BUTLER SCHOOL DISTRICT

High School Marine Biology Curriculum

Authored by:
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Adapted from:
New Jersey Student Learning Standards- Science 2020

Reviewed by:
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Butler School District
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VISION

The Butler School District's Science Department's objective is to prepare students to think critically, innovate, communicate, and collaborate in an ever-changing world. The Science curriculum provides students with quality, rigorous instruction to help them become better **problem solvers, troubleshooters, and analytical thinkers**. The rich, educational experience provided within the Butler School District will produce young adults with the foundation and expertise they need for the future. It is the goal to challenge each student to develop and extend scientific proficiency through highest quality science teaching and standard-based assessments that meet the learning needs of each student. Butler Science students will become individuals who persevere in their pursuit of lifelong learning through a culture that appreciates the beauty and usefulness of science.

As a result of a Butler Science education, students will be able to…

- Synthesize scientific skills across disciplines
- Develop into confident scientists
- Learn at their own pace and advance their understanding in a variety of ways
- Collaborate with others and contribute productively and articulately
- Act responsibly and be accountable for actions, in person and online
- Effectively approach, analyze, plan, and apply appropriate strategies for problem solving in ambitious contexts with accommodations for those who need it.
- Persevere through difficult situations and tasks and maintain a growth mindset despite adversity.
- Draw on knowledge from a wide variety of science topics with flexibility to approach the same problem from different perspectives or represent the science in different ways.
- Evaluate situations, draw logical conclusions, and develop, describe and apply solutions.
- Construct and support arguments.
- Evaluate their own reasoning and critique the reasoning of others.
- Assess the reasonableness of a solution with respect to the given construct or problem context.
- Use effective communication to engage in peer collaboration, reflecting on whether or not a solution is viable.
- Create appropriate representations of scientific situations across a variety of mediums. These models will support the student's ability to demonstrate and explain their scientific understanding.
- Use tools to explore and deepen their understanding of science concepts.
- Make effective choices regarding the use of any available tools.
- Make appropriate use of technology as a tool that is constantly changing and evolving.
- Attend to precision in their mathematical calculations and in their communication.
- Calculate accurately and efficiently and express numerical answers with a degree of precision that is appropriate to the given context.
- Develop precision in their use of scientific language.
- Look closely to determine patterns and structures within science.

- Make meaningful connections between their knowledge from previous experiences and the content they are currently exploring.
- Develop deep understandings of scientific concepts such that these understandings become applicable building blocks for future learning.
- Identify patterns in science that can be used to solve problems that are challenging relative to their learning comfort zone.
- Use generalizations to increase the efficiency and manageability of their work.
- Demonstrate growth mindset and grit in effectively approaching ever-rigorous problem solving.
- Apply appropriate strategies with differentiated levels of support.
- Be confident in participating in higher level discussions that will assess and advance the understanding of concepts.
- Learn science through exploring and solving contextual problems

COURSE OVERVIEW

The Butler School District's Marine Biology program has been designed to provide an overview of the major topics in Marine Biology and Oceanography. The hope is to inform and enlighten the student about the marine environment. First, the course introduces the science of marine biology and the interrelationship of the marine environment with humans. Important experiments and discoveries are not just announced as fact, but the student is provided with insight into the thinking processes of scientists and the ways science and technology merge to provide answers to scientific problems related to marine biology and oceanography. Second, the course proceeds to the understanding of the ocean environment. Ecology and geology of the ocean are introduced as well as a fundamental understanding of water, waves, and tides. Third, marine organisms are discussed in detail regarding taxonomy and their ecological role in the marine environment. Finally, marine ecosystems are addressed to understand the importance of how marine organisms interact in their individual environments. Evolution and marine ecology are interwoven throughout the course and often tie together seemingly unrelated areas of marine science.

COMPONENTS OF THE COURSE

GOALS

New Jersey Student Learning Standards
New Jersey Department of Education Instructional Units for Science

ASSESSMENT

Student learning will be assessed through a variety of formative, summative, benchmark, and alternative assessments.

SCOPE AND SEQUENCE
(*Pacing Guide*)

Unit of Study	Estimated time
Unit I-The Ocean Environment Fundamentals of Ecology, Geology of the Ocean, Water, Waves, and Tides	**6 Weeks**
Unit II – Marine Organisms Sponges, Cnidarians, Comb Jellies, Marine Worms, Molluscs, Arthropods, Echinoderms, Invertebrate Chordates, Fishes, Reptiles, Birds, and Mammals	**8 Weeks**
Unit III – Marine Ecosystems Intertidal Zones, Estuaries, Coral Reef Communities, and Open Ocean/Sea	**4 Weeks**

AFFIRMATIVE ACTION COMPLIANCE STATEMENT

The Butler Public Schools are committed to the achievement of increased cultural awareness, respect, and equity amongst our students, teachers, and community. We are pleased to present all pupils with information pertaining to possible career, professional, or vocational opportunities which in no way restricts or limits options on the basis of race, color, creed, religion, sex, ancestry, national origin, or socioeconomic status.

INTEGRATED ACCOMMODATIONS AND MODIFICATIONS

Students with IEPs, 504s, and/or Students at Risk of Failure Students read authentic texts and write authentic pieces at their independent and instructional reading levels. Individualized feedback is provided through conferences and small groups. The teacher utilizes visual and multi-sensory methods of instruction in addition to assistive technology when needed. Students are provided with graphic organizers and other scaffolded material. Modification of content and product may be deemed necessary based on student needs. Students are provided with testing accommodations and authentic assessments.

Gifted & Talented Students Students read authentic texts and write authentic pieces at their independent and instructional reading levels. Individualized feedback is provided to the student through conferences and small groups. Students are engaged through inquiry-based instruction to develop higher-order thinking skills. Activities are developed based on student interests and student goals. Students engage in real-world projects and scenarios.

English Language Learners Students read authentic texts and write authentic pieces at their independent and instructional reading levels. Individualized feedback is provided to students through conferences and small groups. Students are pre-taught vocabulary terms and concepts. Teachers engage students through visual learning, including the use of graphic organizers. Teachers use cognates to increase comprehension. The teacher models tasks and concepts, and pairs students learning English with students who have more advanced English language skills. Scaffolding is provided including word walls, sentence frames, think-pair-share, cooperative learning groups, and teacher think-alouds.

21ST CENTURY THEMES & SKILLS

Embedded in many of our units of study and problem based learning projects are the 21st Century Themes as prescribed by the New Jersey Department of Education. These themes are as follows:

- Global Awareness
- Financial, Economic, Business, and Entrepreneurial Literacy
- Civic Literacy
- Health Literacy

CURRICULUM ADDENDA FOR SPECIAL EDUCATION

This curriculum can be both grade and age appropriate for special education students and serves as a guide for the special education teacher in line with the district's written philosophy of special education, as stated within Policy #6700 concerning Programs for Educationally Disabled Students. Based on the Child Study Team evaluation and consultation with the parent and classroom teacher, an individualized education plan may include modifications to content, instructional procedures, student expectations, and targeted achievement outcomes of this curriculum document in accordance with the identified needs of an eligible student. This educational plan will then become a supplement guide that the classroom teacher, parent, and Child Study Team will use to measure the individual student's performance and achievement.

CURRICULUM ADDENDA FOR ENGLISH LANGUAGE LEARNERS

This curriculum guide is appropriate and is implemented for all students according to age and grade, and is in line with the district's written philosophy of English language acquisition concerning Bilingual Instruction and English as a Second Language Programs. In accordance with the New Jersey Administrative Code 6A:15, the contents herein provide equitable instructional opportunities for English Language Learners to meet the New Jersey Student Learning Standards and to participate in all academic and non-academic courses. Students enrolled in a Bilingual and/or an ESL program may, in consultation with the classroom teacher and Bilingual and/or ESL teacher, receive modification to content, instructional procedures, student expectations and targeted achievement outcomes of this curriculum document in accordance with the students developmental and linguistic needs.

DIVERSITY AND INCLUSION

In alignment with the 2020 NJSLS, the Science Curriculum materials will:

Cultivate respect towards minority groups to foster appreciation of their differences as well as their contributions to the advancement of science

Analyze and appreciate the diverse contributions made in the past (scientifically, economically, politically, and socially) at both the state and federal level as exemplified through science

Examine grade-level texts and resources that simultaneously highlight science as well as the contributions made to it by those of different genders, ethnicities, and abilities.

Employ science as a means of communication — whether in regard to empathy, inclusivity, or advocacy — in an effort to creatively inspire solutions for those with specific needs.

Engage in authentic learning experiences that motivate the acquisition and application of varied perspectives in science

Facilitate the ability to communicate effectively through science while applying content knowledge, interdisciplinary connections, and thinking skills to do so.

Foster active student participation in an inclusive culture that honors scientists of all genders, ethnicities, and abilities.

Analyze and develop an understanding of how scientific, economic, political, social, and cultural aspects of society influence new technological and scientific processes.

Reflect on both personal and non-personal experiences aimed to promote empathy and inclusivity for all regardless of our differences.

UNIT I-The Ocean Environment
UNIT SUMMARY
To create a foundation of understanding of our dynamic climate patterns, the physical and chemical properties that influence the oceans, and how these properties can relate to the survival of all life on Earth.
NEW JERSEY STUDENT LEARNING STANDARDS SCIENCE
• **HS-ESS1-5** Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.

• **HS-ESS1-6** Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.

• **HS-ESS2-1** Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

• **HS-ESS2-3** Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

• **HS-ESS3-4** Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.

INTERDISCIPLINARY CONNECTIONS

New Jersey Student Learning Standards-Language Arts (2023)

L.VL.11–12.3. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, including technical meanings, choosing flexibly from a range of strategies.

RI.MF.11–12.6. Synthesize complex information across multiple sources and formats to develop ideas, resolve conflicting information, or develop an interpretation that goes beyond explicit text information (e.g., express a personal point of view, new interpretation of the concept).

W.WR.11–12.5. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

SL.PE.11–12.1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

SL.II.11–12.2. 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.

SL.PI.11–12.4 Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.

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

New Jersey Student Learning Standards- Mathematics
MP.2 Reason abstractly and quantitatively

MP.4 Model with mathematics.
HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases
HSF-BF.A.1 Write a function that describes a relationship between two quantities.
HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays
HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.
HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
HSS-IC.B.6 Evaluate reports based on data.
HSF-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

New Jersey Student Learning Standards for Career Readiness, Life Literacies and Key Skills
9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas
9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving
9.4.12.CT.4: Participate in online strategy and planning sessions for course-based, school-based, or other project and determine the strategies that contribute to effective outcomes.
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions
9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience
9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity
9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations
9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to ze and propose a resolution to a real-world problem
New Jersey Student Learning Standards for Computer Science and Design thinking:
8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).
8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system
8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints
8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product
8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.

8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made. •
8.2.12.EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded. •
8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience. •
8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.

21st CENTURY LIFE AND CAREER STANDARDS

Career Readiness, Life Literacies, and Key Skills Practices describe the habits of the mind that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success.

- Act as a responsible and contributing citizen and employee.
- Attend to financial well-being.
- Consider the environmental, social and economic impacts of decisions.
- Demonstrate creativity and innovation.
- Utilize critical thinking to make sense of problems and persevere in solving them.
- Model integrity, ethical leadership and effective management.
- Plan education and career paths aligned to personal goals.
- Use technology to enhance productivity increase collaboration and communicate effectively
- Work productively in teams while using cultural/global competence.

9.1: Personal Financial Literacy

A. Financial Institutions
B. Financial Psychology
C. Planning and Budgeting
D. Risk Management and Insurance
E. Civic Financial Responsibility
F. Credit Profile
G. Economic and Government Influences
H. Credit and Debt Management

9.2: Career Awareness, Exploration & Preparation, and Training

A. Career Awareness (K-2)
B. Career Awareness and Planning (3-5)
C. Career Awareness and Planning (6-8)
D. Career Awareness and Planning (9-12)

9.4 Life Literacies and Key Skills

A. Creativity and Innovation
B Critical Thinking and Problem-solving
C. Digital Citizenship
D. Global and Cultural

9.3: Career and Technical Education

A. Agriculture
B. Architecture
C. Arts,A/V, Technology
D. Business Management
E. Education
F. Finance
G. Government
H. Health Science
I. Hospital & Tourism
J. Human Services
K. Information Tech.
L. Law and Public Safety
M. Manufacturing
N. Marketing
O. Science, Technology, Engineering & Math
P. Trans./Logistics

	Awareness E. Information and Media Literacy F. Technology Literacy	

TECHNOLOGY STANDARDS	
8.1: Computer Science A. Computing systems B. Networks and the Internet C. Impacts of Computing D. Data & Analysis E. Algorithms & Programming	**8.2 Design Thinking** A. Engineering Design B. Interaction of Technology and Humans C. Nature of Technology D. Effects of Technology on the Natural World E. Ethics & Culture
ENDURING UNDERSTANDINGS	**ESSENTIAL QUESTIONS**
It is an important resource for all living things Study the relationships among organisms and their interactions of organisms with their environment	Why is it important to protect our Oceans? What is ecology?

STUDENT LEARNING OBJECTIVES (Students are learning to / Students are learning that)

- Describe the scope and methodology of marine science.
- Explain safe and humane laboratory practices.
- Use current communication technology to interact with the global scientific community.
- Discuss a scientific approach to problem solving
- Develop an experimental procedure.
- Identify and label the major oceans on a world map.
- Discriminate among the structures of the ocean floor (mid-ocean ridges, seamounts, subduction zones, abyssal plains, and trenches).
- Relate the theories of continental drift and plate tectonics to the evolution of the ocean basins.
- Describe the evolution of today's ocean basins.
- Identify the three major types of plate boundaries and explain the consequences of these interactions.
- Discuss the basic physical properties of a sample of seawater (i.e., temperature, salinity, transparency, density, and pressure).
- Explain the ability of water to act as a solvent of solids and gases.
- Describe the basic chemical composition of seawater.
- Discuss the sources of variations in the ocean's salinity.
- Explain the major biogeochemical cycles that relate to the marine environment (carbon, nitrogen, water).
- Identify the properties and types of ocean waves.
- Explain how the Coriolis effect and wind patterns create ocean currents.
- Describe how the gravitational pull from the Earth, Moon, and Sun create tides.

- Describe how and why an El Nino event occurs and explain its effects.

SUGGESTED ACTIVITIES

Creation of Google site for the students coursework **Climate**
Word Wall Introduction
Video - History of Earth
Nearpod - Waves
Nearpod - Symbiotic Relationships
Create a timeline for the history of marine science specific to a particular area in the progress of marine studies. **DEI Climate**
Discuss the special properties of water that contribute to Earth's suitability as an environment for life . **Climate**
Research a person you identify with who has made a contribution in the area of ecology and human impact on the environment.**DEI**
Discussion of the Earth's rotation, creation of seasons and tides, the changing of the seasons due to climate change**. Climate**
Discuss the role of famous Marine Biologists in the field, and their effect on society **LGBTQ+**

EVIDENCE OF LEARNING

Formative Assessments:	**Summative Assessment:**
Classroom Discussion Exit Slip Checklists Peer Assessment Vocabulary Quizzes Rubric Participation and teacher observation Mini Whiteboard Responses Think-Pair-Share Concept Map Classroom Poll	Unit Tests End-of-Book Test NJSLA Test
Benchmark Assessment: Teacher created Assessments Unit Benchmarks	**Alternative Assessments:** Project Portfolio

INSTRUCTIONAL RESOURCES

Core Instructional Resource:	**Teacher Created Materials**	**Supplemental Resources:**
INTRO TO MARINE BIOLOGY/2nd Ed, Karlesk; Turner, Small	Nearpods Google Slides Pear Deck	Current Articles, Movies, news clips, web references, Discovery Education

MARINE BIOLOGY Castro, Huber		

INTEGRATED ACCOMMODATIONS AND MODIFICATIONS

Special Education:
Provide modified notes and access to extra copies online
Provide oral reminders and check student work during independent work time
Model skills/techniques to be mastered
Check and sign assignment planner
Preferential seating
Pair visual prompts with verbal presentations
Modified or scaffolded homework and classwork
Extended time as needed
Provide graphic organizers and study guides

English Learners:
Provide scaffolded assignments and assessments
Pair visual prompts with visual presentations
Check and sign assignment planner
Native Language translation (peer, online assistive technology, translation device, bilingual dictionary)
Extended time for assignment and assessment as needed
Highlight key vocabulary
Use graphic organizers
Provide verbal and written directions
Preferential seating with a English-speaking peer

At Risk of Failure:
Check and sign assignment planner
Encourage class participation and reinforce skills
Model skills and assignments
Extended to time to complete class work
Preferential seating
Provide extra help outside of class and 1:1 instruction when needed
Communicate regularly with students' other teachers
Provide positive feedback for tasks well done
Encourage student to proofread assessments and projects and ask for teacher proofreading of large writing assignments

Gifted and Talented:
Pose higher-level thinking questions
Provide higher level reading and writing materials for literacy based activities

Probe student to extend thinking beyond the text or connect two or more texts
Provide alternate or project-based assessments and assignments

Students with 504 Plans
Provide extended time as needed
Modify length of writing assignment
Provide short breaks within the lesson
Provide scaffolding for students
Utilize graphic organizers

UNIT II - Marine Organisms

UNIT SUMMARY

The unit will cover the vertebrates that makeup the marine world, ranging from lampreys to cetaceans. The unit will start off with the superclass Agnatha (jawless fish) and proceed with the superclass Osteichthyes (bony fish). The unit will continue with the superclass Tetrapoda of the marine environment: class Reptilia, class Aves and class Mammalia. The unit is designed to give the students an understanding of the diversity, the biological adaptations, and the niche these organisms play in the marine ecosystem.

NEW JERSEY STUDENT LEARNING STANDARDS SCIENCE

HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
LS1.A: Structure and Function

- Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)
- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS3- 1.)

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

[Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.]

- Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. [Clarification Statement: Examples of investigations could include heart rate response to exercise, stomata response to moisture and temperature, and root development in response to water levels.]

- Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3)

LS1.B: Growth and Development of Organisms

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

- In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)

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

Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [Assessment Boundary: Assessment does not include specific biochemical steps.]

- The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)

HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. [Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.]

- The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6)

HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. [Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.]

- As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6),(HS-LS1-7)
- As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. (HS-LS1-7)

INTERDISCIPLINARY CONNECTIONS

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problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

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MP.4 Model with mathematics.

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

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

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

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

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

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

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9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition

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9.4.12.CT.4: Participate in online strategy and planning sessions for course-based, school-based, or other project and determine the strategies that contribute to effective outcomes.

9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions

9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience

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9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to ze and propose a resolution to a real-world problem

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8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).

8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system

8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints

8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product

8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.

8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made. •

8.2.12.EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded. •

8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience. •

8.2.12.ETW.4: Research historical tensions between environmental and economic derations as driven by human needs and wants in the development of a technological product resent the competing viewpoints.

21st CENTURY LIFE AND CAREER STANDARDS

Career Readiness, Life Literacies, and Key Skills Practices describe the habits of the mind that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success.

- Act as a responsible and contributing citizen and employee.
- Attend to financial well-being.
- Consider the environmental, social and economic impacts of decisions.
- Demonstrate creativity and innovation.
- Utilize critical thinking to make sense of problems and persevere in solving them.
- Model integrity, ethical leadership and effective management.
- Plan education and career paths aligned to personal goals.
- Use technology to enhance productivity increase collaboration and communicate effectively
- Work productively in teams while using cultural/global competence.

9.1: Personal Financial Literacy	**9.2: Career Awareness, Exploration & Preparation, and Training**	**9.3: Career and Technical Education**
A. Civic Responsibility	A. Career Awareness (K-2)	A. Agriculture
B. Financial Institutions	B. Career Awareness and	B. Architecture
C. Financial Psychology		C. Arts,A/V, Technology

D. Planning and Budgeting E. Risk Management and Insurance F. Civic Financial Responsibility G. Credit Profile H. Economic and Government Influences I. Credit and Debt Management	Planning (3-5) C. Career Awareness and Planning (6-8) D. Career Awareness and Planning (9-12) **9.4 Life Literacies and Key Skills** A. Creativity and Innovation B Critical Thinking and Problem-solving C. Digital Citizenship D. Global and Cultural Awareness E. Information and Media Literacy F. Technology Literacy	D. Business Management E. Education F. Finance G. Government H. Health Science I. Hospital & Tourism J. Human Services K. Information Tech. L. Law and Public Safety M. Manufacturing N. Marketing O. Science, Technology, Engineering & Math P. Trans./Logistics

TECHNOLOGY STANDARDS	
8.1: Computer Science A. Computing systems B. Networks and the Internet C. Impacts of Computing D. Data & Analysis E. Algorithms & Programming	**8.2 Design Thinking** A. Engineering Design B. Interaction of Technology and Humans C. Nature of Technology D. Effects of Technology on the Natural World E. Ethics & Culture

ENDURING UNDERSTANDINGS	**ESSENTIAL QUESTIONS**
• Hagfish and lampreys are the only existing representatives of early jawless fishes. • Sharks, skates, rays, and chimeras are the modern representatives of the cartilaginous fishes. • Most bony fish use a gas-filled sac called a swim bladder to maintain neutral buoyancy. • Bony fish makeup all heterotrophic groups.	• What are the major groups of marine fishes? • What are the two classes of jawless fish? • What are the three classes of bony fish? • What are some key adaptations of fish? • What are the behaviors of fish? • What classes makeup the marine tetrapods?

• The evolution of an amniotic egg allowed reptiles to completely sever all ties with their aquatic environment. • The only marine lizard is the marine iguana of the Galapagos Islands. • Sea snakes are venomous and feed primarily on fish and eels. • Shorebirds, gulls, pelicans, albatrosses, petrels, and penguins makeup the marine birds. • Mammals are distinguished from other animals by their body covering of hair, constant warm body temperature, and mammary glands that produce milk. • The marine mammal class consists of Pinnipeds (seals, sea lions, walruses) Sirens (manatees and dugongs), and Cetaceans (whales, dolphins, porpoises).	• What are some key adaptations of marine tetrapods? • What are the behavior habits of marine tetrapods? • What environments do marine vertebrates occupy?

STUDENT LEARNING OBJECTIVES (Students are learning to / Students are learning that)

- Describe the anatomy and physiology of the jawless fish and the bony fish.
- Describe some of the behaviors of fish.
- Describe the advantage of producing an amniotic egg.
- Describe the migratory habits of sea turtles.
- Recognize the specific adaptations of marine iguanas and sea snakes.
- Describe the main groups of seabirds including adaptation, behavior, feeding, and reproduction.
- Describe the general characteristics of marine mammals.

SUGGESTED ACTIVITIES

Creation of Google site for the students coursework
Word Wall Introduction
Reaction Papers- Sharkwater, The Whale, Blackfish, The Cove
Shark Week Oral Presentations

Ecosystems are being destroyed in various parts of the world both by man-made and natural events.**DEI/Climate**
Scientists and engineers from different countries are designing ways to clean and distribute water. **DEI/Climate**

EVIDENCE OF LEARNING

Formative Assessments:	**Summative Assessment:**
Classroom Discussion Exit Slip Checklists Peer Assessment Vocabulary Quizzes Rubrics Participation and teacher observation Mini Whiteboard Responses Think-Pair-Share Concept Map Classroom Poll	Unit Tests End-of-Book Test NJSLA Test
Benchmark Assessment: Teacher Created Benchmarks Unit Benchmarks	**Alternative Assessments:** Project Portfolio

INSTRUCTIONAL RESOURCES

Core Instructional Resource:	**Teacher Created Materials**	**Supplemental Resources:**
INTRO TO MARINE BIOLOGY/2nd Ed, Karlesk; Turner, Small MARINE BIOLOGY Castro, Huber	Nearpods Google Slides Pear Deck	Current Articles, Movies, news clips, web references, Discovery Education

INTEGRATED ACCOMMODATIONS AND MODIFICATIONS

Special Education:
Provide modified notes and access to extra copies online
Provide oral reminders and check student work during independent work time
Model skills/techniques to be mastered
Check and sign assignment planner
Preferential seating
Pair visual prompts with verbal presentations
Modified or scaffolded homework and classwork
Extended time as needed
Provide graphic organizers and study guides

English Learners:
Provide scaffolded assignments and assessments
Pair visual prompts with visual presentations
Check and sign assignment planner
Native Language translation (peer, online assistive technology, translation device, bilingual dictionary)
Extended time for assignment and assessment as needed
Highlight key vocabulary
Use graphic organizers
Provide verbal and written directions
Preferential seating with a English-speaking peer

At Risk of Failure:
Check and sign assignment planner
Encourage class participation and reinforce skills
Model skills and assignments
Extended to time to complete class work
Preferential seating
Provide extra help outside of class and 1:1 instruction when needed
Communicate regularly with students' other teachers
Provide positive feedback for tasks well done
Encourage student to proofread assessments and projects and ask for teacher proofreading of large writing assignments

Gifted and Talented:
Pose higher-level thinking questions
Provide higher level reading and writing materials for literacy based activities
Probe student to extend thinking beyond the text or connect two or more texts
Provide alternate or project-based assessments and assignments

Students with 504 Plans
Provide extended time as needed
Modify length of writing assignment
Provide short breaks within the lesson
Provide scaffolding for students
Utilize graphic organizers

UNIT III – Marine Ecosystems
UNIT SUMMARY

The unit will cover the interdependence of the organisms, covered in this curriculum, and their environment. Marine ecosystems makeup earth's largest aquatic ecosystem while providing nearly half the world's oxygen. This unit will cover the estuaries, intertidal, and the open ocean ecosystems. There will be a focus on the ecosystem of the Barnegat Bay, so as to give the students an understanding of the local marine organisms and their environment. The unit is designed to give students an understanding of the diversity, the biological adaptations, and the niche these organisms play in the marine ecosystem

NEW JERSEY STUDENT LEARNING STANDARDS SCIENCE

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

Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [Assessment Boundary: Assessment does not include specific biochemical steps.]

- The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)

HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. [Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.]

- The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6)

HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. [Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.]

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

As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds

are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. (HS-LS1-7)

INTERDISCIPLINARY CONNECTIONS

New Jersey Student Learning Standards-Language Arts (2023)

L.VL.11–12.3. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, including technical meanings, choosing flexibly from a range of strategies.

RI.MF.11–12.6. Synthesize complex information across multiple sources and formats to develop ideas, resolve conflicting information, or develop an interpretation that goes beyond explicit text information (e.g., express a personal point of view, new interpretation of the concept).

W.WR.11–12.5. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

SL.PE.11–12.1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

SL.II.11–12.2. 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.

SL.PI.11–12.4 Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.

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

New Jersey Student Learning Standards- Mathematics
MP.2 Reason abstractly and quantitatively
MP.4 Model with mathematics.
HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases
HSF-BF.A.1 Write a function that describes a relationship between two quantities.
HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays
HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.
HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

HSS-IC.B.6 Evaluate reports based on data.
HSF-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

New Jersey Student Learning Standards for Career Readiness, Life Literacies and Key Skills

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas
9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving
9.4.12.CT.4: Participate in online strategy and planning sessions for course-based, school-based, or other project and determine the strategies that contribute to effective outcomes.
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions
9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience
9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity
9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations
9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to ze and propose a resolution to a real-world problem

New Jersey Student Learning Standards for Computer Science and Design thinking:

8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).
8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system
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8.2.12.EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded. •
8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience. •
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J. Civic Responsibility K. Financial Institutions L. Financial Psychology M. Planning and Budgeting N. Risk Management and Insurance O. Civic Financial Responsibility P. Credit Profile Q. Economic and Government Influences R. Credit and Debt Management	G. Career Awareness (K-2) H. Career Awareness and Planning (3-5) I. Career Awareness and Planning (6-8) J. Career Awareness and Planning (9-12) **9.4 Life Literacies and Key Skills** A. Creativity and Innovation B Critical Thinking and Problem-solving C. Digital Citizenship D. Global and Cultural Awareness K. Information and Media Literacy L. Technology Literacy	Q. Agriculture R. Architecture S. Arts,A/V, Technology T. Business Management U. Education V. Finance W. Government X. Health Science Y. Hospital & Tourism Z. Human Services AA. Information Tech. BB. Law and Public Safety CC. Manufacturing DD. Marketing EE. Science, Technology, Engineering & Math FF. Trans./Logistics

TECHNOLOGY STANDARDS		
8.1: Computer Science A. Computing systems B. Networks and the Internet C. Impacts of Computing D. Data & Analysis E. Algorithms & Programming	**8.2 Design Thinking** A. Engineering Design B. Interaction of Technology and Humans C. Nature of Technology D. Effects of Technology on the Natural World E. Ethics & Culture	
ENDURING UNDERSTANDINGS	**ESSENTIAL QUESTIONS**	
• Intertidal organisms must survive complex habitats. • Intertidal organisms must be able to tolerate radical changes in temperature, salinity, wave shock and moisture. • Tidal pools are refuges for organisms during periods of low tide. • Distribution and type of organisms found on sandy shores are greatly influenced by wave action. • Sandy shore can be divided into zones on the basis of the amount of tidal coverage they receive. • Meiofauna are microscopic organisms that live among the sand grains. • Abiotic and biotic factors affect organism distribution. • Estuaries form where freshwater from rivers and streams mix with seawater. • Estuaries, due to the mixing of nutrients from freshwater and seawater, are one of the most productive marine environments	• What adaptations intertidal organisms use to tolerate desiccation and high temperatures? • What factors influence the distribution of organisms on sandy shores? • How organisms inhabiting sandy shores survive dry periods and the intense heat of the sun? • What are some adaptive features organisms exhibit to help them survive wave shock? • What is an estuary? • What kind of marine organisms live in estuaries? • Why are estuaries so important to offshore fisheries? • What marine organisms inhabit the Barnegat Bay? • What is meiofauna?	
STUDENT LEARNING OBJECTIVES (Students are learning to / Students are learning that)		

- Describe the general adaptations of intertidal organisms.
- Recognize the importance of tide pools as refuge during low tides. **Climate**
- Describe a sandy beach habitat and the adaptations of meiofauna in order to live within it.
- Describe the general characteristics of estuaries and their mixing patterns.
- Explain the different types of estuarine communities.
- Identify the various marine species living within the local marine environments. **Climate**

SUGGESTED ACTIVITIES

Creation of Google site for the students coursework
Word Wall Introduction
Discuss the role of famous Marine Biologists in the field, and their effect on society **LGBTQ+**
Investigate how ecosystems are being destroyed in various parts of the world both by man-made and natural events. **DEI/Climate**
Scientists and engineers from different countries are designing ways to clean and distribute water. **DEI/Climate**

EVIDENCE OF LEARNING

Formative Assessments:	**Summative Assessment:**
Classroom Discussion Exit Slip Checklists Peer Assessment Vocabulary Quizzes Rubrics Participation and teacher observation Mini Whiteboard Responses Think-Pair-Share Concept Map Classroom Poll	Unit Tests End-of-Book Test NJSLA Test
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INSTRUCTIONAL RESOURCES

Core Instructional Resource:	**Teacher Created Materials**	**Supplemental Resources:**
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INTEGRATED ACCOMMODATIONS AND MODIFICATIONS

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Provide modified notes and access to extra copies online
Provide oral reminders and check student work during independent work time
Model skills/techniques to be mastered
Check and sign assignment planner
Preferential seating
Pair visual prompts with verbal presentations
Modified or scaffolded homework and classwork
Extended time as needed
Provide graphic organizers and study guides

English Learners:
Provide scaffolded assignments and assessments
Pair visual prompts with visual presentations
Check and sign assignment planner
Native Language translation (peer, online assistive technology, translation device, bilingual dictionary)
Extended time for assignment and assessment as needed
Highlight key vocabulary
Use graphic organizers
Provide verbal and written directions
Preferential seating with a English-speaking peer

At Risk of Failure:
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Encourage class participation and reinforce skills
Model skills and assignments
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Preferential seating
Provide extra help outside of class and 1:1 instruction when needed
Communicate regularly with students' other teachers
Provide positive feedback for tasks well done
Encourage student to proofread assessments and projects and ask for teacher proofreading of large writing assignments

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Students with 504 Plans
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