Marine Science 1 (2002500) Scope and Sequence

Unit	Standards	Suggested Timeframe
Unit 1: Science Processes, History, and Ocean Research Equipment	SC.912.N.1.1, SC.912.N.1.2, SC.912.N.1.3, SC.912.N.1.4, SC.912.N.1.5, SC.912.N.1.6, SC.912.N.1.7, SC.912.N.2.1, SC.912.N.2.4, SC.912.N.2.5, SC.912.N.3.1, SC.912.N.3.5, SC.912.N.4.1, SC.912.N.4.2	5 weeks
Unit 2: Geological Oceanography	SC.912.N.1.3, SC.912.N.1.5, SC.912.N.1.6, SC.912.N.2.4, SC.912.N.2.5 Supporting Standards: SC.912.E.6.1, SC.912.E.6.2, SC.912.E.6.3, SC.912.E.6.4, SC.912.E.6.5, SC.912.E.6.6	4 weeks
Unit 3: Chemical Oceanography	SC.912.L.17.2, SC.912.L.17.10, SC.912.L.18.12 Supporting Standard: SC.912.E.7.1	4 weeks
Unit 4: Physical Oceanography	SC.912.L.17.2, SC.912.L.17.3, SC.912.P.10.2, SC.912.P.10.20 Supporting Standards: SC.912.E.7.2, SC.912.E.7.3	4 weeks
Unit 5: Marine Meteorology	SC.912.E.7.9 Supporting Standards: SC.912.E.7.4, SC.912.E.7.5, SC.912.E.7.6, SC.912.P.10.4	4 weeks
Unit 6: Marine Ecology	SC.912.L.17.1, SC.912.L.17.4, SC.912.L.17.6, SC.912.L.17.7, SC.912.L.17.8, SC.912.L.17.9, SC.912.L.17.10 Supporting Standards: SC.912.L.17.5, SC.912.L.18.7, SC.912.L.18.8, SC.912.E.7.1	5 weeks
Unit 7: Marine Conservation	SC.912.L.14.6, SC.912.L.17.8, SC.912.L.17.11, SC.912.L.17.16 Supporting Standards: SC.912.E.6.6, SC.912.L.15.3, SC.912.L.15.9, SC.912.L.16.10, SC.912.L.17.13, SC.912.L.17.15, SC.912.L.17.17, SC.912.L.17.18, SC.912.L.17.20, SC.912.E.7.8, HE.912.C.1.3, HE.912.C.1.5	6 weeks
Unit 8: Marine Classification	SC.912.L.17.2, SC.912.L.15.13 Supporting Standards: SC.912.L.15.4, SC.912.L.15.5, SC.912.L.15.6, SC.912.L.15.7	6 weeks

GENERAL NOTES

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).

Special Notes:

Instructional Practices

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

Science and Engineering Practices (NRC Framework for K-12 Science Education, 2010)

- Asking questions (for science) and defining problems (for engineering).
- Developing and using models.
- Planning and carrying out investigations.
- Analyzing and interpreting data.
- Using mathematics, information and computer technology, and computational thinking.
- Constructing explanations (for science) and designing solutions (for engineering).
- Engaging in argument from evidence.
- Obtaining, evaluating, and communicating information.

Additional standards/ practices that are to be taught in this course:

- LAFS.1112.RST.1.1: 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.
- LAFS.1112.RST.1.2: 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.
- LAFS.1112.RST.1.3: 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.
- LAFS.1112.RST.2.4: 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.
- LAFS.1112.RST.2.5: Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
- LAFS.1112.RST.2.6: 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.

- LAFS.1112.RST.3.7: 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.
- LAFS.1112.RST.3.8: 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.
- LAFS.1112.RST.3.9: 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.
- LAFS.1112.RST.4.10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently.
- LAFS.1112.SL.1.1: Initiate and participate effectively in a range of collaborative discussions (oneonone, in groups, and teacherled) with diverse partners on grades 11– 12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
    a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
    b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.
    c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.
    d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.
- LAFS.1112.SL.1.2: Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.
- LAFS.1112.SL.1.3: Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.
- LAFS.1112.SL.2.4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
- LAFS.1112.SL.2.5: 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.
- LAFS.1112.WHST.1.1: Write arguments focused on discipline-specific content.
    a. 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.
    b. 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.

c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationship between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

e. Provide a concluding statement or section that follows from or supports the argument presented.

- LAFS.1112.WHST.1.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

  a. 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.

  b. 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.

  c. 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.

  d. 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.

  e. 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).

- LAFS.1112.WHST.2.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- LAFS.1112.WHST.2.5: 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.
- LAFS.1112.WHST.2.6: 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.
- LAFS.1112.WHST.3.7: 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.
- LAFS.1112.WHST.3.8: 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.
- LAFS.1112.WHST.3.9: Draw evidence from informational texts to support analysis, reflection, and research.
- LAFS.1112.WHST.4.10: 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.
- MAFS.912.N-Q.1.1: 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. ★
- MAFS.912.N-Q.1.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★

- MAFS.912.F-IF.2.4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. ★
- MAFS.912.F-IF.3.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★
    a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
    b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
    c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
    d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
    e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.
- MAFS.912.G-MG.1.2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★
- MAFS.912.N-VM.1.3: Solve problems involving velocity and other quantities that can be represented by vectors.
- MAFS.912.S-ID.1.1: Represent data with plots on the real number line (dot plots, histograms, and box plots). ★
- MAFS.912.S-ID.1.2: Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★
- MAFS.912.S-ID.1.3: Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★
- MAFS.912.S-ID.1.4: Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. ★
- MAFS.912.S-ID.2.5: Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★

Florida Standards for Mathematical Practice:
Integrate Common Core Standards for Mathematical Practice (MP) as applicable:

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

English Language Development Standards:

- ELD.K12.ELL.SC.1 English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.
- ELD.K12.ELL.SI.1 English language learners communicate for social and instructional purposes within the school setting.

English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link: http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf

Additional Instructional Resources:

A.V.E. for Success Collection is provided by the Florida Association of School Administrators: http://www.fasa.net/4DCGI/cms/review.html?Action=CMS_Document&DocID=139.

CPALMS:

There are more than 1043 related instructional/educational resources, 147 student resource, and 72 parent resource available for this course on CPALMS. Click on the following link to access them: http://www.cpalms.org/Public/PreviewCourse/Preview/4334

Course: Marine Science 1 (2002500)	**Unit 1: Science Processes, History, and Ocean Research Equipment**	**Length of Unit:** 5 Weeks

Included Standards: SC.912.N.1.1, SC.912.N.1.2, SC.912.N.1.3, SC.912.N.1.4, SC.912.N.1.5, SC.912.N.1.6, SC.912.N.1.7, SC.912.N.2.1, SC.912.N.2.4, SC.912.N.2.5, SC.912.N.3.1, SC.912.N.3.5, SC.912.N.4.1, SC.912.N.4.2

Score 4.0

In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.

- ☐ Design your own experiment to control variables. **(SC. 912.N.1.1)**

Score 3.0

The student will understand the history, technology, and scientific processes involved in Marine Science.

Performs complex skills:

- ☐ Differentiate between science and non-science, citing examples of each.
- ☐ Design a controlled experiment on a marine science topic.
- ☐ Collect, analyze, and interpret data from the experiment to draw conclusions.
- ☐ Determine an experiment's validity and justify its conclusions based on: control group, limiting variables and constants, multiple trials (repetition) or large sample sizes, bias, method of data collection, analysis, and interpretation, communication of results.
- ☐ Differentiate between an observation and inference
- ☐ Compare the interactions of early civilizations with the ocean to modern civilizations such as: food, trade, discovery, research, etc.
- ☐ Classify and explain the function of different types of Marine science research equipment. Including but not limited to: Secchi Disk, Bottom Grabber, Plankton Net, CTD, Hydrometer, and refractometer.
- ☐ Explain how individual scientists, driven by need, used creativity and critical thinking to solve scientific problems. These contributions impacted a variety of scientific problems in various locations about oceanography including: James Cook – included scientific studies on voyages, John Harrison – chronometer, Charles Darwin – Theory of Coral Reef Development, H.M.S. Challenger I and II expeditions – first marine science expeditions, and Benjamin Franklin - Gulf Stream.
- ☐ Describe the dangers of using SCUBA (ex. Decompression sickness)

The student exhibits no major errors or omissions regarding the score 3.0 content.

Score 2.0

The student:

Recognizes or recalls specific terminology, such as:

Science, Non-science, Pseudoscience, Empirical knowledge, Marine Science, oceanography, biological oceanography, chemical oceanography, physical oceanography, geological oceanography, Reliability, Validity, Bias, Peer review, Control group, Limiting variables, Multiple trials, Inference, Observation, Analysis, Interpretation, Evidence, Prime Meridian, Latitude, Longitude, Equator, Compass, Chronometer, Secchi Disk, Bottom Grabber, Plankton Net, CTD, Hydrometer, and refractometer

Performs basic skills:

- ☐ Describe science as the study of the natural world and marine science as the study of the oceans, its organisms, and their interactions with marine environments
- ☐ Describe science as both durable (long lasting) and robust (strongly supported by data through experimentation), yet open to change
- ☐ Explain why something would fail to meet the criteria for science. (criteria should include testability, repeatability, and replicability)
- ☐ Identify examples of observations and inferences.
- ☐ Describe the major historical contributions to oceanography (Such as: Phoenicians – Mediterranean trade routes, Polynesians – primitive mapping and long distance open ocean seafaring, Greeks – latitude via North Star and earth circumference, Chinese – compass, Vikings – Leif Eriksson landed in North America, Portuguese – Christopher Columbus)
- ☐ Describe how scientists use technology to make inferences about ocean topography
- ☐ Identify some of the major submersible vehicles used to study the oceans and their accomplishments such as: Trieste – Challenger Deep, Alvin – hydrothermal vents and Titanic site, and Johnson Sealink – panoramic view.
- ☐ Describe the use of ROV, AUV, electronic navigation, and satellites in ocean research including: Remotely operated vehicles (ROVs), Autonomous Underwater Vehicles (AUVs), GPS and other satellites, SCUBA, and SONAR.

No major errors or omissions regarding the score 2.0 content.

Score 1.0 With help, I know some of 2.0 and 3.0.

Score 0.0 Even with help, I am unable to understand.

Course: Marine Science 1 (2002500)	**Unit 2: Geological Oceanography**	**Length of Unit:** 4 Weeks

Included Standards: SC.912.N.1.3, SC.912.N.1.5, SC.912.N.1.6, SC.912.N.2.4, SC.912.N.2.5
Supporting Standards: SC.912.E.6.1, SC.912.E.6.2, SC.912.E.6.3, SC.912.E.6.4, SC.912.E.6.5, SC.912.E.6.6

Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.** ☐ Students will research how the ocean floor and other geological features have changed overtime and make predictions as to how they may be different in the future.
Score 3.0	**The student will understand how the ocean floor and other geological features were formed.** **Performs complex skills:** ☐ Explain the processes and mechanisms of plate tectonics and how it shapes the surface of the planet ☐ Explain the role that different individuals have played in the development of the Theory of Plate Tectonics including: Edward Suess, Alfred Wegener, and Harry Hess ☐ Differentiate between the three plate boundaries ☐ Compare the ocean zones ☐ Explain what sediments are, how marine geologists classify them and what physical factors affect the process of sedimentation of the ocean floor ☐ Differentiate between the three types of reefs ☐ Explain how a hotspot forms an island chain **The student exhibits no major errors or omissions regarding the score 3.0 content.**
Score 2.0	**The student:** **Recognizes or recalls specific terminology, such as:** Hot Spot Theory, SONAR, Seafloor Spreading, Divergent, Convergent, Transform, convection, lithosphere, asthenosphere, subduction, Intertidal Zone, Neritic Zone, Oceanic Zone, Pelagic Zone, Photic, Aphotic, Benthic Zone, Hadal Zone, Continental Margin, Ocean Basin, continental shelf, continental slope, continental rise, submarine canyon, abyssal plains, seamounts, guyots, trenches, ridges, hot spots, barrier islands, fringing, atoll **Performs basic skills:** ☐ Identify the evidence used to support the Theory of Plate Tectonics ☐ Explain what happens at convergent, divergent, and transform plate boundaries ☐ Describe the various expeditions that played a role in providing evidence to support seafloor spreading and identifying ocean features. ☐ Describe how the invention of sonar contributed to an advanced knowledge of the ocean bottom ☐ Identify the ocean zones ☐ Describe major geological ocean floor features ☐ Describe the composition of the sea floor ☐ Describe how the ocean floor and its topography are mapped ☐ Describe the structure of a barrier island **No major errors or omissions regarding the score 2.0 content.**
Score 1.0	With help, I know some of 2.0 and 3.0.
Score 0.0	Even with help, I am unable to understand.

Course: Marine Science 1 (2002500)	**Unit 3: Chemical Oceanography**	**Length of Unit:** 4 Weeks

Included Standards: SC.912.L.17.2, SC.912.L.17.10, SC.912.L.18.12
Supporting Standard: SC.912.E.7.1

Score 4.0

In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.

- ☐ Students will research examples of poor water quality and its effect on marine organisms and ecosystems.

Score 3.0

The student will understand properties of water and how those properties contribute to Earth's suitability as an environment for life.

Performs complex skills:

- ☐ Discuss the special properties of water that contribute to earth's suitability as an environment for life: cohesive behavior, ability to moderate temperatures, expansion upon freezing, and versatility as a solvent including:
  - salinity and temperature affects the density of water
  - polarity of water and hydrogen bonding capacity
  - the thermal properties of sea water
  - the process of desalination
- ☐ Explain how marine organisms osmoregulate.

The student exhibits no major errors or omissions regarding the score 3.0 content.

Score 2.0

The student:

Recognizes or recalls specific terminology, such as:

Solvent, Solute, Density, Adhesion, Cohesion, Capillary Action, Polar molecule, Viscosity, Surface tension, Halocline, Thermocline, Parts per thousand, pH, Salinity, Osmoregulation, alkalinity

Performs basic skills:

- ☐ Describe the chemistry of both fresh and salt water.
- ☐ Explain how water molecules bond.
- ☐ Identify the different properties of water including: cohesive behavior, ability to moderate temperatures, expansion upon freezing, and versatility as a solvent.
- ☐ Explain why the ocean is salty.
- ☐ Describe tests used to measure water quality.
- ☐ Explain how poor water quality can affect marine organisms.
- ☐ Differentiate between acids and bases.

No major errors or omissions regarding the score 2.0 content.

Score 1.0 With help, I know some of 2.0 and 3.0.

Score 0.0 Even with help, I am unable to understand.

Course: Marine Science 1 (2002500)	**Unit 4: Physical Oceanography**	**Length of Unit:** 4 Weeks

Included Standards: SC.912.L.17.2, SC.912.L.17.3, SC.912.P.10.2, SC.912.P.10.20
Supporting Standards: SC.912.E.7.2, SC.912.E.7.3

Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.** ☐ Students will research how ocean currents effect marine organisms.
Score 3.0	**The student will understand the measurable properties of waves.** **Performs complex skills:** ☐ Explain the relationships among properties of waves and how these properties change when the waves move from one medium to another. ☐ Describe the forces that generate waves and tides ☐ Differentiate between different types of waves. ☐ Graph the changes in tide height vs. time to determine the relationship between moon phases, moon positions, and the times of spring and neap tides: diurnal, semidiurnal and mixed ☐ Differentiate between different types of tides. ☐ Differentiate between the various types of ocean currents. ☐ Describe the effect of Coriolis on ocean currents. **The student exhibits no major errors or omissions regarding the score 3.0 content.**
Score 2.0	**The student:** **Recognizes or recalls specific terminology, such as:** Coriolis Effect, Surface Current, Deep water current, Gyres, Orbital Motion of Water, waves, tides, crest, trough, wavelength, frequency, tsunami, diurnal, semi-diurnal, spring tide, neap tide **Performs basic skills:** ☐ Describe the measureable properties of waves. ☐ Describe the movement of water in a wave. ☐ Describe the function of models in science and identify the wide range of models used in science. ☐ Label the parts of a wave – crest, trough, wavelength, and height ☐ Describe factors that contribute to the formation of a wind driven wave including: wind speed, fetch, duration ☐ Identify major ocean currents and circulation patterns ☐ Explain how tidal waves are generated ☐ Describe an intertidal habitat. **No major errors or omissions regarding the score 2.0 content.**
Score 1.0	With help, I know some of 2.0 and 3.0.
Score 0.0	Even with help, I am unable to understand.

Course: Marine Science 1 (2002500)	**Unit 5: Marine Meteorology**	**Length of Unit:** 4 Weeks

Included Standards: SC.912.E.7.9
Supporting Standards: SC.912.E.7.4, SC.912.E.7.5, SC.912.E.7.6, SC.912.P.10.4

Score 4.0

In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.

- ☐ Students will research local historical weather events and figure out what caused them.

Score 3.0

The student will be able to explain how the oceans effect weather and climate.

Performs complex skills:

- ☐ Explain how wind circulation and Coriolis develop air masses.
- ☐ Differentiate between the four types of weather fronts.
- ☐ Predict weather using information about weather fronts and weather systems.
- ☐ Cite evidence that the ocean has had a significant influence on climate change by absorbing, storing, and moving heat, carbon, and water. Explain how the Coriolis Effect and wind patterns create ocean currents.
- ☐ Explain the occurrence of upwelling currents and their relationship to El Nino/La Nina.
- ☐ Explain how global warming and climate change impact our oceans.

The student exhibits no major errors or omissions regarding the score 3.0 content.

Score 2.0

The student:

Recognizes or recalls specific terminology, such as:

Coriolis Effect, trade winds, westerlies, polar easterlies, air mass (maritime, continental, tropical, polar, arctic), weather front (warm, cold, occluded, stationary), air pressure (high, low), conduction, convection, radiation, heat capacity, thermal inertia, solar heating, ozone, greenhouse effect, global warming, climate, El Nino, La Nina, monsoon, cyclone, hurricane

Performs basic skills:

- ☐ Identify four types of weather fronts.
- ☐ Explain the concept of heat capacity and the role of the ocean in moderating Earth's climate.
- ☐ Identify causes of special weather events including hurricanes, Monsoons, El Nino, and La Nina.
- ☐ Explain the effects of the Earth's rotation on wind, weather, and the Coriolis Effect.
- ☐ Describe the importance of heat capacity and thermal inertia in the ocean.
- ☐ Explain how a monsoon forms.
- ☐ Explain how a cyclone forms.
- ☐ Identify the wind speed of a certain hurricane category.
- ☐ Differentiate between temperature and heat.
- ☐ Compare and contrast the two types of cyclones.

No major errors or omissions regarding the score 2.0 content.

Score 1.0 With help, I know some of 2.0 and 3.0.

Score 0.0 Even with help, I am unable to understand.

Course: Marine Science 1 (2002500)	**Unit 6: Marine Ecology**	**Length of Unit:** 5 Weeks

Included Standards: SC.912.L.17.1, SC.912.L.17.4, SC.912.L.17.6, SC.912.L.17.7, SC.912.L.17.8, SC.912.L.17.9, SC.912.L.17.10
Supporting Standards: SC.912.L.17.5, SC.912.L.18.7, SC.912.L.18.8, SC.912.E.7.1

Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.** Students will research a marine ecosystem found in Florida and design a model that describes the symbiotic relationships and the energy transfer between organisms.
Score 3.0	**The student will understand the symbiotic relationships in an ecosystem and be able to use food webs to distinguish how energy moves through the trophic levels.** **Performs complex skills:** ☐ Describe changes in marine ecosystem resulting from seasonal variations, climate, and succession including: island formation, hydrothermal communities, changes in coral communities due to human impact, etc. ☐ Compare and contrast the relationships including predation, parasitism, competition, commensalism and mutualism. ☐ Use a food web to identify and distinguish producers, consumers, and decomposer. ☐ Analysis the movement of matter through different biochemical cycles (including water, carbon, and nitrogen cycles). ☐ Characterize the biotic and abiotic components that define freshwater systems, marine systems and terrestrial systems. **The student exhibits no major errors or omissions regarding the score 3.0 content.**
Score 2.0	**The student:** **Recognizes or recalls specific terminology, such as:** Ecology, food web, food chain, herbivore, carnivore, omnivore, detritivore, niche, photosynthesis, cellular respiration, primary producer, trophic level, energy/trophic pyramids, limiting factors, carrying capacity, upwelling, symbiotic, predation, parasitism, competition, commensalism and mutualism, successive, biogeochemical cycle, matter, energy, abiotic, biotic, species, ecosystem, biosphere, habitat, producers, consumers, and decomposer, autotroph, heterotrophy, ocean zones, benthic, pelagic, neritic, oceanic, epipelagic, mesopelagic, bathypelagic, abyssal pelagic, hadelpalagic, photic zone, aphotic zone, supralittoral, littoral, sublitoral, bathyal, abyssal, hadal, epifauna, epiflora, infauna, neuston, nekton, benthos, plankton, marine biomass **Performs basic skills:** ☐ Discuss the characteristics of populations, such as number of individuals, age structure, density, and pattern of distribution ☐ Explain the relationship between limiting factors and carrying capacity ☐ Describe symbiotic relationships including predation, parasitism, competition, commensalism and mutualism. ☐ Describe the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic level ☐ Apply the Law of Conservation of Energy to the transfer of energy between trophic levels in terms of open and closed systems ☐ Explain the movement of matter through different biochemical cycles (including water, carbon, and nitrogen cycles). ☐ Give reasons for competition between organisms such as: availability of resources, space, and food ☐ Identify abiotic and biotic components of aquatic systems. **No major errors or omissions regarding the score 2.0 content.**
Score 1.0	With help, I know some of 2.0 and 3.0.
Score 0.0	Even with help, I am unable to understand.

Course: Marine Science 1 (2002500)	**Unit 7: Marine Conservation**	**Length of Unit:** 6 Weeks

Included Standards: SC.912.L.14.6, SC.912.L.17.8, SC.912.L.17.11, SC.912.L.17.16
Supporting Standards: SC.912.E.6.6, SC.912.L.15.3, SC.912.L.15.9, SC.912.L.16.10, SC.912.L.17.13, SC.912.L.17.15, SC.912.L.17.17, SC.912.L.17.18, SC.912.L.17.20, SC.912.E.7.8, HE.912.C.1.3, HE.912.C.1.5

Score 4.0

In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.
Students will research human and nature's impact on local marine resources and formulate ideas to protect the oceans and marine organisms.

Score 3.0

The student will understand human and nature's impact on marine resources.

Performs complex skills:

- ☐ Analyze past, present, and potential future consequences to the environment resulting from various energy production technologies.
- ☐ Make positive and negative inferences about the interactions between humans and marine species.
- ☐ Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.
- ☐ Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests.
- ☐ Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.
- ☐ Draw conclusions about ocean sediments as economic resources.
- ☐ Draw conclusions about biological resources (algae, fish and marine mammals).
- ☐ Compare reasons for having limits on marine productivity.
- ☐ Compare issues surrounding global habitat destruction and pollutants.
- ☐ Differentiate between misconceptions in using marine resources both renewable and nonrenewable.
- ☐ Classify the needs and issues for coastal management and conservation efforts (positive and negative consequences).
- ☐ Assess the effectiveness of innovative methods of protecting the environment.

The student exhibits no major errors or omissions regarding the score 3.0 content.

Score 2.0

The student:

Recognizes or recalls specific terminology, such as:

consequences, environment, energy production technologies, geologic time, constructive and destructive forces, human civilization, Earth's internal and external energy, material resources, consequences (costs and benefits), human consumption (e.g. mining and extraction techniques off-shore drilling petrochemical refining), pollution, health, habitat destruction, energy production, genetic factors, environmental factors, pathogenic agents to health (both individual and public health), cell (growth, maintenance, reproduction, and homeostasis), hierarchy (functional and structural), natural selection (overproduction of offspring, inherited variation, and the struggle to survive), differential reproductive success, scientific theory of evolution, biotechnology (including medical and ethical impact issues), DNA, genetic information, genes, organisms, genetically modified organisms, reproduction, multicellular organisms, organ systems, renewable and nonrenewable resources (water, energy, fossil fuels, wildlife, and forests), non-living environment, biotic, abiotic, components of ecosystems (physical, chemical and biological), environmental impacts (waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution), human activities, natural events, populations, biodiversity, ecosystem processes, innovative methods, environmental quality, the scientific method, scientific argumentation, scientific inquiry, scientific knowledge, inference, natural phenomena, competing interpretations (explanations), empirical evidence, supernatural, aesthetic, bias, data analysis (qualitative and quantitative), models, theories, laws, hypotheses, alternative strategies, societal problems, economic

	Performs basic skills: ☐ Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health. ☐ List and explain the impact of alien species on various marine environments. ☐ Determine how invasive species can result in biodiversity loss. ☐ Explain how humans affect marine ecosystems both positively and negatively. ☐ Diagram methods to clean up oil spills. ☐ Recognize the concept of over-fishing. ☐ Describe how human population size and resource use relate to environmental quality. ☐ List the role of aquaculture in meeting the world's marine food needs. ☐ Identify the various types of food items provided by marine environments. ☐ Describe biologically important processes for life in the sea. ☐ List the effects of pollution on the marine environment (e.g., oil, sewage, synthetic chemicals, heavy metals, thermal, solid and radioactive waste). ☐ Describe the importance of the Endangered Species Act and give examples of Florida ☐ List and discuss the species that are threatened and endangered. **No major errors or omissions regarding the score 2.0 content.**
Score 1.0	With help, I know some of 2.0 and 3.0.
Score 0.0	Even with help, I am unable to understand.

Course: Marine Science 1 (2002500)	**Unit 8: Marine Classification**	**Length of Unit:** 6 Weeks

Included Standards: SC.912.L.17.2, SC.912.L.15.13
Supporting Standards: SC.912.L.15.4, SC.912.L.15.5, SC.912.L.15.6 SC.912.L.15.7

Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.** Students will research local organisms and identify their classification by using multiple sources.
Score 3.0	**The student will understand how marine organisms are classified and how life is distributed throughout marine ecosystem.** **Performs complex skills:** ☐ Categorize the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature. ☐ Describe and compare the unique characteristics of marine organisms that define how they are classified. ☐ Analyze how factors of natural selection and speciation contribute to marine evolution. ☐ Justify your findings about how organisms are classified based on their evolutionary history. ☐ Explain the adaptations to the marine environment for the following divisions in Kingdom Protista: (different colors are caused by different pigments) Phaeophyta (brown algae), Chlorophyta (green algae), Rhodophyta (red algae). ☐ Cite examples and explain the adaptations to the marine environment of the following fish classes: Agnatha, Chondrichthyes, and Osteichthyes. (sensory systems, buoyancy and energy saving techniques (skeleton, liver, body shape), fins, mouths, and body shapes, reproductive strategies) ☐ Cite examples and explain the adaptations to the marine environment of the following invertebrate phyla: Porifera, Cnidaria, Ctenophora, Mollusca, Annelida, Arthropoda, and Echinodermata. ☐ Cite examples and explain the adaptations to the marine environment of the following tetrapod classes: Aves, Reptilia, and Mammalia. ☐ Cite examples and explain the adaptations to the marine environment of the following mammalian orders: Pinnipedia (seal, walrus, and sea lion), Sirenia (manatee and dugong), Cetacea (whale), Odontecete (toothed whale), Mysticete (baleen), and Carnivora (sea otter, polar bear). ☐ Compare and contrast traditional and modern classification methods. **The student exhibits no major errors or omissions regarding the score 3.0 content.**
Score 2.0	**The student:** **Recognizes or recalls specific terminology, such as:** ocean zones, benthic, pelagic, neritic, oceanic, epipelagic, mesopelagic, bathypelagic, abyssal pelagic, hadelpalagic, photic zone, aphotic zone, supralittoral, littoral, sublitoral, bathyal, abyssal, hadal, epifauna, epiflora, infauna, neuston, nekton, benthos, plankton, Prokaryotes, Eukaryotes, Porifera, Cnidaria, Echinodermata, Marine Worms, Mollusca, Mammal, Aves, domain, kingdom, phylum, class, order, family, genus, species, cladogram, binomial nomenclature, dichotomous key **Performs basic skills:** ☐ Describe how and why organisms are hierarchically classified and based on evolutionary relationships. ☐ Explain the reasons for changes in how organisms are classified. ☐ Describe the conditions required for natural selection including: overproduction of offspring, inherited variation, struggle to survive which results in differential reproductive success ☐ Discuss distinguishing characteristics of the domains and kingdoms of living organisms. **No major errors or omissions regarding the score 2.0 content.**
Score 1.0	With help, I know some of 2.0 and 3.0.
Score 0.0	Even with help, I am unable to understand.