Marine Biology/Oceanography

Summit High School
Summit, NJ

Grade Level / Content Area:

11 and 12th Grade
Science

Developed by
John Shipley
2017

Length of Course: 1 semester
Course description

Marine Biology is a science elective for students who have successfully completed Biology. The first third of the course surveys the fields of oceanography, weather, physical and chemical aspects of the oceans. Part two features a survey of marine organisms and their interactions. The 3rd and final unit covers ecosystems providing the big picture of the workings and health of our marine ecosystems. There is also an introduction to conservation concerns and efforts, with a final focus on the many altruistic opportunities available for marine conservation enthusiasts at the end of the course.

Grades are based on projects, quizzes and class participation.

Course Pacing Guide

Content Curriculum

Unit 1: Oceanography
Unit 2: Biology of the seas
Unit 3: Ecology
Unit 4: Conservation of the oceans and the ocean Ecosystems

Texts and Resources

“Marine Biology” by Castro and Huber
<table>
<thead>
<tr>
<th>Weeks</th>
<th>Unit</th>
<th>Key Topics</th>
</tr>
</thead>
</table>
| 1-4    | 1 (Covering chapters 1-4) | Marine Science (technological advancements)  
- Sonar, radar, scuba, navigation  
Seafloor mapping / Plate tectonics  
Climate / ocean currents / weather forecasting  
Waves / pressure (atmospheric)  
  - unit 1 project: Hurricane history PPT |
| 5-9    | 2 (covering chapters 5-9) | Organisms:  
- Microbes  
- Primary producers  
- Invertebrates  
- Marine Fishes  
- The “other” Vertebrates  
  - 2 unit 2 projects:  
    - Invertebrate animal (group)  
    - Fish species (individual) |
| 10-14  | 3 (covering chapters 10-16) | Marine ecosystems:  
Intro to ecology (how to research)  
  - Project on one of 8 marine ecosystems (group)  
Blue Planet videos on various marine ecosystems |
| 14-18  | 4 (covering chapters 17-19) | Conservation:  
Investigation of conservation organizations:  
For example:  
- Atlantic Salmon Federation  
- Billfish Foundation  
- Bonefish and Tarpon Trust  
  - Final project:  
    - Pick a conservation organization to research  
    - Present to class aspects of organization |
- Create proposal to raise funds to donate to organization and act on proposals where appropriate.

*Note: the textbook “Marine Biology” by Castro and Huber, is issued to students as a reference guide.

Unit 1: Oceanography

Course Objectives for Unit 1 “oceanography”: To create a foundation of understanding of our dynamic climate patterns, the physical and chemical properties that influence the oceans, and how these properties can relate to the survival of all of life on Earth.

Big Ideas for Unit 1: Science and Engineering Practices

- Planet Earth’s dynamic systems are largely defined by the oceans.
- Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS2-1)
- Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. (HS-ESS1-6)
- Evaluate evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-ESS1-5)
- Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Essential Questions

1. What factors determine ocean depth?
2. How do we know details about the ocean depths?
3. What is atmospheric pressure and what is the difference between air and water in terms of pressure?
4. Why is seawater salty and how do minerals get into water?
5. How does “Plate tectonics” relate to the ocean basins?
6. How does the uneven heating of the Earth’s surface by the Sun affect wind patterns, ocean currents, and climate?
7. How do we predict the weather, and access those predictions?

Enduring Understandings

Cross cutting concepts

Patterns

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS4-1)
- Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. (HS-PS4-4)
- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for
8. How do the Sun and Moon affect the tides in different parts of the world?

causality in explanations of phenomena. (HS-PS2-4)

**Stability and Change**
- Much of Science deals with constructing explanations of how things change and how they remain the same.
- Change and rates can be quantified and modeled over very long or very short periods of times. Some system changes are irreversible.
- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined. (HS-PS2-2)

<table>
<thead>
<tr>
<th>Areas of Focus: Proficiencies (Cumulative Progress Indicators)</th>
<th>Examples, Outcomes, Assessments (see note below about the content of this section)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disciplinary Core Ideas</strong></td>
<td><strong>Instructional Focus:</strong></td>
</tr>
<tr>
<td>Students will:</td>
<td>● Identify different tidal patterns in different parts of the world and how they are affected by various forces</td>
</tr>
<tr>
<td>ESS2.D: Weather and Climate</td>
<td>● Identify how different depth profiles affect seawater characteristics</td>
</tr>
<tr>
<td>● The foundation for Earth’s global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy’s re-radiation into space. (HS-ESS2-2), (HS-ESS2-4)</td>
<td>● Compare different major ocean currents</td>
</tr>
<tr>
<td>● Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (HS-ESS2-6), (HS-ESS2-7)</td>
<td>● Describe how the rotation of the Earth affects ocean currents</td>
</tr>
</tbody>
</table>
| ESS1.B: Earth and the Solar System | ● Explore how the concentrations of salt found in the ocean are related to the density of seawater and therefore the “great conveyor”.
| ● Cyclical changes in the shape of Earth’s orbit around the sun, together with changes in the tilt of the planet’s axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. (secondary to HS-ESS2-4) | ● Analyze how seafloor features vary depending on tectonic forces |
| ESS2.A: Earth Materials and Systems | ● Research how technology has changed throughout the history of oceanography |
| ● Earth’s systems, being dynamic and interacting, cause feedback effects that can | Sample Assessments: |
| | ● Periodic quizzes |
| | ● Class discussions and debates |
| | ● Short-term in-class projects |
| | ● One long-term project |
increase or decrease the original changes. (HSESS2-1), (HS-ESS2-2)

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

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

Instructional Strategies:
- Class-discussion
- Teacher-derived Powerpoint presentation (available for student download)
- Class-demonstration
- Cooperative learning
- Independent research projects
- Independent practice and reading
- Video presentations

Interdisciplinary Connections
- Physics of water movement
- Analyzing weather data
- Chemistry of seawater
- Geological features

Technology Integration
- Use of “Chromebooks” to access web-based resources
- Analysis of Sonar, Radar, Loran, and GPS technology.
- Use of probeware for water quality monitoring.

Global Perspectives
- International shipping laws
- Global climate patterns

Culturally Responsive Teaching
- Our reliance on the oceans is universal for all walks of human life
- Inuit and Polynesian societies were first to unlock the secrets of the oceans.

Unit 2 Name: Biology of the seas

Big Ideas:

Organisms in the oceans are diverse and are not evenly dispersed.
Nutrients and light are the essentials for survival in almost every marine ecosystem.

Derived from NGSS:
Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1)

Course Objectives for Unit 2 “Marine Biology”: To develop a foundation of understanding of how Evolution and Natural Selection have contributed to the array of organisms we see in the oceans today. To gain an understanding of how those organisms can depend on one another to maintain their individual niches.

<table>
<thead>
<tr>
<th>Essential Questions</th>
<th>Enduring Understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td>How can microbes maintain a balance of nutrients in an ecosystem?</td>
<td>Cross Cutting Concepts</td>
</tr>
<tr>
<td>How is energy transferred from the Sun to organisms on Earth?</td>
<td>Cause and Effect</td>
</tr>
<tr>
<td>How has evolution modified adaptations in marine organisms?</td>
<td>Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS2-8), (HS-LS2-5)</td>
</tr>
<tr>
<td>How do organisms deal with osmotic balance in the marine environment?</td>
<td>Energy and Matter</td>
</tr>
<tr>
<td>What evolutionary pressures or adaptive advantages may have driven marine mammal ancestors into the water?</td>
<td>Energy cannot be created or destroyed— it only moves between one place and another place, between objects and/or fields, or between systems. (HS-LS2-4)</td>
</tr>
</tbody>
</table>

Enduring Understandings

Cross Cutting Concepts

Cause and Effect

Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS2-8), (HS-LS2-5)

Energy and Matter

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

Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-6), (HSL2-7)

Areas of Focus: Proficiencies (Cumulative Progress Indicators)

Disciplinary Core Ideas

LS4.A : Evidence of Common Ancestry and Diversity

Genetic information 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

Examples, Outcomes, Assessments

- Review the fundamentals of biology, including photosynthesis and cellular respiration
- Relate evolution and natural selection to adaptations in a marine environment
- Describe how autotrophs contribute to the survival of all organisms.
- Survey unicellular and multicellular algae as well as marine flowering plants
differences in amino acid sequences and from anatomical and embryological evidence. (HS-LS4-1)
  ● The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)
  ● The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6)
  ● As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6), (HS-LS1-7)
  ● As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. (HS-LS1-7)
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. (HS-LS4-2),(HS-LS4-3)
  ● Identify and describe all of the invertebrate phyla and their adaptations.
  ● ID marine vertebrate phyla
  ● Describe whale evolution.

Sample Assessments:
  ● Periodic reading quizzes
  ● Class discussions
  ● Mini in-class projects on specific marine animals.

Instructional Strategies:
  ● Class discussion
  ● Teacher-derived Power point presentation (available for student download)
  ● Class demonstration
  ● Cooperative learning
  ● Independent research projects
  ● Independent practice and reading
  ● Video presentations
  ● Animal dissections (shark, squid)

Interdisciplinary Connections
  ● Veterinarian/medical

Technology Integration
  ● Use of “Chromebooks” to access web-based resources
The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3)

**LS4.C: Adaptation**

- Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment’s limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (HS-LS4-2)
- 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. (HS-LS4-3), (HS-LS4-4)
- Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3)
- Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline—and sometimes the extinction—of some species. (HS-LS4-5),(HS-LS4-6)

**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. (HS-LS2-3)

Plants or algae form the lowest level of the food web. At each link, upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. (HS-LS2-4)

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. (HS-LS2-5)

PS3.D: Energy in Chemical Processes

The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. (secondary to HS-LS2-5)

**Unit 3: Ecology**

**Big Ideas:**

All ecosystems consist of a complex array of interdependent organisms whose balance is easily disrupted by human activities and exploitation.

Derived from NGSS:
Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)

<table>
<thead>
<tr>
<th>Essential Questions</th>
<th>Enduring Understandings: Cross Cutting Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>● How do organisms in each marine ecosystem depend on one-another?</td>
<td>Patterns</td>
</tr>
<tr>
<td>● How has co-evolution influenced interactions among organisms in the marine environment?</td>
<td>● Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS4-1)</td>
</tr>
<tr>
<td>● How do the physical features of marine environments determine where organisms can be found?</td>
<td>● Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. (HS-PS4-4)</td>
</tr>
<tr>
<td>● How are marine communities organized?</td>
<td>● Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS2-4)</td>
</tr>
<tr>
<td>● In what ways do we depend on the oceans for our current needs and ways of life?</td>
<td>Stability and Change</td>
</tr>
<tr>
<td>● How has the human race negatively impacted the marine environment?</td>
<td>● Much of Science deals with constructing explanations of how things change and how they remain the same.</td>
</tr>
<tr>
<td>● What is the best way for us (humans) to conserve/preserve marine natural resources?</td>
<td></td>
</tr>
<tr>
<td>● How should (human) communities along the coast deal with the constant threat of weather and water?</td>
<td></td>
</tr>
<tr>
<td>● What is the appropriate role of government in protecting marine environments?</td>
<td></td>
</tr>
<tr>
<td>● How can/should individuals influence meaningful change for our Marine ecosystems?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Areas of Focus: Proficiencies (Cumulative Progress Indicators)</th>
<th>Examples, Outcomes, Assessments Instructional Focus:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disciplinary Core Ideas</td>
<td>● Summarize and review the various ecosystems found in the Earth’s oceans.</td>
</tr>
<tr>
<td>● The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)</td>
<td>B. Estuaries</td>
</tr>
<tr>
<td></td>
<td>C. Littoral zone (light penetration)</td>
</tr>
<tr>
<td></td>
<td>D. Reefs (both tropical and otherwise)</td>
</tr>
</tbody>
</table>
The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6)

As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6), (HS-LS1-7)

As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. (HS-LS1-7)

Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (HS-LS2-3)

Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and

E. Epipilagic (surface waters)
F. Deep ocean (benthic and Pilagic)

Sample Assessments:
- Periodic reading quizzes
- Class discussions
- Mini in-class projects on specific marine ecosystems.

Interdisciplinary Connections
- Conservation Biology
- International and local politics
- Ecotourism
- Diving / snorkeling

Technology Integration
- Use PowerPoint to present an Ecosystem.
- Use GoogleEarth to track the movements of dolphins, whales, Sharks and Marlin.
- Use of “Chromebooks” to access web-based resources

Global Perspectives
- Each nation and area has it’s own marine environment to take care of and exploit.
- Culturally Responsive Teaching
- Discuss how different cultures rely on certain ecosystems for food (Coral dynamite)

Instructional Strategies:
- Class-discussion
- Teacher-derived Powerpoint presentation (available for student download)
- Class-demonstration
- Cooperative learning
- Group research projects
- Independent practice and reading
- Video presentations
into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. (HS-LS2-4)

- 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. (HS-LS2-5)

PS3.D: Energy in Chemical Processes

- The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. (secondary to HS-LS2-5)

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. (HS-ESS2-7)

Unit 4: Resources and Conservation

Big Ideas:

Through collaboration, cooperation, and hard work, humans can resist the decline of biodiversity at the hands of human development and progress of civilization.

Derived from NGSS:
Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)
### Essential Questions:
In what ways do we depend on the oceans for our current needs and ways of life? 
How has the human race negatively impacted the marine environment? 
In what ways do we (humans) attempt to conserve marine natural resources? 
How do governments deal with necessary legislation of conservation requirements? 
What non-profit options are there for concerned members of the community at large?

### Enduring Understandings:

#### Cross Cutting Concepts

**Cause and Effect**
- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS2-8), (HS-LS2-5)

**Patterns**
- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS4-1)
- Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. (HS-PS4-4)
- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS2-4)

**Stability and Change**
- Much of Science deals with constructing explanations of how things change and how they remain the same.

### Areas of Focus: Proficiencies (Cumulative Progress Indicators)

#### Disciplinary Core Ideas

**ESS3.A : Natural Resources**
- Resource availability has guided the development of human society. (HS-ESS3-1)
- All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (HS-ESS3-2)

### Examples, Outcomes, Assessments:

**Instructional Focus:**
- Summarize which resources we obtain from the ocean.
- Describe offshore drilling for oil
- Describe various types of commercial fishing practices.
- Summarize environmental disasters (oil spills, whaling, tuna depletion)
- Examine the coastal effects of “superstorm Sandy”.
- Research government legislation of topics that the students are interested in IE: fisheries management, mineral
ESS3.B: Natural Hazards
- Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1)

ESS3.C: Human Impacts on Earth Systems
- The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3)
- Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)

ESS3.D: Global Climate Change
- Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. (HS-ESS3-5)
- 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. (HS-ESS3-6)

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. (secondary to HS-ESS3-2), (secondary HS-ESS3-4)

Sample Assessments:
- Periodic reading quizzes
- Teacher-derived Powerpoint presentation (available for student download)
- Class discussions
- Mini in-class projects on specific issues
- Substantial group research project and presentation on government / conservation / legislation.

Interdisciplinary Connections
- Humanities, History, Law, Environmental science, Geology

Technology Integration
- Use of “Chromebooks” to access web-based resources

Global Perspectives
- Global Perspective is self-evident.

Culturally Responsive Teaching
- Likewise, this unit is intimately related to the culture of our global community.
## Curricular Addendum

<table>
<thead>
<tr>
<th>Career-Ready Practices</th>
<th>Interdisciplinary Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CRP1</strong>: Act as a responsible and contributing citizen and employee.</td>
<td><strong>Close Reading of works of art, music lyrics, videos, and advertisements</strong></td>
</tr>
<tr>
<td><strong>CRP2</strong>: Apply appropriate academic and technical skills.</td>
<td><strong>Use Standards for Mathematical Practice and Cross-Cutting Concepts</strong> in science to support debate/inquiry across thinking processes</td>
</tr>
<tr>
<td><strong>CRP3</strong>: Attend to personal health and financial well-being.</td>
<td></td>
</tr>
<tr>
<td><strong>CRP4</strong>: Communicate clearly and effectively and with reason.</td>
<td><strong>Technology Integration</strong></td>
</tr>
<tr>
<td><strong>CRP5</strong>: Consider the environmental, social and economic impacts of decisions.</td>
<td><strong>Ongoing:</strong></td>
</tr>
<tr>
<td><strong>CRP6</strong>: Demonstrate creativity and innovation.</td>
<td>- Listen to books on CDs, Playaways, videos, or podcasts if available.</td>
</tr>
<tr>
<td><strong>CRP7</strong>: Employ valid and reliable research strategies.</td>
<td>- Use document camera or overhead projector for shared reading of texts.</td>
</tr>
<tr>
<td><strong>CRP8</strong>: Utilize critical thinking to make sense of problems and persevere in solving them.</td>
<td><strong>Other:</strong></td>
</tr>
<tr>
<td><strong>CRP9</strong>: Model integrity, ethical leadership and effective management.</td>
<td>- Use Microsoft Word, Inspiration, or SmartBoard Notebook software to write the words from their word sorts.</td>
</tr>
<tr>
<td><strong>CRP10</strong>: Plan education and career paths aligned to personal goals.</td>
<td>- Use available technology to create concept maps of unit learning.</td>
</tr>
<tr>
<td><strong>CRP11</strong>: Use technology to enhance productivity.</td>
<td></td>
</tr>
<tr>
<td><strong>CRP12</strong>: Work productively in teams while using cultural global competence.</td>
<td></td>
</tr>
</tbody>
</table>
### Instructional Strategies: Supports for English Language Learners:

<table>
<thead>
<tr>
<th>Sensory Supports</th>
<th>Graphic Supports</th>
<th>Interactive Supports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-life objects (realia)</td>
<td>Charts</td>
<td>In pairs or partners</td>
</tr>
<tr>
<td>Manipulatives</td>
<td>Graphic organizers</td>
<td>In triads or small groups</td>
</tr>
<tr>
<td>Pictures &amp; photographs</td>
<td>Tables</td>
<td>In a whole group</td>
</tr>
<tr>
<td>Illustrations, diagrams, &amp; drawings</td>
<td>Graphs</td>
<td>Using cooperative group structures</td>
</tr>
<tr>
<td>Magazines &amp; newspapers</td>
<td>Timelines</td>
<td>With the Internet (webbased) or software programs</td>
</tr>
<tr>
<td>Physical activities</td>
<td>Number lines</td>
<td>In the home language</td>
</tr>
<tr>
<td>Videos &amp; films</td>
<td></td>
<td>With mentors</td>
</tr>
<tr>
<td>Broadcasts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Models &amp; figures</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Media Literacy Integration
- Use multiple forms of print media (including books, illustrations/photographs/artwork, video clips, commercials, podcasts, audiobooks, Playaways, newspapers, magazines) to practice reading and comprehension skills.

Global Perspectives
- The Global Learning Resource Library

### Differentiation Strategies:

<table>
<thead>
<tr>
<th>Accommodations</th>
<th>Interventions</th>
<th>Modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allow for verbal responses</td>
<td>Multi-sensory techniques</td>
<td>Modified tasks/expectations</td>
</tr>
<tr>
<td>Repeat/confirm directions</td>
<td>Increase task structure (e.g., directions, checks for understanding, feedback)</td>
<td>Differentiated materials</td>
</tr>
<tr>
<td>Permit response provided via computer or electronic device</td>
<td>Increase opportunities to engage in active academic responding (e.g., writing, reading aloud, answering questions in class)</td>
<td>Individualized assessment tools based on student need</td>
</tr>
<tr>
<td>Audio Books</td>
<td>Utilize prereading strategies and activities: previews, anticipatory guides, and semantic mapping</td>
<td>Modified assessment grading</td>
</tr>
</tbody>
</table>

from [https://wida.wisc.edu](https://wida.wisc.edu)