Garfield Public Schools
Science Curriculum
Marine Biology

Revision Committee:
Mrs. Christine D’Angelo

Final Revision Date: August 31, 2011

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Board Adoption Date – September 26, 2011
Resolution # - 09-137-11
Science Curriculum
Marine Biology

Course Description
Prerequisites: Satisfactory completion of Biology and Chemistry
Co-requisite: Chemistry, with approval of Biology Teacher and Guidance

This course is designed for students with an interest in marine biology and oceanography. This course provides an excellent background for students who are interested in further study of the oceans and the organisms that inhabit it. Major concepts include the study of: the interrelationship of marine and terrestrial environments, the geology of the oceans, marine organisms, and the ecology of coral reefs. Laboratory activities, including the examination of marine specimens are utilized throughout this course to build upon student knowledge.

*THIS IS A HALF-YEAR COURSE*
Science Curriculum
Marine Biology
Unit Map

Contents

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Duration: 1 month
Students will gain an understanding of the physical components of ocean systems in order to understand how they affect the flora and fauna present throughout them.

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Duration: 1 week
In this unit, students will be examining the characteristics of the Phylum Porifera and examine the structures and functions involved with sponge anatomy.

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Duration: 2 weeks
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Duration: 2 weeks
In this unit, students will study the characteristics of cnidarians. They will examine the jellyfish and sea anemone in detail (leaving detailed discussion of coral polyps for the chapter on coral reefs) They will gain an appreciation for the strange way these creatures work, and for the methods they use for food collection and survival.

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Duration: 2-3 weeks
Students will take notes, observe organisms in videos, and create a children’s’ book about coral reef life.

Unit Title: Cephalopods.......................................................................................................................................... 16
Duration: 2-3 weeks
Students will learn about cephalopods.

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Duration: 1-2 weeks
Students will learn about the anatomy and physiology of sharks and how those characteristics allow them to survive in their environments.

Unit Title: Microorganisms ................................................................................................................................. 20
Duration: 2 weeks
In this unit, students will be exposed to microorganisms, their characteristics, and the roles they play in marine environments. During this time, students will be given lecture notes on the characteristics and
different types of microorganisms. Next, they view videos, and they complete questions based on the videos. After that, they will complete a lab where they will view and sketch 18 different types of microorganisms and answer questions on their structural characteristics, life cycles, nutrition requirements and methods of reproduction. Finally, the students will complete lab questions based on the characteristics of these microorganisms they viewed in the videos, their labs and during lecture.

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## Unit Overview

**Content Area:** Science  
**Unit Title:** The Physical Ocean  
**Target Course/Grade Level:** Marine Biology / Grades 11-12  
**Duration:** 1 month

**Description**  
Students will gain an understanding of the physical components of ocean systems in order to understand how they affect the flora and fauna present throughout them.

### Concepts & Understandings

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tides</td>
<td>Tides are a function of the Earth - Sun - Moon system. Salinity Ocean Floor Profile Bathymetry</td>
</tr>
<tr>
<td>Surface Currents</td>
<td>Surface Currents allow movement of nutrients and are driven by wind.</td>
</tr>
<tr>
<td>Density Currents</td>
<td>The spin of the Earth and the Coriolis Effect determine the pattern in which surface currents flow.</td>
</tr>
<tr>
<td>Sedimentation</td>
<td>Density Currents allow for upwelling.</td>
</tr>
<tr>
<td>Sand Formation</td>
<td>Rocks align based upon principles of density.</td>
</tr>
<tr>
<td>Seafloor Spreading</td>
<td>Gems and minerals will be found in sand.</td>
</tr>
<tr>
<td>Density</td>
<td>There are ways to determine whether sand is young or old.</td>
</tr>
<tr>
<td></td>
<td>Organisms are dependent on other organisms and on their environment for survival.</td>
</tr>
<tr>
<td></td>
<td>The ocean has ridges and subduction zones where the ocean floor grows and shrinks.</td>
</tr>
<tr>
<td></td>
<td>Water behaves differently depending upon if it is hot or cold and fresh or salty.</td>
</tr>
</tbody>
</table>

### CPI Codes

- 5.1.12.A.2  
- 5.1.12.B.1  
- 5.1.12.B.2  
- 5.1.12.D.2  
- 5.2.12.A.2  
- 5.2.12.A.5  
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- 5.3.12.C.1  
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- 5.4.12.D.1  
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Marine Biology – Physical Oceans

21st Century Themes and Skills

Themes
- Global Awareness
- Environmental Literacy

Skills
- Critical Thinking and Problem Solving Skills
- Communication and Collaboration Skills
- ICT Literacy
- Life and Career Skills

Guiding Questions
- What is the difference between biotic and abiotic components of the ocean?
- What are some important interdependencies in the ocean? (biotic - biotic, abiotic-abiotic and biotic-abiotic).
- Name some parts of the ocean.
- Name some ocean zones/divisions
- Are tides affected by the alignment of the Earth, Moon and Sun? How?
- How many tidal bulges are present of the Earth at a time?
- How do the Earth, Moon and Sun revolve around each other?
- How does the position of the Earth, Moon and Sun affect the tides?
- What is the difference between Benjamin Franklin's map and the modern satellite image of the Gulf Stream?
- How do you think Ben Franklin made his map?
- Do you think Ben Franklin's map will be as accurate as the one created more recently with modern technology?
- Where on the map do you expect to see warm and cold currents?
- Which currents cause Labrador, Canada to remain ice-bound for most of the winter while Norwegian ports remain ice-free all year?
- How does upwelling occur?
- What is the importance of upwelling?
- Why are areas of upwelling so important to marine life and people who depend on it, like fishermen?
- How do density currents distribute water thousands of km and keep the world's oceans well mixed?
- When mixed/churned, which types of sediment tend to fall the fastest back to the ocean floor?
- What is the Law of Superposition?
- What is the Principle of Original Horizontality?
- What do you think the difference between "old" and "young" sands?
- Why do precious gems like diamond, sapphire, and ruby sometimes accumulate in the sand?
- What is a turbidity current?
- Who do turbidity currents: - form? - travel?

Unit Results

Students will ...
- Compile information from lecture and additional materials in order to gain a better understanding of the physical aspects of the ocean and of oceanography.
- Describe the properties and the currents that result because of the properties of liquids at different temperatures and salinities.
- Explain how interrelationships effect the overall behavior of the system on a microscopic and macroscopic level.
- Explain how tides are affected by the alignment of the sun, moon & Earth
- Explain the components of the earth-moon-sun system in creating tides and describe their effects on the world's oceans. Tides -global tug of war
- Compare the surface currents on maps created by Ben Franklin and NOAA and understand the magnitude of
surface currents and their impact on regional climates. Surface currents-rivers of the ocean
- Re-create density currents. Density currents-deep distant flow
- Compile information that they will utilize to complete the lab assignment.
- View and interpret maps, graphs and charts that they will utilize to complete their labs.
- View that pH (as it pertains to homeostasis) effects organisms in the ocean
- View evidence of plate tectonics and seafloor spreading
- Manipulate and utilize the earth-sun-moon model to create various situations regarding tides and moon phases
- Analyze and compare the map created in 1760 by Ben Franklin with on created by the NOAA using modern satellite technology.
- Analyze and compare the map created in 1760 by Ben Franklin with on created by the NOAA using modern satellite technology

### Suggested Activities

**The following activities can be incorporated into the daily lessons:**

- Sedimentation: Filling in the Details—Completing Activity #5
- Sand: Dump it out of your shoes & take a look-
- Turbidity Currents - Massive Muddy Movement-
- Salinity - Salty Sea Solutions-
- Ocean Floor Profile - Details of the Deep-
- Bathymetry - Sonar Sounds Sweet!- Students will utilize a model of a region, "Mystery Bay" and a bamboo skewer to mimic sonar mapping of the ocean floor.
- Oceanography Careers - Time to Pay the Bills- Write a job announcement related to marine biology or oceanography, and then mock interview someone for the job based on their knowledge from the lab.
- Murder on the Beach-Utilize characteristics of sand particles to find the murderer Students will utilize a stereomicroscope to investigate a crime scene. Each group will investigate their scene and will decide who the murderer is based on characteristics of sand particles.

### Laboratory Experiments

**The following experiments should be included into the daily lessons.**

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### Resources
# Marine Biology – Sponges

## Unit Overview

**Content Area:** Science  
**Unit Title:** Sponges  
**Target Course/Grade Level:** Marine Biology / Grades 11-12  
**Duration:** 1 week

### Description

In this unit, students will be examining the characteristics of the Phylum Porifera and examine the structures and functions involved with sponge anatomy.

### Concepts & Understandings

<table>
<thead>
<tr>
<th><strong>Concepts</strong></th>
<th><strong>Understandings</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Classification</td>
<td>Sponges are simple animals.</td>
</tr>
<tr>
<td>Anatomy</td>
<td>Sponges have various structures and functions.</td>
</tr>
<tr>
<td>Cellular Biology</td>
<td>Sponges have cells specific to their phylum.</td>
</tr>
<tr>
<td>Evolution</td>
<td>Sponges have evolved structures specific to their phylum.</td>
</tr>
</tbody>
</table>

### CPI Codes

- 5.3.12.C.1
- 5.3.12.E.1
- 5.3.12.E.2
- 5.3.12.E.4

### 21st Century Themes and Skills

**Themes**

- Global Awareness  
- Environmental Literacy

**Skills**

- Critical Thinking and Problem Solving Skills  
- Communication and Collaboration Skills  
- ICT Literacy  
- Life and Career Skills

### Guiding Questions

- What is the texture of a sea sponge?  
- What can sea sponges be used for?

### Unit Results

**Students will ...**

- Describe sponge external & internal anatomy.  
- Describe structures exclusive to this marine phylum.  
- Explain the symbiotic relationships and interdependence between sponges and other marine organisms.  
- Specifically explain cellular structures of sponges.  
- List the 3 sponge body plans and their characteristics  
- List the characteristics of the 4 sponge classes  
- List the characteristics of the kingdom Animalia
### Suggested Activities

**The following activities can be incorporated into the daily lessons:**

- Compile information including cell structure and function, anatomy and life cycle. Students will be able to list & explain features exclusive to Phylum Porifera including collar cells, central spongocoel, and asymmetrical shape.
- Utilize a sea sponge, their textbooks and internet resources to label the internal and external anatomy of a general sponge. They will also list the function of each part. (WORKSHEET) Label sponge anatomy List anatomical structures and their functions
- View sponges in their natural environment while also seeing how sponges reproduce and exist in varying environments (VIDEO)

### Laboratory Experiments

**The following experiments should be included into the daily lessons.**

- Examine and dissect a sponge. They will view the cells under a stereomicroscope and examine their anatomy. Students will be able to compare and relate features of the organism to others in the group and to other organisms. Students will also observe the specialized cells and anatomical structures found only in these organisms.
### Unit Overview

**Content Area:** Science  
**Unit Title:** Echinoderms  
**Target Course/Grade Level:** Marine Biology / Grades 11-12  
**Duration:** 2 weeks

**Description**  
During this section, students will explore the world of the spiny-skinned creatures known as echinoderms focusing on sea stars and sea urchins. They will investigate their niche in the ocean world, examine and understand their anatomy through dissection.

### Concepts & Understandings

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy</td>
<td>Echinoderms have various structures exclusive to their phylum.</td>
</tr>
<tr>
<td>Evolution</td>
<td>Structures specific to the Echinoderm phylum have evolved.</td>
</tr>
<tr>
<td>Cell Biology</td>
<td>Echinoderms have cells specific to their phylum.</td>
</tr>
</tbody>
</table>

### Learning Targets

<table>
<thead>
<tr>
<th>CPI Codes</th>
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</thead>
<tbody>
<tr>
<td>5.3.12.A.3</td>
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<tr>
<td>5.3.12.E.1</td>
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<tr>
<td>5.3.12.E.2</td>
</tr>
<tr>
<td>5.3.12.E.4</td>
</tr>
</tbody>
</table>

### 21st Century Themes and Skills

**Themes**  
- Global Awareness  
- Environmental Literacy

**Skills**  
- Critical Thinking and Problem Solving Skills  
- Communication and Collaboration Skills  
- ICT Literacy  
- Life and Career Skills

### Guiding Questions

- What echinoderms have you seen on the beach in this area?  
- Have you ever been on vacation and seen an echinoderm?  
- What is the most obvious trait of this phylum?  
- What structures do you expect to see when you examine your starfish?  
- Can you find the madreporite?  
- Which side is the "back" and which side is the "belly" of the starfish?  

### Unit Results

**Students will ...**  
- Compile information while examining and exploring the anatomy, life cycle and importance of echinoderms to the ocean ecosystem they will then use to complete the tasks of the unit.
Identify internal and external structures of the starfish during this dissection.

Identify internal and external structures of the sea cucumber during this dissection.

**Suggested Activities**

**The following activities can be incorporated into the daily lessons:**

- Examine diagrams and information showing the specific traits for the phylum Echinodermata. They will see how the cells behave under certain conditions. They will also see comparisons between echinoderms and other phyla as they relate to each other structurally and functionally.
- View a video explaining starfish dissection and focusing on the anatomy both external & internal.
- View a video explaining sea cucumber dissection and focusing on the anatomy both external & internal.

**Laboratory Experiments**

**The following experiments should be included into the daily lessons.**

- Utilizing the lab guide and dissection manual, students will first examine the external anatomy followed by the internal anatomy of the starfish. They will utilize a dissection microscope and compound microscope to view the cells and other structures.
- Utilizing the lab guide and dissection manual, students will first examine the external anatomy followed by the internal anatomy of the sea cucumber. They will utilize a dissection microscope and compound microscope to view the cells and other structures. Comparisons will be made between the sea cucumber and other related organisms including those from the unit.
# Marine Biology – Cnidarians: Jellyfish and Anemones

## Unit Overview

**Content Area:** Science  
**Unit Title:** Cnidarians: Jellyfish and Anemones  
**Target Course/Grade Level:** Marine Biology / Grades 11-12  
**Duration:** 2 weeks  

**Description**  
In this unit, students will study the characteristics of cnidarians. They will examine the jellyfish and sea anemone in detail (leaving detailed discussion of coral polyps for the chapter on coral reefs) They will gain an appreciation for the strange way these creatures work, and for the methods they use for food collection and survival.

## Concepts & Understandings

### Concepts
- Anatomy  
- Evolution  
- Cell Biology  
- Life Cycle  
- Interconnectedness and Interrelatedness  
- Environmental Impact

### Understandings
- Cnidarians have structures specific to the organisms in their phylum.  
- Cnidarians share characteristics with organisms in other phyla.  
- Cnidarians have cells specific to the organisms in their phyla.  
- Many cnidarians exist in different anatomical forms throughout their lives.  
- These are many examples of interconnectedness and interrelatedness throughout organisms of the phylum.  
- Cnidarians are effected by even very small environmental changes – particularly those caused by humans (tourism/pollution, etc.)

## Learning Targets

**CPI Codes**  
- 5.3.12.A.3  
- 5.3.12.C.1  
- 5.3.12.C.2  
- 5.3.12.E.1  
- 5.3.12.E.2  
- 5.3.12.E.4

## 21st Century Themes and Skills

**Themes**  
- Global Awareness  
- Environmental Literacy

**Skills**  
- Critical Thinking and Problem Solving Skills  
- Communication and Collaboration Skills  
- ICT Literacy  
- Life and Career Skills
## Guiding Questions
- Have you ever seen/touched a jellyfish? If so where?
- Can you identify the cnidarians in the fish tank?
- What anatomical similarities are similar in all cnidarians?
- What is the life cycle of a jellyfish?
- What is the life cycle of an anemone?

## Unit Results

**Students will ...**
- Describe the difference between radial & bilateral symmetry
- List the difference between a polyp & a medusa
- List the 3 classes of cnidarians, where they are found and if they exist as a polyp, medusa or both
- Describe the Portuguese Man of War jellyfish; why is it so special?
- Describe the structure of a nematocyte.
- List the characteristics of the 3 classes of cnidarians in their natural environment. They will explain how they eat, reproduce, coexist and are affected by changes in their environment caused by things such as pollution and tourism.
- Examine, draw and label the external and internal anatomy of the sea anemone and moon jellyfish while completing a dissection. (anemone/jellyfish dissection)
- List mechanisms by which scientists study these organisms
- Determine ways in which people (swimmers) can be better protected from these organisms.
- Compare & contrast these jellyfish with other species.

## Suggested Activities

_The following activities can be incorporated into the daily lessons:_
- View a video and see how cnidarians eat, reproduce and interact with each other. They will be able to view these organisms in their natural environment and see the interconnectedness between them and other organisms.
- View how these organisms are affected by even small changes in their environments including changes in salinity/temperature. Students will be able to list factors that affect these organisms and be able to develop solutions to negative issues such as pollution and changes caused by excessive tourism.
- View the information during the video and compile notes focusing on anatomy and the behavior of the organisms. Students will then discuss mechanisms for protecting the people who swim in these waters. They will also discuss the similarities and differences between these and other types of jellyfish.

## Laboratory Experiments

_The following experiments should be included into the daily lessons._
- compare and contrast the external anatomy of both the sea anemone and the moon jellyfish. They will utilize stereo and compound light microscopes to view the structures.
## Unit Overview

**Content Area:** Science

**Unit Title:** Coral Reefs

**Target Course/Grade Level:** Marine Biology / Grades 11-12

**Duration:** 2-3 weeks

**Description**
Students will take notes, observe organisms in videos, and create a children’s' book about coral reef life.

### Concepts & Understandings

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy</td>
<td>Corals have unique anatomy.</td>
</tr>
<tr>
<td>Geography</td>
<td>Corals exist in specific places in the world.</td>
</tr>
<tr>
<td>Photosynthesis</td>
<td>Coral zooxanthellae are specific to the system and reefs would not function without them.</td>
</tr>
<tr>
<td>Cell Biology</td>
<td>Corals have cells unique to the phylum.</td>
</tr>
</tbody>
</table>

### Learning Targets

**CPI Codes**
- 5.1.12.A.1
- 5.1.12.A.2
- 5.1.12.A.3
- 5.3.12.C.1
- 5.3.12.C.2
- 5.3.12.D.2
- 5.3.12.E.1
- 5.3.12.E.2
- 5.3.12.E.3
- 5.3.12.E.4

### 21st Century Themes and Skills

**Themes**
- Global Awareness
- Environmental Literacy

**Skills**
- Critical Thinking and Problem Solving Skills
- Communication and Collaboration Skills
- ICT Literacy
- Life and Career Skills

### Guiding Questions
- Where on the planet would you expect to find a coral reef?
- What kinds of animals would you expect to see if you were to visit a coral reef?
- What is interdependence?
- Are coral reefs worth saving from pollution?
- There are many different ways organisms in the coral reef reproduce. In what ways are humans impacting these reproductive methods and what can we do to prevent future human destruction?
Where is Australia?
What is the climate in Australia?
What types of organisms would you expect to find in these oceans?
What types of organisms would you expect to find in a coral reef?
Have you ever been to a coral reef?
What are some characteristics of a coral reef?
How do you think humans effect coral reef environments?

Unit Results

Students will ...

- List and describe the 3 types of coral reefs and their characteristics.
- Label the parts of the coral reef and their components.
- Explain why certain organisms occupy different parts of the reef and why.
- Explain/describe coral reproduction.
- Explain the importance of zooxanthellae.
- Describe the impact of wave stress on corals and the organisms that live in the reefs.
- Explain the importance of interdependence of organisms in the coral reef.
- List several ways that humans can and are impacting the delicate interdependencies in the coral reef.
- List and describe organisms found in the Great Barrier Reef.
- View and describe characteristics defining the organisms in this area of the world.
- View organisms in the Red Sea, and recognize the unique characteristics they possess because of the are in which they live.

Suggested Activities

The following activities can be incorporated into the daily lessons:

- Watch the Australia's Great Barrier Reef video and compile a list of 5 sets of organisms who are interdependent on one another throughout the video.
- View and analyze organisms in this area and list their characteristics. They will indicate any characteristics specific to organisms of this area. They will also complete a worksheet following the video.
- Create a children's book using organisms from the coral reefs.
- View the video and compile lists of the organisms and their characteristics specific for that area and that of coral reefs generally.

Laboratory Experiments

The following experiments should be included into the daily lessons.

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## Unit Overview

<table>
<thead>
<tr>
<th>Content Area: Science</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit Title:</strong> Cephalopods</td>
</tr>
<tr>
<td><strong>Target Course/Grade Level:</strong> Marine Biology / Grades 11-12</td>
</tr>
<tr>
<td><strong>Duration:</strong> 2-3 weeks</td>
</tr>
</tbody>
</table>

### Description
Students will learn about cephalopods.

### Concepts & Understandings

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy</td>
<td>Cephalopods have structures that are characteristics of this phylum of mollusks.</td>
</tr>
<tr>
<td>Comparative Cell Biology</td>
<td>Identify similar cell types across this class of organisms.</td>
</tr>
</tbody>
</table>

### Learning Targets

<table>
<thead>
<tr>
<th>CPI Codes</th>
</tr>
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<tbody>
<tr>
<td>5.3.12.C.1</td>
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<tr>
<td>5.3.12.C.2</td>
</tr>
<tr>
<td>5.3.12.E.1</td>
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</tr>
<tr>
<td>5.3.12.E.4</td>
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### 21st Century Themes and Skills

<table>
<thead>
<tr>
<th>Themes</th>
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<tbody>
<tr>
<td>Global Awareness</td>
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<table>
<thead>
<tr>
<th>Skills</th>
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<tbody>
<tr>
<td>Critical Thinking and Problem Solving Skills</td>
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</tr>
<tr>
<td>ICT Literacy</td>
</tr>
<tr>
<td>Life and Career Skills</td>
</tr>
</tbody>
</table>

### Guiding Questions

- What are some of the prominent structures you can see in these organisms?
- How do you think squid/octopus are related to snails/clams?

### Unit Results

**Students will ...**

- List the defining characteristics of the Phylum Mollusca.
- Explain the differences between the 3 classes of Molluscs.
- List the anatomical characteristics of squid, octopuses and cuttlefish.
- Locate/define/draw the anatomy of the squid (dissection)

### Suggested Activities

**The following activities can be incorporated into the daily lessons:**

- Compile information in the form of notes which they will utilize to complete the remainder of the unit.
- view Kings of Camouflage and compile notes based on the information presented
### Laboratory Experiments

*The following experiments should be included into the daily lessons.*

- Dissect a squid and view the internal & external anatomy focusing on reproductive system and digestion.
## Unit Overview

**Content Area:** Science  
**Unit Title:** Sharks  
**Target Course/Grade Level:** Marine Biology / Grades 11-12  
**Duration:** 1-2 weeks

### Description
Students will learn about the anatomy and physiology of sharks and how those characteristics allow them to survive in their environments.

### Concepts & Understandings

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy</td>
<td>Sharks have anatomical structures specific for their class.</td>
</tr>
<tr>
<td>Ecology</td>
<td>Sharks have specific characteristics that make them well adapted to their environments.</td>
</tr>
<tr>
<td>Reproduction</td>
<td>Sharks have reproductive organs specific to their class.</td>
</tr>
</tbody>
</table>

### Learning Targets

**CPI Codes**
- 5.3.12.C.1
- 5.3.12.C.2
- 5.3.12.E.1
- 5.3.12.E.2

### 21st Century Themes and Skills

**Themes**
- Global Awareness
- Environmental Literacy

**Skills**
- Critical Thinking and Problem Solving Skills
- Communication and Collaboration Skills
- ICT Literacy
- Life and Career Skills

### Guiding Questions
- What do you know about the anatomy of sharks?  
- Have you ever seen a shark?  
- Are all sharks aggressive?  
- How do sharks reproduce?  
- How can you tell if you have a male or female shark?  
- What do you expect to find in the shark stomachs?

### Unit Results

**Students will ...**
- Compile information relative to their understanding of sharks including their anatomy and behavior.  
- Describe aspects of shark anatomy & behavior
## Suggested Activities

*The following activities can be incorporated into the daily lessons:*

- [ ]

## Laboratory Experiments

*The following experiments should be included into the daily lessons.*

- Dissection of a dogfish shark
Unit Overview

**Content Area:** Science

**Unit Title:** Microorganisms

**Target Course/Grade Level:** Marine Biology / Grades 11-12

**Duration:** 2 weeks

**Description**
In this unit, students will be exposed to microorganisms, their characteristics, and the roles they play in marine environments. During this time, students will be given lecture notes on the characteristics and different types of microorganisms. Next, they view videos, and they complete questions based on the videos. After that, they will complete a lab where they will view and sketch 18 different types of microorganisms and answer questions on their structural characteristics, life cycles, nutrition requirements and methods of reproduction. Finally, the students will complete lab questions based on the characteristics of these microorganisms they viewed in the videos, their labs and during lecture.

**Concepts & Understandings**

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<tr>
<td>● Role of Microorganisms in Marine Environments</td>
<td>● Microorganisms play an important role in the marine ecosystems.</td>
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**Learning Targets**

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**21st Century Themes and Skills**

**Themes**
- Global Awareness
- Environmental Literacy

**Skills**
- Critical Thinking and Problem Solving Skills
- Communication and Collaboration Skills
- ICT Literacy
- Life and Career Skills

**Guiding Questions**
- Surrounding the Paramecium carcass, to what was the bacteria responding? Does this behavior have any survival value?
- Would you place Volvox in the Protist, or Plant kingdom?
- In the relationship between flatworm & internal algae, how does each species benefit?
- Although blue-green prokaryotes are often called “algae” they are also called “cyanobacteria”. Which name best indicates their evolutionary relationship?
- What advantages might a simple colony of cells have over independently living cells?
- What advantage might Volvox gain from its very elaborate form of sexual reproduction?

**Unit Results**

Students will ...

Marine Biology – Microorganisms
| Marine Biology – Microorganisms | 21 |

**Garfield High School**  
Aligned to the 2009 New Jersey Core Curriculum Content Standards  
ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

- Define: paramecium cilia blue-green algae cyanobacteria flagellum
- List the characteristics of the protist kingdom?
- List the characteristics of the plant kingdom.
- Describe how planktonic diatoms regulate their oil content, and adjust their buoyancy.
- View and draw the different types of microorganisms they examine under the microscope.

### Suggested Activities

**The following activities can be incorporated into the daily lessons:**

- 

### Laboratory Experiments

**The following experiments should be included into the daily lessons.**

- 


### New Jersey Core Curriculum Content Standards Index

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Common Core Standards for Literacy in History/Social Studies, Science, and Technical Subjects

The following Common Core Standards are infused throughout the curriculum. Specific standards addressed will be noted in the individual teacher’s lesson plans.

**Reading Standards for Literacy in Science and Technical Subjects (RST)**

**Grades 11-12**

### Key Ideas and Details

- **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.11-12.3** – Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

### Craft and Structure

- **RST.11-12.4** – Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.
- **RST.11-12.5** – Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
- **RST.11-12.6** – Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

### Integration of Knowledge and Ideas

- **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.11-12.8** – 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.11-12.9** – 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.

### Range of Reading and Level of Text Complexity

- **RST.11-12.10** – By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.
Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects (WHST)

Grades 11-12

Text Types and Purpose

- **WHST.11-12.1** - Write arguments focused on *discipline-specific content*.
  - **WHST.11-12.1a** - Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
  - **WHST.11-12.1b** - Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.
  - **WHST.11-12.1c** - Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
  - **WHST.11-12.1d** - Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
  - **WHST.11-12.1e** - Provide a concluding statement or section that follows from or supports the argument presented.

- **WHST.11-12.2** - Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
  - **WHST.11-12.2a** - Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
  - **WHST.11-12.2b** - Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.
  - **WHST.11-12.2c** - Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
  - **WHST.11-12.2d** - Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
  - **WHST.11-12.2e** - Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

- **WHST.11-12.3** (See note; not applicable as a separate requirement)
  - NOTE: Students’ narrative skills continue to grow in these grades. The Standards require that students be able to incorporate narrative elements effectively into arguments and informative/explanatory texts. In history/social studies, students must be able to incorporate narrative accounts into their analyses of individuals or events of historical import. In science and technical subjects, students must be able to write precise enough descriptions of the step-by-step...
procedures they use in their investigations or technical work that others can replicate them and (possibly) reach the same results.

Production and Distribution of Writing

- **WHST.11-12.4** - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- **WHST.11-12.5** - 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.
- **WHST.11-12.6** - Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge

- **WHST.11-12.7** - 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.
- **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.11-12.9** - Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing

- **WHST.11-12.10** - Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.