

COURSE: Marine Biology

Grade Level: 9-12 Elective

MAIN/ GENERAL TOPIC	SUB-TOPIC:	ESSENTIAL QUESTIONS:	WHAT THE STUDENTS WILL KNOW:	WHAT THE STUDENT WILL BE ABLE TO DO:	Assessments:	WHEN STUDENT DOES IT:
The Marine Environment	The oceans	❖ What is the marine environment? •	❖ What is the marine environment? ➤ The marine environment is the world's salt water oceans and seas. ▪ There are five arbitrary divisions of the worlds oceans • Arctic • Antarctic • Pacific • Atlantic • Indian	Identify the oceans on a map	Tests/Quizzes	1 st week
	Seas		▪ There are several large areas within the oceans known as seas (as well as bays and gulfs) the largest in decreasing order of area are: • South China Sea • Caribbean Sea • Mediterranean Sea • Bering Sea • Gulf of Mexico • Arabian Sea • Sea of Japan • Hudson Bay • East China Sea • Andaman Sea and Bay of Bengal • Black sea • Red Sea	Identify the world's Seas on a Map	Tests/Quizzes	1 st week
Organizing the Marine Environment	Ocean Zonation	❖ How do marine scientists organize the marine environment? ❖ The marine environment is	➤ Regions of the marine environment ▪ Continental shelf ▪ Continental slope and rise ▪ Abyssal plain ▪ Mid-ocean ridge	Identify the ocean zones on a map	Tests /Quizzes/Homework assignments	1 st quarter

		the largest and most complex in the world. How can we divide it into more manageable sections?	<ul style="list-style-type: none"> ▪ Deep ocean trench 			
			<ul style="list-style-type: none"> ➤ Horizontal zonation <ul style="list-style-type: none"> ▪ The benthic zone is the ocean bottom. <ul style="list-style-type: none"> • Intertidal zones are known as the littoral zones • The Continental shelf is the sublittoral zone • The benthic zones of the ocean basins are the bathyal (Continental slopes) abyssal (abyssal plains) and hadal (trench) zones. ▪ The pelagic zone is the waters of the open ocean environment <ul style="list-style-type: none"> • The pelagic zone over the continental shelves is neritic, all other pelagic water is oceanic 	Explain how the marine environment changes through out its horizontal and vertical zones.		

Motion in the Marine environment	Currents	❖ What are the patterns of water motion in the Sea	<ul style="list-style-type: none"> ➤ Currents are constantly moving areas of water in the ocean <ul style="list-style-type: none"> ▪ Currents are caused by <ul style="list-style-type: none"> • Differences in density • Differences in temperature • Cascading sediments (Turbidity currents) • Wind • Convergence with currents or objects • Divergence with currents or objects ▪ Downward currents are called downwelling. ▪ Upward Currents are called upwelling ▪ The Coriolis effect causes currents to deflect as they move north or south this causes circular motions called gyres. 			
	Waves	❖ How does energy travel through the marine environment	<ul style="list-style-type: none"> ➤ Waves are oscillating disturbances in seawater <ul style="list-style-type: none"> ▪ Waves do not move seawater but they transfer energy through sea water ▪ Waves have length amplitude and frequency ▪ Waves in the ocean have a base equal to ½ the wavelength ▪ When the wave base hits the bottom a wave “breaks” ▪ Tsunami are very large waves caused by upheavals of the seafloor ▪ Tidal bore waves occur in rivers and narrow inlets 			

	Tides	How do the sun and moon effect the marine environment?	<ul style="list-style-type: none"> ➤ Tides are the periodic rise and fall of the sea level due to the gravitational interaction of the Earth, Sun and Moon <ul style="list-style-type: none"> ▪ Tides are influenced by shore and basin features and differ in many bodies of water. ▪ The highest tides are called spring tides Sun and moon arte aligned ▪ The lowest tides are called neap tides Sun and moon are at right angle to one another ▪ Tides effect the life cycle of certain organisms 			
Comparisons between the terrestrial and marine environment		How does the marine environment differ from the terrestrial environment?	<ul style="list-style-type: none"> ➤ Seawater differs significantly from air physically and chemically from air <ul style="list-style-type: none"> ▪ Sea water: <ul style="list-style-type: none"> • is more than 800 times as dense as air • is about 60 times more viscous than air • transmits sound 4 times faster than air • is 10^{16} times more electrically conductive than air • absorbs light ➤ Marine environments are significantly more diverse than terrestrial or fresh water environments ➤ Marine organisms often have more complex life histories than terrestrial organisms 			

		❖ How is seawater different from freshwater?	Sea water contains many dissolved ionic substances <i>Chloride</i> 55.04% <i>Sodium</i> 30.61% <i>Sulfate</i> 7.68% <i>Magnesium</i> 3.69% <i>Calcium</i> 1.16% <i>Potassium</i> 1.10%			
Marine Organisms	Marine habitats	❖ How do we classify marine organisms?	<ul style="list-style-type: none"> ➤ Marine organisms are classified by taxonomy as well as habitat ➤ Marine organisms are classified as plankton, nekton, or benthos based on their habitat <ul style="list-style-type: none"> ▪ Plankton drift in the water column and have little or no ability to swim ▪ Nekton are able to swim throughout the water column ▪ Benthos live on the substrate 			
	Marine Phyla: Eukaryotes	❖ What role do prokaryotes have in the Marine Environment?	<ul style="list-style-type: none"> ▪ Prokaryotes are the bacteria and blue-green bacterial cells (cyanobacteria) that lack nuclei. <ul style="list-style-type: none"> • Cyanobacteria are important photosynthetic producers • Many bacteria are chemosynthetic • Many Bacteria are important decomposers 			

		<p>❖ What role to Unicellular protists play in the marine environment</p>	<p>➤ Unicellular eukaryotes are the protists and fungi that possess a true nucleus.</p> <ul style="list-style-type: none"> ▪ Most are plankton or benthos ▪ Autotrophic protists are typically classified as algae <ul style="list-style-type: none"> • Important micro-algae include coccolithophores, diatoms and dinoflagellates. • Diatoms have tests (shells) made of silica <ul style="list-style-type: none"> ◆ Diatom tests contribute to silica based sediments such as diatomaceous earth and siliceous ooze • Coccolithophores have tests made from calcareous plates <ul style="list-style-type: none"> ◆ Their tests are a major component of calcareous sediments • Dinoflagellates have organic (cellulose) tests <ul style="list-style-type: none"> ◆ They are characterized by two flagella ◆ <i>Zooxanthellae</i> are symbiotic with many marine animals ◆ <i>Noctiluca</i> cause bioluminescence ◆ <i>Gymnodinium</i> and <i>Gonyaulax</i> cause red tides ▪ Heterotrophic protists are typically classified as protozoans <ul style="list-style-type: none"> • Foraminiferans and Radiolarians are the “shelled” amoebas <ul style="list-style-type: none"> ◆ Both have tests <ul style="list-style-type: none"> ➤ Foraminifereans have CaCO₃ tests ➤ Radiolarians have Silica tests 		
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	Marine Phyla: Macroalgae	❖ What properties do macroalgae share	<ul style="list-style-type: none"> ➤ Macro-algae are the multicellular algae commonly known as seaweeds <ul style="list-style-type: none"> ▪ Macro-algae do not have true roots stems or leaves ▪ Macro algae experience alternation of generations ▪ Macro algae are classified by dominant pigment color <ul style="list-style-type: none"> • Red algae are the rhodophyta • Green algae are the chlorophyta • Brown algae are the phaeophyta 			
	Marine plants	❖ What adaptations are necessary for plants to live in salt water?	<ul style="list-style-type: none"> ➤ Plants require osmotic pressure to remain upright <ul style="list-style-type: none"> ▪ Many plants excrete salt through their leaves ➤ Mangroves and seagrasses have adaptations for living in seawater ➤ Some plants such as dune grasses and cord grasses have adaptations for living near salt water. 			

	Marine Animals	❖ What are the characteristics of the ocean's invertebrate animal phyla?	<ul style="list-style-type: none"> ▪ Each of the following animal invertebrate phyla have distinct body plans and life histories ▪ Sponges ▪ Bryozoans ▪ Cnidarians <ul style="list-style-type: none"> ◆ Anthozoans ◆ Scyphozoans ◆ Hydrozoans ▪ Platyhelminthes ▪ Nematodes ▪ Nemertean ▪ Annelids <ul style="list-style-type: none"> ◆ Polychaets ◆ Oligochaets ◆ Hirudineans ▪ Chaetognaths ▪ Pogonophorans ▪ Molluscs <ul style="list-style-type: none"> • Bivalves • Gastropods • Cephalopods ▪ Crustaceans <ul style="list-style-type: none"> ◆ Decapods (Crabs Shrimp and Lobsters) ◆ Copepods and Euphausiids ◆ Isopods ◆ Amphipods ◆ Limulus polyphemus ▪ Echinoderms <ul style="list-style-type: none"> ◆ Seastars ◆ Sea Urchins and sand dollars ◆ Brittle Stars ◆ Sea Cucumbers ▪ Cordates <ul style="list-style-type: none"> ◆ Tunicates ◆ Lancelets 	<ul style="list-style-type: none"> • For each phylum the student should • Observe examples of species in the phylum directly or indirectly • Describe the body plan of the phyla and their specific characteristics • Describe the typical life history of members of the phylum • Dissect representative species of select phyla 		
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