



# Township of Ocean Schools

Assistant Superintendent  
Office of Teaching and Learning

## **SPARTAN MISSION:**

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## **Curriculum Development Timeline**

**School:** Township of Ocean Intermediate School

**Course:** Science, Grade 7

**Department:** Science

<b>Board Approval</b>	<b>Supervisor</b>	<b>Notes</b>
December 2008	Patrick Sullivan	Born Date
August 2011	Patrick Sullivan	Revisions
May 2015	Patrick Sullivan	Revisions
July 2017	Patrick Sullivan	Revisions
March 2019	Patrick Sullivan	Review

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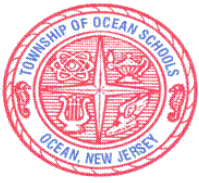
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<b>Week</b>	<b>Marking Period 1</b>	<b>Week</b>	<b>Marking Period 3</b>
1	Course Intro. / Science as a Process	21	Ecological Interactions
2	Science as a Process	22	Genetics & Medical Technologies
3	Science as a Process	23	Genetics & Medical Technologies
4	Science as a Process	24	Genetics & Medical Technologies
5	Cell Parts, Functions & Organization	25	Genetics & Medical Technologies
6	Cell Parts, Functions & Organization	26	Genetics & Medical Technologies
7	Cell Parts, Functions & Organization	27	Natural Selection & Evolution
8	Cell Parts, Functions & Organization	28	Natural Selection & Evolution
9	Cell Parts, Functions & Organization	29	Natural Selection & Evolution
10	Cell Parts, Functions & Organization	30	Natural Selection & Evolution
<b>Week</b>	<b>Marking Period 2</b>	<b>Week</b>	<b>Marking Period 4</b>
11	Cell Parts, Functions & Organization	31	Buffer Week: Benchmark / Biology Final
12	Cell Parts, Functions & Organization	32	PLTW: Energy and the Environment Unit: Investigating Energy
13	Cell Parts, Functions & Organization	33	PLTW: Energy and the Environment Unit: Investigating Energy
14	Cell Parts, Functions & Organization	34	PLTW: Energy and the Environment Unit: Investigating Energy
15	Cell Parts, Functions & Organization	35	PLTW: Energy and the Environment Unit: Sustainable Energy
16	Cell Parts, Functions & Organization	36	PLTW: Energy and the Environment Unit: Sustainable Energy
17	Cell Parts, Functions & Organization	37	PLTW: Energy and the Environment Unit: Sustainable Energy
18	Ecological Interactions	38	PLTW: Energy and the Environment Unit: Making an Impact

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19	Ecological Interactions	39	PLTW: Energy and the Environment Unit: Making an Impact
20	Ecological Interactions	40	PLTW: Energy and the Environment Unit: Making an Impact

### Core Instructional & Supplemental Materials including various levels of Texts

#### **Texts:**

Glencoe-2012---I-Science: Interactions of Life (CP)  
Glencoe-2012---I-Science: Structure + Function (Accelerated)

#### **Digital Resources Across All Levels: (D=differentiated)**

BioDigital Human (D)  
Edpuzzle (D)  
Gizmo (D)  
Science World Articles  
Youtube Streaming Videos  
PhET Interactive Simulations (D)  
Tedx Talks

<b>Time Frame</b>	<b>4 weeks</b>
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### Topic

**Science as a Process**

### Essential Questions

1. How do scientists design controlled experiments to answer scientific questions?
2. How do scientists analyze and interpret data to determine similarities and differences in findings?
3. How do scientists communicate ideas and evaluate competing design solutions?

### Enduring Understandings

**Based on NGSS Disciplinary Core Ideas:**

1. **ETS1.B: Developing Possible Solutions**

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- a. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3)
- b. Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)
- c. Models of all kinds are important for testing solutions. (MS-ETS1-4)
- d. A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)

## **2. ETS1.C: Optimizing the Design Solution**

- a. Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MSETS1-3)
- b. The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MSETS1-4)

## **Alignment to Standards**

*Students who demonstrate understanding can:*

1. **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
2. **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
3. **MS-ETS1-4.** Develop a model to generate data for iterative testing and modifications of a proposed object, tool, or process such that an optimal design can be achieved.

*Connections to other DCIs in this grade-band:* MS-PS3-3, MS-PS1-6; MS-LS2-5

*Articulation to DCIs across grade-levels:* 3-5.ETS1.A, 3-5.ETS1.B, 3-5.ETS1.C, HS.ETS1.A, HS.ETS1.B, HS.ETS1.C

## **Key Concepts and Skills**

### **CONCEPTS:**

The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions.

### **SKILLS:**

*By the end of this unit students will be able to:*

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1. Make, use and interpret different types of graphs
2. Design a controlled experiment to answer a scientific question based on student interest
3. Use scientific tools to make observations and record qualitative and quantitative data
4. Analyze scientific data to draw conclusions
5. Understand the various ways scientific research is communicated

## **Learning Activities**

- Grabbing Some Teamwork / Structure Challenge
- Lab Safety Contact / Mishaps Activity
- There's a Graph for That! Activity
- Analyze THIS! Graphing & Data Table Practice
- Scientific Method: There's a Method to the Madness Reading
- Being the Scientist - Observation, Inference, Prediction WS
- Excavating Evidence - An Observation & Inference Story
- Can You See It? Observation Activity
- What Specimen is That? Activity
- See It. Say It. Build It. Compare It. Lab
- Little Black Box of Science Lab
- Scientific Cents
- Putting It All Together
- Passing Judgement Activity
- How Many Times? / Don't Burst My Bubble Lab
- Gizmo: Germination
- Controlled Experiment of your Choice Project

## **Assessments**

### *Formative:*

- Pre-lab Investigation and Review / Practice Questions
- Topic Worksheets
- Observational Assessment/ Lab Participation
- Lab Analysis Questions

### *Summative:*

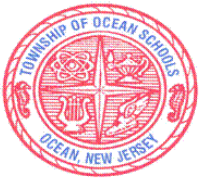
- Writing Tasks: Inquiry Lab Reports
- Quizzes and Tests (1 block)

### *Benchmark:*

### *Alternative:*

- Journal Entries: "Do now and Wrap-up" participation.

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### Career Education

- CRP-2 – Students use knowledge and skills through their lab work.
- CRP-12 – Students work productively in collaborative groups using culturally global competence.

### 21st Century Skills

- 9.3.ST-SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.

## Interdisciplinary Connections

*Common Core State Standards Connections:*

*ELA/Literacy –*

**RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts.

**RST.6-8.7** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually.

**RST.6-8.9** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

**WHST.6-8.7** Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

**WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research. **SL.8.5** Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.

*Mathematics –*

**MP.2** Reason abstractly and quantitatively.

**7.EE.3** Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.

**7.SP** Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.

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## **Technology Integration**

- Use of google apps (google slides, google classroom, google docs, google forms, etc.)
- Video streaming, learning & formative assessment via EdPuzzle
- Applicable Gizmo's (virtual labs) from ExploreLearning.com
- Elmo Demonstrations

8.1.8 Educational Technology- All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.

TECH.8.1.8.E - Students apply digital tools to gather, evaluate, and use information.

**Time Frame**

**13 Weeks**

## **Topic**

## **Cell Parts, Functions, & Organization**

## **Essential Questions**

1. What are the characteristics of all living things?
2. What are the similarities and differences between prokaryotic and eukaryotic cells?
3. What are the major organelles in bacteria, plant and animal cells? What disorders and/or diseases can be caused when an organelle is not functioning properly?
4. What are the similarities and differences between bacteria and viruses and what diseases can they cause?
5. Describe the structure of the phospholipid bilayer that makes up the cell membrane and explain how it is selectively permeable.
6. What is the difference between passive and active transport?
7. Predict the movement of water across a membrane depending on isotonic, hypertonic, or hypotonic concentrations.
8. How is homeostasis maintained within the human body?
9. What is the role of photosynthesis in the cycling of matter (atoms) and flow of energy into and out of organisms?
10. What is the relationship between availability of reactants and varied conditions (temperature, color of light, intensity of light, etc.) on the rate of photosynthesis?
11. What are three ways that living things create energy for cellular function?
12. How are cellular respiration and photosynthesis are related?

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13. How is the photosynthetic process currently being applied in the medical field to synthesize medicinal drugs and/or treat cancer cells?
14. How and why do cells duplicate?
15. What are the levels of cellular organization of multicellular organisms?
16. What are the similarities and differences between the four types of tissue in the human body?
17. Describe the functions of the 11 major body systems and explain how each system interacts with the other systems. What medical conditions are associated with each body system?

## **Enduring Understandings**

### **Based on NGSS Disciplinary Core Ideas:**

#### **LS1.A: Structure and Function**

- a. All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism consists of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1)
- b. Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2)
- c. In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions (MS-LS1-3)

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

- a. Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6)
- b. Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7)

#### **LS1.D: Information Processing**

- a. Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.

#### **PS3.D: energy in Chemical Processes and Everyday Life**

- a. The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (MS-LS1-6)
- b. Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon

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dioxide and other materials. (MS-LS1-7)

## **Alignment to Standards**

*Students who demonstrate understanding can:*

1. **MS-LS1-1.** Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
2. **MS-LS1-2.** Develop and used a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.
3. **MS-LS1-3.** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
4. **MS-LS1-6.** Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
5. **MS-LS1-7.** Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism
6. **MS-LS1-8.** Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
7. **MS-LS1-4.** Explain how characteristic animal behaviors affect the probability of successful reproduction.
8. **MS-LS1-5.** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

*Connections to other DCIs in this grade-level:* MS.LS3.A (MS-LS1-2), MS.PS1.B, MS.ESS2.A

*Articulation to DCIs across grade-levels:* 4.LS1.A (MS-LS1-2); HS.LS1.A (MS-LS1-1, MS-LS1-2, MS-LS1-3), 5.PS3.D, 5.LS1.C, 5.LS2.A, 5.LS2.B, HS.PS1.B, HS.LS1.C, HS.LS2.B, HS.ESS2.D

## **Key Concepts and Skills**

### **CONCEPTS:**

*Medical Applications:*

1. Some prokaryotic organisms, such as bacteria and protists, are capable of causing disease
2. The interaction of human body systems is important in maintaining our health (Body Systems Unit)

*Crosscutting Concepts:*

1. Scale, Proportion, and Quantity: Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1)

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2. Systems and System Models: Systems that interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS-LS1-3)
3. Structure and Function: Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-2)
4. Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)
5. Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6)

## **SKILLS:**

*By the end of this unit students will be able to:*

1. Compare and contrast the observable traits of prokaryotic and eukaryotic cells
2. Demonstrate the use of a compound light microscope and wet mount slide preparation
3. Identify the major organelles that make up bacteria, plant, and animal cells
4. Identify disorders and diseases that may be caused when an organelle is not functioning properly
5. Argue that viruses are not living organisms
6. Identify diseases that are caused by bacteria and viruses
7. Describe the structure of the phospholipid bilayer that makes up the cell membrane
8. Define selective permeability
9. Differentiate between passive transport and active transport
10. Predict the movement of water across a membrane depending on isotonic, hypertonic, or hypotonic concentrations
11. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter (atoms) and flow of energy into and out of organisms
12. Explain how photosynthesis uses energy from light to make sugars (glucose) from carbon dioxide and water, which also release oxygen
13. Describe the relationship between availability of reactants and varied conditions (temperature, color of light, intensity of light, etc.) on the rate of photosynthesis
14. Describe how cellular respiration involves chemical reactions with oxygen that release stored energy from glucose
15. Compare the energy output of aerobic and anaerobic respiration
16. Explain how cellular respiration and photosynthesis are related
17. Describe how and why cells make copies of themselves
18. Describe the levels of cellular organization of multicellular organisms
19. Differentiate between the 4 types of tissues in the human body
20. Describe the functions of the 11 major body systems in the human body
21. Explain how each of the body systems interact to other systems
22. Identify medical conditions associated with each body system

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## **Learning Activities**

### **Characteristics of Life**

- Lost at Sea Activity
- Characteristics of Life INB Flipbook
- Homeostasis Lab - Heart Rate
- Gizmo: Human Homeostasis
- Response to Stimuli Lab
- Gizmo: Sight vs. Sound Reaction

### **Cell History / Parts & Function**

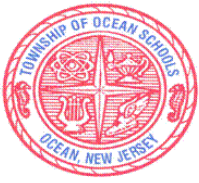
- History of the Cell Theory Flipbook & Basic Cell Substances Research
- Lipids Lab / Chemical Identification Tests Flipbook
- CSI Food Analysis Lab
- Life Under the Microscope Reading
- Gizmo: Cell Types
- Bacteria Characteristics Chart & Diagram / Name that Bacteria! Activity
- BrainPop: Antibiotics
- Prokaryote Wanted Project
- Bacteria Flipbook / Instagerm Project
- Gizmo: Cell Structure
- Cell Comparison Color by Number
- Microscope Madness Notes/Lab
- Cell Organelles - Animal or Plant?
- Plant VS Animal Cell Flipbooks
- Cell Project Brochure
- Cell Processes: Why are Cells So Small? Lab
- Battle for Planet Earth: The Structure & Function of Cells Project

### **Cell Processes**

- What do Cells do Anyway? Reading
- Smell Test Demo / Cellular Transport Foldable / Moving Across a Membrane Lab
- Egg-Speriment
- Move It! Lab
- Osmosis Application Scenarios + Effects of Osmosis on Cells Chart
- Gizmos: Diffusion & Osmosis
- Photosynthesis Flipbook / Graphic Organizer
- Gizmo: Photosynthesis Virtual Lab
- Respiration Flipbook / Graphic Organizer
- Gizmo: Cell Energy Cycle Virtual Lab

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- Gizmo: Plants and Snails Virtual Lab
- Lactic Acid Fermentation Lab
- Yeast on the Rise Lab
- Photosynthesis & Respiration Edpuzzle
- Cell Mitosis: Flipping Out Over Cell Division
- Gizmo: Cell Division
- Cell Cycle: Onion & Blastula Fish Virtual Lab
- Cell Cycle Spinner

### **Cellular Organization**

- Human Body Pre - Assessment and Word Dissections
- The Human Body: The Insiders Look Reading
- The Human Body Project

## **Assessments**

### *Formative:*

- Pre-lab Investigation and Review / Practice Questions
- Topic Worksheets
- Observational Assessment/ Lab Participation
- Lab Analysis Questions

### *Summative:*

- Writing Tasks: Inquiry Lab Reports
- Body Systems Project
- Quizzes and Tests (1 block)

### *Benchmark:*

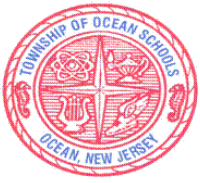
### *Alternative:*

- Journal Entries: "Do now and Wrap-up" participation

## **Career Education**

- CRP-2 – Students use knowledge and skills through their lab work.
- CRP-12 – Students work productively in collaborative groups using culturally global competence.

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### 21st Century Skills

9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.

## Interdisciplinary Connections

*Common Core State Standards Connections:*

*ELA/Literacy –*

**RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts.

**RST.6-8.2** Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

**RI.6.8** Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not.

**WHST.6-8.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

**WHST.6-8.7** Conduct short research projects to answer a question (including self-generating questions), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration

**WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research.

**SL.8.5** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

*Mathematics –*

**6.EE.C.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation

## Technology Integration

- Use of google apps (google slides, google classroom, google docs, google forms, etc.)
- Video streaming, learning & formative assessment via EdPuzzle
- Applicable Gizmo's (virtual labs) from ExploreLearning.com
- Elmo Demonstrations
- TECH.8.1.8.E- Students apply digital tools to gather, evaluate, and use information.

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**Time Frame**

**4 Weeks**

## **Topic**

### **Ecological Interactions**

#### **Essential Questions**

1. What are the levels of organization in nature?
2. How are ecosystems affected by both biotic and abiotic factors?
3. What are examples of competition, predation, mutualism, commensalism, and parasitism in nature?
4. What is the difference between producers, primary, secondary, tertiary consumers, and decomposers and why are they important to their ecosystem?
5. What is the difference between a food chain and a food web?
6. What is the correlation between the size of populations and the availability of energy and matter in different trophic levels?
7. What is biodiversity and how does it benefit an ecosystem? What are specific threats to biodiversity?
8. What is the importance of sunlight, water, air and food for living things on earth?
9. How do physical changes to an environment affect the well-being of living organisms?

#### **Enduring Understandings**

##### **Based on NGSS Disciplinary Core Ideas:**

##### **LS1.D: Information Processing**

- a. Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.

##### **LS2.A: Interdependent Relationships in Ecosystems**

- a. Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and nonliving factors. (MS-LS2-1)
- b. In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1)
- c. Growth of organisms and populations increases are limited by access to resources. (MS-LS2-1)
- d. Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each

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organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2)

### **LS2.B: Cycle of Matter and Energy Transfer in Ecosystems**

- a. Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem (MS-LS2-3)

### **LS2.C: Ecosystem Dynamics, Functioning, and Resilience**

- a. Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)
- b. Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5)

### **LS4.D: Biodiversity and Humans**

- a. Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (secondary to MS-LS2-5)

### **ETS1.B: Developing Possible Solutions**

- a. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to MS-LS2-5)

## **Alignment to Standards**

*Students who demonstrate understanding can:*

1. **MS-LS2-1.** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
2. **MS-LS2-2.** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
3. **MS-LS2-3.** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
4. **MS-LS2-4.** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

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5. **MS-LS2-5.** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

*Connections to other DCIs in this grade-band:* MS.PS1.B (MS-LS2-3); MS.LS1.B (MS-LS2-3); MS.ESS2.A (MS-LS2-3)

*Articulation to DCIs across grade-levels:* 1.LS1.B (MS-LS2-2); 5.LS2.A (MS-LS2-3); 5.LS2.B (MS-LS2-3); HS.PS3.B (MS-LS2-3); HS.LS1.C (MS-LS2-3); HS.LS2.A (S-LS2-2); HS.LS2.B (MS-LS2-2),(MS-LS2-3); HS.LS2.D (MS-LS2-2); HS.ESS2.A (MS-LS2-3);

## **Key Concepts and Skills**

### **CONCEPTS:**

*Medical Application:* The interaction of normal flora, abiotic factors, and pathogenic organisms in the human body can have a profound impact on our health.

### *Crosscutting Concepts:*

1. Patterns: Patterns can be used to identify cause and effect relationships. (MS-LS2-2)
2. Cause and Effect: Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)
3. Energy and Matter: The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)

### **SKILLS:**

*By the end of this unit students will be able to:*

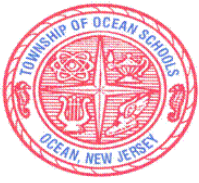
1. Discuss the levels of organization in nature and differentiate between organisms, populations, communities, and ecosystems
2. Differentiate between abiotic and biotic factors
3. Describe how ecosystems are affected by both biotic and abiotic factors
4. Describe how living things interact with one another.
5. Differentiate between producers, primary, secondary, tertiary consumers, and decomposers
6. Differentiate between a food chain and a food web
7. Explain the correlation between the size of populations and the availability of energy and matter in different trophic levels
8. Explain the importance of decomposers in an ecosystem
9. Create a food web that describes the transfer of energy in an ecosystem
10. Predict the consequences of drastic changes to the population of individual organisms in an ecosystem

## **Learning Activities**

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- Interactions Within the Environment Reading / Review Questions
- What's in an Ecosystem? It's a Frog's World + Ecosystem Choice Project Research
- Species Characteristics Chart / You Are What You Eat! Graphic Organizer
- Food Chain / Food Web Ecology Project
- A Pyramid of Energy Graphic Organizer / Stacking it Up Activity
- Why Can't We All Just Get Along? Graphic Organizer / Symbiotic Relationships Card Sort + Apply to Project
- Ecological Interactions: Symbiosis Want Ad
- Analyzing Predator-Prey Relationships Activity
- Monsters in the Forest - A Game of Biodiversity
- Threats to my Ecosystem Research Activity
- Ecology PowerPoints & Presentations
- Gizmos: Rabbit Population by Season, Prairie Ecosystem, Forest Ecosystem

## **Assessments**

### *Formative:*

- Pre-lab Investigation and Review / Practice Questions
- Topic Worksheets
- Observational Assessment/ Lab Participation
- Lab Analysis Questions

### *Summative:*

- Writing Tasks: Inquiry Lab Reports
- Quizzes and Tests (1 block)

### *Benchmark:*

### *Alternative:*

- Journal Entries: "Do now and Wrap-up" participation

## **Career Education**

- CRP-2 – Students use knowledge and skills through their lab work.
- CRP-12 – Students work productively in collaborative groups using culturally global competence.

## **21st Century Skills**

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9.3.ST-SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

## **Interdisciplinary Connections**

*Common Core State Standards Connections:*

*ELA/Literacy –*

**RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts.

**WHST.6-8.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

**WHST.6-8.9** Draw evidence from literary or informational texts to support analysis, reflection, and research.

**SL.8.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.

**SL.8.4** Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, x topics, texts, and issues, building on others' ideas and expressing their own clearly.

**SL.8.5** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

*Mathematics –*

**6.EE.C.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

**6.SP.B.5** Summarize numerical data sets in relation to their context. (MS-LS2-2)

## **Technology Integration**

- Use of google apps (google slides, google classroom, google docs, google forms, etc.)
  - Video streaming, learning & formative assessment via EdPuzzle
  - Applicable Gizmo's (virtual labs) from ExploreLearning.com
  - Elmo Demonstrations
- TECH.8.1.8.E - Students apply digital tools to gather, evaluate, and use information.  
TECH.8.1.8.A- Demonstrate knowledge of a real world problem using digital tools.

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**Time Frame**

**5 Weeks**

## **Topic**

### **Genetics & Medical Technologies**

#### **Essential Questions**

1. How are DNA structure, genes, chromosomes, and proteins related?
2. How do mutations in DNA affect proteins and the overall health and appearance of an organism?
3. What are the advantages/disadvantages of sexual and asexual reproduction?
4. What current genetic technologies are available and how do they influence human health and medicine?

#### **Enduring Understandings**

##### **Based on NGSS Disciplinary Core Ideas:**

##### **LS1.B: Growth and Development of Organisms**

- a. Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (MS-LS3-2)

##### **LS3.A: Inheritance of Traits**

- a. Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1)
- b. Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)

##### **LS3.B: Variation of Traits**

- a. In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS-LS3-2)
- b. In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of

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proteins. Some changes are beneficial, others harmful, and some neutral to the organisms. (MS-LS3-1)

### **LS4.B: Natural Selection**

- a. In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring. (MS-LS4-5)

## **Alignment to Standards**

*Students who demonstrate understanding can:*

1. **MS-LS3-1.** Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
2. **MS-LS3-2.** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
3. **MS-LS4-5.** Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.

*Connections to other topics in this grade level:* MS.LS1.A, MS.LS4.A

*Articulation to DCIs across grade-levels:* 3.LS3.A, 3.LS3.B, HS.IS1.A, HS.LS1.B, HS.LS3.A, HS.LS3.B, HS.LS4.C

## **Key Concepts and Skills**

### **CONCEPTS:**

*Medical Applications:*

1. Genetic technologies are capable of improving human health, medicine, and Healthcare.

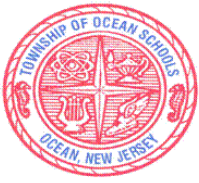
*Crosscutting Concepts:*

Cause and Effect

1. Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

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2. Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability

### Structure and Function:

Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS3-1)

### Interdependence of Science, Engineering, and Technology:

Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS4-5)

### Science Addresses Questions About the Natural and Material World:

Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS4-5)

## **SKILLS:**

*By the end of this unit students will be able to:*

1. Explain how genes play a role in inherited characteristics
2. Describe the contributions of Gregor Mendel in the area of genetics
3. Determine how traits are passed from parent to offspring
4. Determine the probability of inheriting a trait
5. Understand other complex inheritance patterns (incomplete dominance, codominance, multiple alleles)
6. Determine how traits are passed from parent to offspring
7. Learn how DNA translates to physical characteristics
8. Use amino acids (words) to build proteins (sentences) using various sequences of DNA
9. Learn how gametes pass on characteristics
10. Determine how common certain phenotypes are within a population
11. Demonstrate how to trace a trait through a family tree
12. Understand the process of hybridization, a type of selective breeding
13. Show understanding of selective breeding by creating a hybrid organism from two genetically similar organisms
14. Identify methods geneticists use to obtain specific traits within organisms
15. Research a type of genetic engineering and create a public service announcement from a chosen perspective.

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## **Learning Activities**

- My Parents Wrecked My Favorite Genes Reading / Questions
- Father of Genetics Notes / Squaring It Up Activity
- Genetics: You're Such a Square
- Phenylthiocarbamide Says What?! Genetics of Taste Lab
- Genetically Superior Hero Project
- Yellow and Blue Make? - Other Inheritance Patterns
- Genetics - A Twisted Tale
- DNA Crime Scene Lab
- DNA - Show Me What You're Made of! INB Activity
- My Fruit is Alive - DNA Extraction Lab
- My DNA Speaks to Me - Protein Synthesis Activity
- Oh Me, Oh Mei-osis notes, Just Like Me and Game of Chance Activities
- Track the Trait - Pedigrees Activity
- Pick Me Hybrid Article Analysis
- Mix it Up - a Hybrid Matching Game
- Get Your Hybrid Here - A Hybrid Sales Campaign
- An Engineered Reading
- Opinion Matters - Genetic Engineering PSA
- Genetics Study Guide / Test

## **Assessments**

### *Formative:*

- Pre-lab Investigation and Review / Practice Questions
- Topic Worksheets
- Observational Assessment/ Lab Participation
- Lab Analysis Questions

### *Summative:*

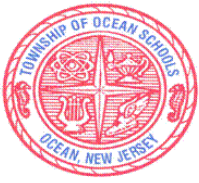
- Writing Tasks: Inquiry Lab Reports
- Quizzes and Tests (1 block)

### *Benchmark:*

### *Alternative:*

- Journal Entries: "Do now and Wrap-up" participation

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### Career Education

### 21st Century Skills

- 9.3.ST-SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.

## **Interdisciplinary Connections**

*Common Core State Standards Connections:*

*ELA/Literacy –*

**RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts.

**RST.6-8.4** 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 6-8 texts and topics.

**RST.6-8.7** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

**WHST.6-8.8** Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the Data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.

**SL.8.5** Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.

*Mathematics –*

**MP.4** Model with mathematics.

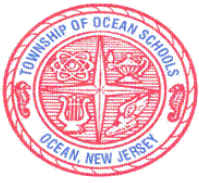
**6.SP.B.5** Summarize numerical data sets in relation to their context

## **Technology Integration**

- Use of google apps (google slides, google classroom, google docs, google forms, etc.)
- Video streaming, learning & formative assessment via EdPuzzle

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- Applicable Gizmo's (virtual labs) from ExploreLearning.com
  - Elmo Demonstrations
- TECH.8.1.8.E - Students apply digital tools to gather, evaluate, and use information.  
TECH.8.1.8.A- Demonstrate knowledge of a real world problem using digital tools.

**Time Frame**

**4 Weeks**

## **Topic**

### **Natural Selection, Adaptations & Evolution**

#### **Essential Questions**

1. How do genetic variations of traits in a population increase or decrease some individuals' probability of surviving and reproducing in a specific environment?
2. How can we use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time?
3. What evidence exists to support Darwin's theory of evolution and concept of common descent?

#### **Enduring Understandings**

**Based on NGSS Disciplinary Core Ideas:**

##### **LS4.B: Natural Selection**

- a. Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)

##### **LS4.C: Adaptation**

- a. Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6)

##### **LS4.A: Evidence of Common Ancestry and Diversity**

- a. The collection of fossils and their placement in chronological order (e.g., through the location of sedimentary layers in which they are found or through radioactive dating) is known as the fossil

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record. It documents the existence, diversity, extinction, and change of many life forms throughout history of life on Earth. (MS-LS4-1)

- b. Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inferences of lines of evolutionary descent. (MS-LS4-2)
- c. Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy (MS-LS4- 3)

## **Alignment to Standards**

*Students who demonstrate understanding can:*

1. **MS-LS4-4.** Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.
2. **MS-LS4-6.** Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
3. **MS-LS4-1.** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
4. **MS-LS4-2.** Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
5. **MS-LS4-3.** Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.

*Connections to other topics in this grade level:* MS.LS2.A, MS.LS2.C, MS.LS3.A, MS.LS3.B, MS.ESS1.C

*Articulation to DCIs across grade-levels:* 3.LS3.B, 3.LS4.B, 3.LS4.C, HS.LS2.A, HS.LS2.C, HS.IS3.B, HS.IS4.B, HS.IS4.C

## **Key Concepts and Skills**

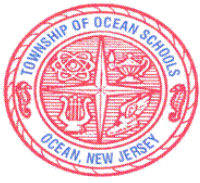
### **CONCEPTS:**

Cause and Effect

1. Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-4), (MS-LS4-6)

Patterns

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1. Patterns can be used to identify cause and effect relationships (MS-LS4-2)
2. Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1), (MS-LS4-3)

### Scientific Knowledge Assumes an Order and Consistency in Natural Systems

1. Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS4-1), (MS-LS4-2)

### **SKILLS:**

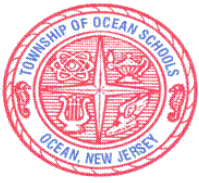
*By the end of this unit students will be able to:*

1. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment
2. Demonstrate how species change over time
3. Observe how the shape of a bird's beak determines what it eat
4. Demonstrate how camouflage can help an organism to survive in its environment
5. Demonstrate the process of evolution through natural selection
6. Determine the age of fossils using radioactive dating
7. Provide evidence for evolution through tracing the history of whales
8. Provide evidence that supports Darwin's theory of evolution and concept of common descent
9. Compare and contrast the embryonic development of different species

## **Learning Activities**

- Changes Over Time Differentiated Reading / Questions
- Birdbeak Toothpick Lab
- Mutation Nation and Bird Beak Adaptations Notes/Activity
- Masters of Disguise and Camouflage Chameleons
- Funky Monkeys
- How Old Is That Fossil? Lab
- Evolution of Whales
- HASPI Evolutionary Relationships Reading / Questions
- HASPI Hominid Skull Comparisons Lab
- Gizmo: Human Evolution - Skull Analysis
- HASPI Embryology Lab
- HASPI Evidence of Evolution Reading / Questions
- HASPI Evidence of Evolution Lab
- Building Beasts

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- Gizmos: (1) Natural Selection, (2) Evolution: Mutation & Selection, (3) Evolution: Mutation & Artificial Selection, (4) Rainfall and Bird Beaks (Optional - Additional Reinforcement)

## **Assessments**

### *Formative:*

- Pre-lab Investigation and Review / Practice Questions
- Topic Worksheets
- Observational Assessment/ Lab Participation
- Lab Analysis Questions

### *Summative:*

- Writing Tasks: Inquiry Lab Reports
- Quizzes and Tests (1 block)

### *Benchmark:*

### *Alternative:*

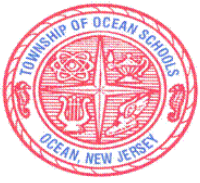
- Journal Entries: "Do now and Wrap-up" participation

## **Career Education**

- CRP-2-Students use knowledge and skills through their lab work.
- CPR-5-Students will have an increased awareness of how human population can affect the environment.
- CRP-12-Students work productively in collaborative groups using culturally global competence.

## **21st Century Skills**

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## **Interdisciplinary Connections**

### *Common Core State Standards Connections:*

#### *ELA/Literacy –*

**RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts.

**RST.6-8.8** Distinguish among facts, reasoned judgement based on research findings, and speculation in a text.

**RST.6-8.9** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

**WHST.6-8.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

**WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research.

**SL.8.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

**SL.8.4** Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

#### *Mathematics –*

**MP.4** Model with mathematics.

**6.RP.A.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

**7.RP.A.2** Recognize and represent proportional relationships between quantities.

## **Technology Integration**

- Use of google apps (google slides, google classroom, google docs, google forms, etc.)
  - Video streaming, learning & formative assessment via EdPuzzle
  - Applicable Gizmo's (virtual labs) from ExploreLearning.com
  - Elmo Demonstrations
- TECH.8.1.8.E -Students apply digital tools to gather, evaluate, and use information.  
TECH.8.1.8.A- Demonstrate knowledge of a real world problem using digital tools.

**Time Frame**

**9 Weeks**

**Topic**

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## **PLTW: Energy in the Environment**

### **Essential Questions**

1. What is the difference between renewable and nonrenewable resources?
2. How is human resource use impacting the environment and what is the resulting effect on our geosphere, cryosphere, hydrosphere and biosphere?
3. What sustainable solutions are available for our energy needs?
4. How can we model alternative energy sources and reduce our energy consumption?

### **Enduring Understandings**

#### **Unit 1: Investigating Energy**

- a. Two types of energy exist: potential (stored energy) and kinetic (energy in motion).
- b. Energy sources can be renewable, exhaustible, or inexhaustible. There are advantages and disadvantages to each.
- c. The six main forms of energy include solar or light radiation, thermal, electrical, mechanical, chemical, and nuclear.
- d. Energy efficiency and conservation are necessary in order to minimize pollution, improve business/economy, reduce dependence on foreign sources, and reduce our carbon footprint to create a sustainable world.
- e. Energy can be transferred (moved) or transformed (changed) from one object to another.
- f. The second law of thermodynamics states that not all energy is 100 percent efficient when it is converted from one form to another.
- g. Engineers, designers, and engineering technologists are high demand for the development of future technology to meet societal needs and wants.

#### **Unit 2: Sustainable Energy**

- a. There are events and issues that challenge us to use energy wisely and to develop alternate forms of energy, including economic and population growth, natural disasters, and conflicts with countries that provide the United States with oil.
- b. Fossil fuel use and greenhouse gas emissions can be reduced by using innovative means to implement renewable and inexhaustible energy sources.
- c. Energy sources can be used to produce electricity and hydrogen, energy carriers that provide the greatest diversity and lowest impact on the environment.
- d. Decisions regarding the implementation of alternative energy sources involve the weighing of tradeoffs between predicted positive and negative effects on the environment and financial

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burden.

- e. Careers in sustainable engineering will be created because our planet needs environmentally sustainable solutions to support population growth and preserve our limited natural resources.

### **Unit 3: Making an Impact**

- a. Water plays a critical role in our daily lives; it should be used wisely and users should be conscientious about conserving water.
- b. Environmental engineering focuses on developing a sustainable future, preventing pollution, and assessing the environmental impact of integrated waste management systems.
- c. The seven steps of integrated waste management include reduce, reuse, recycle, compost, incineration that creates usable energy, landfills, and incineration with no usable energy created.
- d. Engineers must consider a product's life cycle when designing because every product has an impact on the environment.
- e. Every individual impacts the environment through the choices they make in energy consumption and garbage disposal.
- f. Using energy efficiently will reduce the need for new power plants and utility infrastructure and will reduce the need to burn fossil fuels to produce energy, thereby reducing greenhouse gas emissions that contribute to climate change.
- g. Heat transfer occurs through conduction, convection, and radiation.

## **Alignment to Standards**

*Students who demonstrate understanding can:*

### **Matter and Its Interactions**

1. **MS-PS1.3** Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
2. **MS.PS1.4** Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

### **Energy**

3. **MS.PS3.1** Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
4. **MS.PS3.3** Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.\*
5. **MS.PS3.4** Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured

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by the temperature of the sample.

6. **MS.PS3.5** Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

### Engineering Design

7. **MS.ETS1.1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
8. **MS.ETS1.2** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
9. **MS.ETS1.3** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
10. **MS.ETS1.4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
11. **HS.ETS1.1** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
12. **HS.ETS1.2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
13. **HS.ETS1.3** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

### Earth and Human Activity

14. **MS-ESS3.3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
15. **MS.ESS3.4** Construct an argument supported by evidence for how increases in human population and per capita consumption of natural resources impact Earth's systems.
16. **MS-ESS3.5.** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

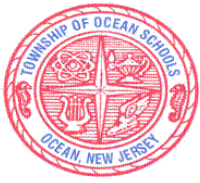
*Connections to other DCIs in this grade-band:* MS.PS1.A (MS-ESS3-1); MS.PS1.B (MS-ESS3-1); MS.LS2.A (MS-ESS3-3); MS.LS2.C (MS-ESS3-3), MS.LS4.D (MS-ESS3-3)

*Articulation to DCIs across grade-levels:* 3.LS2.C (MS-ESS3-3); 3.LS4.D (MS-ESS3-3); 5.ESS3.C (MS-ESS3-3); HS.LS1.C (MS-ESS3-1); HS.LS2.C (MS-ESS3-3); HS.LS4.C (MS-ESS3-3); HS.LS4.D (MS-ESS3-3); HS.ESS2.A (MS-ESS3-1); HS.ESS2.B (MS-ESS3-1); HS.ESS2.C (MS-ESS3-1), (MSESS3-3); HS.ESS2.D (MS-ESS3-3); HS.ESS2.E (MS-ESS3-3); HS.ESS3.A (MS-ESS3-1); HS.ESS3.C (MS-ESS3-3); HS.ESS3.D (MS-ESS3-3)

## **Key Concepts and Skills**

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### **CONCEPTS:**

#### Cause and Effect:

1. Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (MS-ESS3-3)
2. Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1)

#### Influence of Science, Engineering, and Technology on Society and the Natural World

1. All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ESS3-1)
2. The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-ESS3-3)

### **SKILLS:**

#### **Unit 1: Investigating Energy**

1. Describe the differences between, and the advantages and disadvantages of exhaustible, inexhaustible, renewable, and non-renewable energy sources.
2. Describe the six main forms of energy; including solar or light radiation, thermal, electrical, mechanical, chemical, and nuclear.
3. Differentiate between potential and kinetic energy.
4. Identify global energy uses and explain trends toward future demands.
5. Demonstrate ways to increase the efficiency of energy used in homes and at school.
6. Calculate financial savings and explain effects of our carbon footprint as a result of using energy efficiently.
7. Use the design process to design, model, and test a wind turbine for efficiency.
8. Calculate power and work by measuring force, distance, and time using the wind turbine model.
9. Describe the roles and responsibilities of STEM professionals for high demand technological careers.

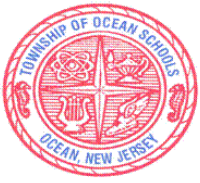
#### **Unit 2: Sustainable Energy**

1. Graph data that represents energy consumption, energy imports, and energy production.
2. Recognize that alternative energies are not always available in every location.
3. Recognize that the solution to our energy needs now and in the future will include conservation and wise use of resources as well as a wide variety of sources.
4. Describe the roles and responsibilities of STEM careers that help solve environmental problems.
5. Identify alternative forms of energy, explain why they are alternative, and identify the advantages and disadvantages of each.

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6. Identify challenges in transferring alternative energies from where they are produced to where they are consumed.
7. Research an alternative energy solution used for a specific purpose that will reduce the nation's dependence on fossil fuels.

### **Unit 3: Making an Impact**

1. Calculate daily water consumption for a building such as a home or school and recommend water conservation strategies.
2. Identify ways that individuals can reduce the effect on the environment through their energy choices and garbage disposal.
3. Identify how STEM professionals are involved in integrated waste management and other environmental careers.
4. Understand the difference between energy conservation and energy efficiency and be able to calculate both.
5. Differentiate between conduction, convection, and radiation as forms of energy transfer.
6. Compare the temperature of different materials to determine which are better at preventing heat transfer.
7. Design an experiment to investigate the prevention of heat transfer.
8. Evaluate a design to reduce heat transfer by weighing the amount of ice remaining; propose improvements for the design.

## **Learning Activities**

- PLTW Unit 1: Investigating Energy & Associated Activities
- PLTW Unit 2: Sustainable Energy & Associated Activities
- PLTW Unit 3: Making an Impact & Associated Activities

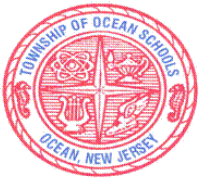
Additional Human Impact Activities if Time:

- STEM the Spill! PBL Project
- Hot Stuff! Lab
- Ocean Acidification Lab (1.5 Blocks)
- Chasing Corals Project
- The Penguin Predicament PBL Unit
- Renewable Resources K'NEX PBL Project
- The Green Energy Debate
- Gizmos: Greenhouse Effect, Coral Reefs 1&2, The Carbon Cycle, Energy Conversions

## **Assessments**

*Formative:*

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- Pre-lab Investigation and Review / Practice Questions
- Topic Worksheets
- Observational Assessment/ Lab Participation
- Lab Analysis Questions

### *Summative:*

- Writing Tasks: Inquiry Lab Reports
- Quizzes and Tests (1 block)

### *Benchmark:*

### *Alternative:*

- Journal Entries: “Do now and Wrap-up” participation

## Career Education

- CRP-2 – Students use knowledge and skills through their lab work.
- CPR-5 – Students will have an increased awareness of how human population can affect the environment.
- CRP-12 – Students work productively in collaborative groups using culturally global competence.

## 21st Century Skills

9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

## Interdisciplinary Connections

### *Common Core State Standards Connections:*

#### *ELA/Literacy –*

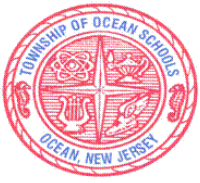
**RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts.

**WHST.6-8.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

**WHST.6-8.7** Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple

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avenues of exploration.

**WHST.6-8.8** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

**WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research.

*Mathematics –*

**6.RP.A.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS3-3)

**7.RP.A.2** Recognize and represent proportional relationships between quantities. (MS-ESS3-3)

**6.EE.B.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

**7.EE.B.4** Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

## **Technology Integration**

- Use of google apps (google slides, google classroom, google docs, google forms, etc.)
- Video streaming, learning & formative assessment via EdPuzzle
- Applicable Gizmo's (virtual labs) from ExploreLearning.com
- Elmo Demonstrations

TECH.8.1.A.1- Demonstrate knowledge of a real world problem using digital tools.

TECH.8.1.8.F.1-Explore a local issue by using digital tools to collect/analyze data and to identify a solution, making an informed decision.

TECH.8.1.8.E - Students apply digital tools to gather, evaluate, and use information.

TECH.8.1.8.D-Demonstrate personal responsibility for lifelong learning.

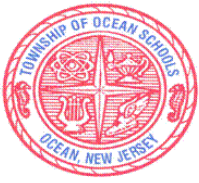
**Modifications (ELL, Special Education, At-Risk Students, Gifted & Talented, & 504 Plans)**

**ELL:**

- Work toward longer passages as skills in English increase
- Use visuals
- Introduce key vocabulary before lesson
- Teacher models reading aloud daily
- Provide peer tutoring

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- Use of Bilingual Dictionary
- Guided notes and/or scaffold outline for written assignments
- Provide students with English Learner leveled readers.

### **Supports for Students With IEPs:**

- Allow extra time to complete assignments or tests
- Guided notes and/or scaffold outline for written assignments
- Work in a small group
- Allow answers to be given orally or dictated
- Use large print books, Braille, or books on CD (digital text)
- Follow all IEP modifications

### **At-Risk Students:**

- Guided notes and/or scaffold outline for written assignments
- Introduce key vocabulary before lesson
- Work in a small group
- Lesson taught again using a differentiated approach
- Allow answers to be given orally or dictated
- Use visuals / Anchor Charts
- Leveled texts according to ability

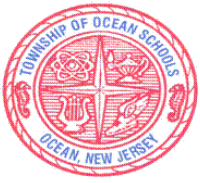
### **Gifted and Talented:**

- Create an enhanced set of introductory activities (e.g. advance organizers, concept maps, concept puzzles)
- Provide options, alternatives and choices to differentiate and broaden the curriculum
- Organize and offer flexible small group learning activities
- Provide whole group enrichment explorations
- Teach cognitive and methodological skills
- Use center, stations, or contracts
- Organize integrated problem-solving simulations
- Propose interest-based extension activities
- Expose students to beyond level texts.

### **Supports for Students With 504 Plans:**

- Follow all the 504 plan modifications
- Text to speech/audio recorded selections
- Amplification system as needed
- Leveled texts according to ability

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- Fine motor skill stations embedded in rotation as needed
- Modified or constrained spelling word lists
- Provide anchor charts with high frequency words and phonemic patterns

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