adaptation

LS4.B: Natural Selection

LS1.B: Growth and Development of Organisms

LS2.D: Social Interactions and Group Behavior

Understandings:

Students will understand that…

- Many organisms are invertebrates
- Life is classified by a variety of character states
- There are differences between marine life strategies
- There are differences in characteristics between invertebrates, vertebrates, mammals, reptiles, birds, fishes, etc. in the ocean
- There is a common ancestry of marine organisms and humans
- Organisms depend on each other in complex relationships in the ocean
- Organisms in the ocean utilize a variety of habitats and ranges
- There is an ecological and economic significance to marine life and marine sustainability

Essential Questions:

1. What characteristics and differences that separate marine invertebrates?
2. What characteristics and differences that separate marine fishes?
3. What characteristics and differences that separate marine reptiles and birds?
4. What characteristics and differences that separate marine mammals?
5. How do marine organisms rely on each other through complex interactions?
6. What are the types of relationships in the ocean?

Assessment Evidence

Performance Tasks:

- Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- 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.

Other Evidence:

Reading and Writing Assignments

Colossal Squid Observation

Exploring the structures and functions of Marine Fishes

Marine Iguana and El Nino relationship discussion

Identifying Individual Whales by the Fluke

Symbiotic Relationships in the Ocean Activity

• Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. • Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.	Coral Reef Adventure and Classified Activity Observing Marine Mammal Behavior Examining the Ranges of Marine Reptiles and Birds Investigating the Animal Kingdom activity *Quizzes* Dissection Introduction Terms and Tools Quiz Invertebrates Quiz Vertebrates Quiz Symbiotic Relationships Quiz *Laboratory Activities* Animals of the Sea Shore Invertebrate ID Lab Squid dissection Fish Dissection Shark Dissection *Unit Tests* Invertebrate and Fish Test Reptiles, Birds, and Mammals Test

Benchmarks: Shark Dissection

Learning Plan

Learning Activities:

1. Marine Invertebrates
Comparing Invertebrate body plans
Animals of the Seashore Invertebrate ID Lab
Disscetion Terms, Tools, and Safety Introduction and Quiz
Colossal Squid Dissection Observation and Discussion
Squid Dissection
Wrap Up using blackboard discussion board post for HW

2. Biology of Fishes - Fish, Shark Dissections
Comparing form and function with fish structures, habitats and niches
Fish Dissection
Shark Dissection
Shark evolution and predatory behavior reading and discussion
Shark tracking data analysis (Mary Lee)
Wrap Up using blackboard discussion board post for HW

3. Invertebrate and Fish Test

4. Marine Reptiles and Birds
Marine Iguana and El Nino
Data analysis of seabird and sea turtle movement
Discussing evolutionary connections between reptiles and birds
Reading and discussion on sea turtle populations
Wrap Up using blackboard discussion board post for HW

5. Marine Mammals

Comparison of marine and land mammals
Whale Fluke Identifying Activity
Observing Marine mammal behavior
Wrap Up using blackboard discussion board post for HW
6. Reptiles, Birds and Mammals Test
7. Relationships in the Sea
Coral Reef Adventure and Symbiotic Relationship Classifieds activity
Symbiosis game
Reading and discussion about symbiotic relationships
Reading and analysis of reproductive strategies of different marine organisms
Wrap Up using blackboard discussion board post for HW

Resources: Text, online etools associated with text, blackboard, and laptops

Unit Learning Goal and Scale *(Level 2.0 reflects a minimal level of proficiency)*	
Standard(s): LS1.A: Structure and Function: Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.	
4.0	Students will be able to: • Catalog species by a variation of characteristics
3.0	Students will be able to: • Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
2.0	Students will be able to: • Recognize and recall vocabulary: circulatory system, function, hierarchical organization, interact, multicellular, organisms, nutrient uptake, organism, regulate, response, stimulus, tissue • Describe life's hierarchical function and importance to multicellular organisms
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS4.B: Natural Selection: Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals.	
4.0	Students will be able to: • Model how changes to environment can impact ocean organisms based on natural selection
3.0	Students will be able to: • 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.
2.0	Students will be able to: • Recognize and recall vocabulary: adaptation, behavior, Charles Darwin, Alfred Wallace, competition, environment, evolution, heritable, modern synthesis, genetic variation, mutation, reproductive success, sexual reproduction • Describe the physical and biological factors that are related to evolution
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS4.C: Adaptation: Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. Adaptation also means that the distribution of traits in a population can change when conditions change.	
4.0	Students will be able to: • Model how populations will change based on different selection conditions when applied
3.0	Students will be able to: • 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.
2.0	Students will be able to: • Recognize and recall vocabulary: distribution, abundance, heritable, reproductive success, trait, survival, heritable • Describe the relationship between advantageous heritable traits and survival of organisms

1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS2.D: Social Interactions and Group Behavior: Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives.	
4.0	Students will be able to: • Model different life strategies for ocean organisms
3.0	Students will be able to: • Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.
2.0	Students will be able to: • Recognize and recall vocabulary: group behavior, individual behaviors, outcome, reproduce, species, survive • Describe the relationship between marine animal behaviors, human interaction and survival
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS1.B: Growth and Development of Organisms: In multicellular organisms, individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.	
4.0	Students will be able to: • Determine organism complexity based on characteristics
3.0	Students will be able to: • Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
2.0	Students will be able to: • Recognize and recall vocabulary: animal, characteristic, plant, reproduction, reproductive strategy, age diagram, cellular differentiation, cellular division, mitosis, meiosis, sexual reproduction, asexual reproduction • Summarize the processes of cellular division
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Unit Modifications for Special Population Students	
Advanced Learners	Enrichment Worksheets and Scenario Investigations
Struggling Learners	Use L1 Differentiated Instructional Support Explanations & Activities as guided by the textbook
English Language Learners	Use ELL Differentiated Instructional Support Explanations & Activities as guided by the textbook as well as any student specific ESL modification guidelines http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Learner with an IEP	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing

		• Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org
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Integration of 21st Century Skills

Indicators:

The standards listed above and the performance tasks and activities that support them are infused with 21st Century Skills. The Level 3 skills listed in each of the Goals & Scales sections involve critical and creative thinking, communication and collaboration. The methods by which students attain these skills require that students practice multi-step problem solving, using technology to research and solve problems, and communicate results with their instructors and peers. The learning activities listed provide a mix of traditional classroom work and interactive, online experiences.

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Cause and Effect
Energy and Matter
Stability and Change
Interdependence of Science, Engineering and Technology
Systems and System Models

Connections to Nature of Science:

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
Scientific Knowledge Assumes an Order and Consistency in Natural Systems
Influence of Science, Engineering, and Technology on Society and the Natural World

Unit Title: Movement in the Ocean and Ocean Research

Unit Description: In this unit, the students will investigate the two important factors associated with the movement in the ocean: waves and tides and then analyze movement of organisms in the ocean based on these conditions. Students will also investigate ways that scientists study and track ocean biotic and abiotic factors in preparation for the final engineering problem. Students will observe, investigate, and analyze ocean movement and ways scientists study the ocean as well as participating in self-directed research analysis.

Unit Duration: 4 weeks

Desired Results

Standard(s) (related to lessons within textbook):

The Ocean's Waves - HS-PS4-1

A Time for Tides - HS-ESS1-4

Animal Needs and Animal Tracking - HS-PS4-2

Student Expert Research - HS-PS4-4

Student Expert Analysis - HS-PS4-4

Indicators:

PS4.A: Wave Properties

ESS1.B: Earth and the Solar System

PS4.B: Electromagnetic Radiation

Understandings:

Students will understand that…

- Waves are local movements in water caused by wind or seismic events
- Tides are large scale movements of water caused by astronomical forces interacting
- Waves and tides are important to large scale ocean movements
- Oceanic animal requirements
- Scientists use various methods to study and track biotic and abiotic factors in the ocean
- Scientists analyze data from various sources and communicate findings

Essential Questions:

1. What are waves?
2. What are tides?
3. How do water movements affect oceanic biotic factors?
4. How do we study oceanic animals?
5. How do we use satellites to study oceanic conditions?
6. How do scientists research and communicate ocean science findings?

Assessment Evidence

Performance Tasks:

- Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
- Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
- Evaluate questions about the advantages of using digital transmission and storage of information.
- Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

Other Evidence:

Reading and Writing Assignments

Wind and Waves

Analyzing Tides

Shark Tracking Data

Conducting and presenting student research

Marine Biology Term Paper

Quizzes

Waves Quiz

Tides Quiz

Research Methods Quiz

Laboratory Activities

Virtual Wave Lab

	Unit Tests Waves and Tides Test

Benchmarks: Student Research and Analysis Paper

Learning Plan

Learning Activities:

1. Oceans Waves

Virtual Wave Lab
Using math to analyze wave
Using waves for renewable energy
Wrap Up using blackboard discussion board post for HW
Quiz

2. Time for Tides

Analyze and graph data related to tidal cycles
Identifying Diurnal, Semidiurnal, Neap, and Spring Tides
Identifying and Discussing how tidal patterns affect marine organisms
Wrap Up using blackboard discussion board post for HW
Quiz

3. Animal Needs and Animal Tracking

Using satellite imagery to relate water conditions to animal movement
Popular Sources of Animal Tracking
Continued Discusson and Observation of Shark Tracking (Mary Lee)
Upwelling/Downwelling and Whales and Plankton Mapping Activity
Wrap Up using blackboard discussion board post for HW

4. Student Expert Research

Analyzing various data sets to begin conducting research for a given speciality: Species, Bathymetry, Phytoplankton, Sea Surface Analysis
Marine Term Paper handed out and begin brainstorming individual papers
Wrap Up using blackboard discussion board post for HW
Quiz

5. Student Expert Analysis

Analyzing data comparing bathymetry, sea surface and chlorophyll imagery and marine mammal movements
Using the teams from Lesson 4 students will do a team analysis journal for their data and create a research wall and communicate findings with the rest of class
Wrap Up using blackboard discussion board post for HW

Resources: Text, online etools associated with text, blackboard, and laptops

Unit Learning Goal and Scale
(Level 2.0 reflects a minimal level of proficiency)

Standard(s): 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.	
4.0	Students will be able to: • Model wave behavior and be able to accurately describe how waves move energy/information • Infer if any changes are made to wave properties how that can impact energy/information
3.0	Students will be able to: • Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
2.0	Students will be able to: • Recognize and recall vocabulary: communications technology, electricity, energy, information, solar cell, technical information, technological device, transmit, wave, wave behavior • Describe the use of waves and satellite technology to transmit and capture information and energy
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ESS1.B: Earth and the Solar System: Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system.	
4.0	Students will be able to: • Model how changes to orbiting objects effect tides
3.0	Students will be able to: • Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
2.0	Students will be able to: • Recognize and recall vocabulary: gravitational pull, moon, sun, motion, orbit, satellite, solar system, neap tide, spring tide, tidal range, high tide, low tide, tidal zone, tidal bore, diurnal, semidiurnal • Describe how the sun and moon position relative to the earth affect tidal movement • Describe different tides
1.0	With help, partial success at level 2.0 content and level 3.0 content:
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Standard(s): PS4.B: Electromagnetic Radiation: Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features.	
4.0	Students will be able to: • Extrapolate how changes in electromagnetic radiation cause changes in sea surface temperature and thus effect ocean organisms
3.0	Students will be able to: • Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.
2.0	Students will be able to: • Recognize and recall vocabulary: electromagnetic radiation, frequency, living tissue, matter, hypothesis, study, research, measurement, migration, case study, bathymetry, scientific community, scientific communication • Describe the use of satellites and other technology in ocean research • Describe correlation between abiotic and biotic measurements in the ocean

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Unit Modifications for Special Population Students	
Advanced Learners	Enrichment Worksheets and Scenario Investigations
Struggling Learners	Use L1 Differentiated Instructional Support Explanations & Activities as guided by the textbook
English Language Learners	Use ELL Differentiated Instructional Support Explanations & Activities as guided by the textbook as well as any student specific ESL modification guidelines http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Leaners with an IEP	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org
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WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research.
RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Math

MP.2 Reason abstractly and quantitatively.
MP.4 Model with mathematics.
HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.
HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.
HSA-SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
HSA.CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
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HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
HSA-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
HSA-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
HSF-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
HSS-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how those variables are related.
HSS-ID.A.1 Represent data with plots on the real number line.
HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
HSS-IC.B.6 Evaluate reports based on data.

Integration of 21st Century Skills

Indicators:

The standards listed above and the performance tasks and activities that support them are infused with 21st Century Skills. The Level 3 skills listed in each of the Goals & Scales sections involve critical and creative thinking, communication and collaboration. The methods by which students attain these skills require that students practice multi-step problem solving, using technology to research and solve problems, and communicate results with their instructors and peers. The learning activities listed provide a mix of traditional classroom work and interactive, online experiences.

Science & Engineering Practices:

Asking Questions and Defining Problems
Using Mathematics and Computational Thinking
Analyzing and Interpreting Data
Developing and Using Models
Constructing Explanations and Designing Solutions

Obtaining, Evaluating and Communicating Information
Planning and Carrying Out Investigation

Cross-Cutting Connections:

Patterns
Cause and Effect
Energy and Matter
Stability and Change
Interdependence of Science, Engineering and Technology
Systems and System Models

Connections to Nature of Science:

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
Scientific Knowledge Assumes an Order and Consistency in Natural Systems
Influence of Science, Engineering, and Technology on Society and the Natural World

Unit Title: Human Impact in Oceanic Ecosystems

Unit Description: In this culmination unit, the students will use knowledge acquired through all previous units to investigate the ecological and economic importance of the ocean ecosystems as well as the impact humans have on the ocean, ways to protect the ocean and sustainable management of the ocean. Students will observe, investigate, and analyze how variety of large and small-scale human activities can impact the environmental and economical aspects of the ocean system.

Unit Duration: 8 weeks

Desired Results

Standard(s) (related to lessons within textbook):

Which Way to the Sea - HS-ESS2-1, HS-ESS2-2, HS-ESS1-6, HS-ESS2-7

Nonpoint Source Pollution - HS-LS4-6

Point source pollution - HS-ESS3-2, HS-ESS3-4, HS-ESS3-6, HSETS1-1, HS-ETS1-2, HS-ETS1-3, HS-LS4-6

Humans and Coastlines - HS-ESS3-1, HS-LS2-7

The Ocean's Resources - HS-ESS3-1

Changing Climate - HS-ESS2-2, HS-ESS2-4, HS-ESS3-5, HS-ESS2-7

Protecting Marine Habitats - HS-ESS3-6, HS-LS2-7

Indicators:

ESS3.D: Global Climate Change

ESS2.D: Weather and Climate

LS4.D: Biodiversity and Humans

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

ETS1.B: Developing Possible Solutions

ESS2.E Biogeology

ESS2.A: Earth Materials and Systems

ESS1.B: Earth and the Solar System

ESS3.A: Natural Resources

LS4.C: Adaptation

ETS1.A: Defining and Delimiting Engineering Problems

ESS3.C: Human Impacts on Earth Systems

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

ESS1.C: The History of Planet Earth

Understandings:

Students will understand that…

- The was formed through a variety of processes and is dynamic
- There are different types of pollution
- Disasters like oil spills require a variety of levels of response
- Human impact on coastlines has been influential in flooding and property loss
- The ocean has a variety of economic and environmental resources
- Global climate change is a large-scale problem causing many different localized issues

Essential Questions:

1. How did geologic processes impact the formation of the ocean and continue to this day?
2. What is nonpoint and point source pollution?
3. How does coastline development impact storm protection?
4. What resources are available in the ocean?
5. How does global climate change affect the ocean?
6. Why is it important to protect marine environments and what can we do?

- Global climate change is detrimental to marine ecosystems
- There are steps to take to protect marine habitats

Assessment Evidence

Performance Tasks:

- 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.
- 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.
- Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
- Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
- Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering
- Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- Evaluate or refine a technological solution that reduces impacts of human activities on natural systems
- Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
- Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
- Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
- 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.
- Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

Other Evidence:

Reading and Writing Assignments

Seagrass Bed investigation

Shark Finning Article and videos

Topographic Map activity

Nonpoint source pollution activities

Oil Spill Cleanup Engineering Problem

Marine Protecting Area mapping and biodiversity activities

Quizzes

Nonpoint and Point Source Pollution

Ocean Resource Quiz

Climate Change and Protecting Marine Habitat

Laboratory Activities

Wetlands Modeling

Water Chemical Analysis Field/Lab

Light and Nutrient Lab

Hurricane Contour Map and Data Analysis

Climate change and sea level activities

Fishing for Resources

Unit Tests

Sources of Human Impact Test

Ocean Resources, Effect, and Protection Test

Final Exam

• Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. • Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.	

Benchmarks: Oil Spill Response Engineering Problem

Learning Plan

Learning Activities:

1. Which Way to the Sea

Reading and discussion of watersheds and topographic maps
Model a watershed
Water Chemical Analysis Field/Lab
Wrap Up using blackboard discussion board post for HW

2. Nonpoint Source Pollution

Identification and discussion of nonpoint source pollution
Pacific Garbage Patch reading and analysis
Campus Debris Survey
Light and Nutrient Lab
Wrap Up using blackboard discussion board post for HW
Quiz

3. Point Source Pollution

Identification and discussion of point source pollution
Oil Spill Cleanup reading, discussion, problem solving
Oil Spill Cleanup debate
Wrap Up using blackboard discussion board post for HW
Quiz

4. Humans and Coastlines

Seagrass Bed Investigation
Reading, and analysis of coastline management strategies
Wrap Up using blackboard discussion board post for HW

5. Test: Sources of Human Impact

6. Ocean's Resources

Shark Finning
Analysis of ocean fish resources
Reading, analysis and discussion of sustainable and nonsustainable fishing practices
Analyzing and communicating sustainable management practices of the Atlantic Bluefin Tuna fishery
Wrap Up using blackboard discussion board post for HW

7. Changing Climate

Analyzing climate data
Analysinz climate change data in relation to coral reef health paramerters
Analyzing climate change data and its relationship to El Nino events
Culminating activity relating SST, human imapact, ecosystem health and explaining importance of maintaining ocean health for global health
Wrap Up using blackboard discussion board post for HW

8. Protecting Marine Habitats

Reading and analyzing marine protected area (MPA) characteristics
Observing and investigating Hawaiian MPA

Observing and investigating Polar Ice Caps
Using data to identify and create plan to implement new MPAs
Wrap Up using blackboard discussion board post for HW
9. Test: Ocean Resources, Effect, and Protection

Resources: Text, online etools associated with text, blackboard, and laptops

Unit Learning Goal and Scale *(Level 2.0 reflects a minimal level of proficiency)*	
Standard(s): ESS2.A: Earth Materials and Systems: Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.	
4.0	Students will be able to: • Determine how changes to ocean systems through human activity can impact ocean systems
3.0	Students will be able to: • Analyze geoscience data to make the claim that one change to the ocean's surface can create feedbacks that cause changes to other Earth systems
2.0	Students will be able to: • Recognize and recall vocabulary: atmospheric change, climate, erosion, glacial ice, global, feedback, surface system, temperature, transport • Describe how changes to the ocean surface results in changes to other Earth's systems
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ESS2.D: Weather and Climate: Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere.	
4.0	Students will be able to: • Describe and model how changes to human activity can cause positive and negative changes to Earth's climate and ocean processes • Determine how weather and climate changes impact ocean organisms
3.0	Students will be able to: • Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
2.0	Students will be able to: • Recognize and recall vocabulary: biosphere, circulation, climate change, distribution, Earth system, energy, flow, ice volume, orbit, precipitation, sea level, solar output, sea surface temperature, variation • Describe the flow of energy into and out of Earth systems • Describe the relationship between energy in Earth systems and changes in climate • Describe how changes in climate may occur over different lengths of time
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ESS2.E Biogeology: The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.	
4.0	Students will be able to: • Describe how changes to ocean systems change ocean organisms
3.0	Students will be able to: • Construct an argument based on evidence about the simultaneous coevolution of ocean systems and life on Earth.
2.0	Students will be able to: • Recognize and recall vocabulary: atmosphere, biogeology, biosphere, coastline, coevolution, evolution, habitat, photosynthesis, weathering • Describe the relationship between geological and biological changes in an ocean system
1.0	With help, partial success at level 2.0 content and level 3.0 content:

0.0	Even with help, no success

Standard(s): ESS3.C: Human Impacts on Earth Systems: Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.	
4.0	Students will be able to: • Model how scientific advancements has or will impact ocean processes
3.0	Students will be able to: • Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
2.0	Students will be able to: • Recognize and recall vocabulary: atmosphere, biomass, diversity, economic factor, empirical data, environmental factor, geoengineering, human activity, natural system, ozone, pollutant, resources • Summarize a technological solution for reducing the impact of human activities • Summarize the impacts of human activity on natural systems
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ESS3.A: Natural Resources: Resource availability has guided the development of human society.	
4.0	Students will be able to: • Model how changes to ocean conditions, human activity, and resource abundance has changed over time and can continue to change
3.0	Students will be able to: • Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
2.0	Students will be able to: • Recognize and recall vocabulary: availability, climate, drought, erosion, flood, fresh water, human activity, hurricane, mass migration, population, sea level, severe weather, surface process, temperature, tsunami, volcanic eruption • Describe the relationship between the availability of natural resources, natural hazards, and changes in climate and human activity
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ESS1.B: Earth and the Solar System: Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system.	
4.0	Students will be able to: • Model how changes to orbiting objects effect tides
3.0	Students will be able to: • Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
2.0	Students will be able to: • Recognize and recall vocabulary: gravitational pull, moon, sun, motion, orbit, satellite, solar system, neap tide, spring tide, tidal range, high tide, low tide, tidal zone, tidal bore, diurnal, semidiurnal • Describe how the sun and moon position relative to the earth affect tidal movement • Describe different tides
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ESS1.C: The History of Planet Earth: Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old.	
4.0	Students will be able to: • Model seafloor spreading • Model magnetic reversals and infer seafloor age
3.0	Students will be able to: • 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.
2.0	Students will be able to: • Recognize and recall vocabulary: age, ancient core, continental crust, crust plate movement, interaction, mid-ocean ridge, mountain building, ocean layer, oceanic crust, plate, plate boundary, plate collision, plate spreading, plate tectonics, sea-floor spreading • Summarize the theory of plate tectonics • Describe the relationship between movements of Earth's crust, rock age, and ocean formation/structure
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS4.D: Biodiversity and Humans: Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.	
4.0	Students will be able to: • Model how future human activities can impact environmental and biodiversity in positive and negative ways
3.0	Students will be able to: • Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
2.0	Students will be able to: • Recognize and recall vocabulary: biodiversity, endangered species, genetic variation, human activity, human impact, organism, species, threatened species • Describe ways in which human activity has an adverse impact on oceanic ecosystems
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): LS4.C: Adaptation: Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. Adaptation also means that the distribution of traits in a population can change when conditions change.	
4.0	Students will be able to: • Model how populations will change based on different selection conditions when applied due to changes in human activity
3.0	Students will be able to: • 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.
2.0	Students will be able to: • Recognize and recall vocabulary: distribution, abundance, heritable, reproductive success, trait, survival, heritable • Describe the relationship between advantageous heritable traits and survival of organisms
1.0	With help, partial success at level 2.0 content and level 3.0 content:

0.0	Even with help, no success

Standard(s): ESS3.D: Global Climate Change: Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities.	
4.0	Students will be able to: • Model how future human activity may impact ocean systems
3.0	Students will be able to: • Use a computational representation to illustrate the relationships among ocean systems and how those relationships are being modified due to human activity.
2.0	Students will be able to: • Recognize and recall vocabulary: acidification, atmosphere, biomass, biosphere, carbon dioxide, geosphere, human activity, marine, population • Describe the relationships between hydrosphere, atmosphere, cryosphere, geosphere and biosphere • Describe how the relationships between earth's systems are modified due to human activity
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ETS1.A: Defining and Delimiting Engineering Problems: 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. Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.	
4.0	Students will be able to: • Extrapolate how humans need to resources will change as global human population grows and changes
3.0	Students will be able to: • Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
2.0	Students will be able to: • Recognize and recall vocabulary: constraint, criteria, engineering, global challenge, measurable, need, qualitative, quantitative, risk mitigation, solution • Summarize oil drilling, maintenance, and spill response • Summarize societal needs and wants related to fossil fuel consumption
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): ETS1.B: Developing Possible Solutions: When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.	
4.0	Students will be able to: • Design a solution to a secondary problem in the ocean with minimal guidance
3.0	Students will be able to: • Design a solution to an oil spill by breaking it down into smaller, more manageable problems that can be solved through engineering.
2.0	Students will be able to: • Recognize and recall vocabulary: criteria, engineer, problem, solution, tradeoff, concerned parties, *Deep Sea Horizon* • Describe the steps to managing and cleaning up an oil spill
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s): 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.	
4.0	Students will be able to: • Describe how changes to biodiversity changes ecosystems
3.0	Students will be able to: • Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
2.0	Students will be able to: • Recognize and recall vocabulary: average, biodiversity, ecosystem, equilibrium, population, tropic level, trophic cascade • Describe how various factors affect the biodiversity and populations of ecosystems
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Unit Modifications for Special Population Students	
Advanced Learners	Enrichment Worksheets and Scenario Investigations
Struggling Learners	Use L1 Differentiated Instructional Support Explanations & Activities as guided by the textbook
English Language Learners	Use ELL Differentiated Instructional Support Explanations & Activities as guided by the textbook as well as any student specific ESL modification guidelines http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Learners with an IEP	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org
Learners with a 504	Refer to page four in the Parent and Educator Resource Guide to Section 504 to assist in the development of appropriate plans.

Interdisciplinary Connections

Indicators: *Common Core Standards Connections*

ELA/Literacy

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

WHST.9-12.1 Write arguments focused on discipline-specific content.

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

WST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

SL.11-12.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

RST-11.12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST-11.12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research.

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

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Math

MP.2 Reason abstractly and quantitatively.

MP.4 Model with mathematics.

HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.

HSA-SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

HSA.CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

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HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

HSF-BF.A.1 Write a function that describes a relationship between two quantities.

HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.
HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
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HSA-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
HSF-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
HSS-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how those variables are related.
HSS-ID.A.1 Represent data with plots on the real number line.
HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
HSS-IC.B.6 Evaluate reports based on data.

Integration of 21st Century Skills

Indicators:

The standards listed above and the performance tasks and activities that support them are infused with 21st Century Skills. The Level 3 skills listed in each of the Goals & Scales sections involve critical and creative thinking, communication and collaboration. The methods by which students attain these skills require that students practice multi-step problem solving, using technology to research and solve problems, and communicate results with their instructors and peers. The learning activities listed provide a mix of traditional classroom work and interactive, online experiences.

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Developing and Using Models
Constructing Explanations and Designing Solutions
Obtaining, Evaluating and Communicating Information
Planning and Carrying Out Investigation

Cross-Cutting Connections:

Patterns
Cause and Effect
Energy and Matter
Stability and Change
Interdependence of Science, Engineering and Technology
Systems and System Models

Connections to Nature of Science:

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
Scientific Knowledge Assumes an Order and Consistency in Natural Systems
Influence of Science, Engineering, and Technology on Society and the Natural World