Alignment with NGSS
Ocean Sciences Sequence for Grades 6–8: The Ocean–Atmosphere Connection and Climate Change

Unit 1: How Do the Ocean and Atmosphere Interact?

Performance Expectations
Students, who have engaged in the practices, content and concepts described in the table, in multiple combinations, should be able to demonstrate the following performances:

MS-ESS2 Earth's Systems

- MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
- MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

MS-PS1 Matter and Its Interactions

- 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.

MS-PS3 Energy

- 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 by the temperature of the sample.**
- MS-PS3-5. Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.

** Introduces some aspects of the Performance Expectations as well as the Practices and the Disciplinary Core Ideas

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models • Develop a model to predict and/or describe phenomena. • Develop a model to describe unobservable mechanisms. **Analyzing and Interpreting Data** • Analyze and interpret data to determine similarities and differences in findings. **Constructing Explanations and Designing Solutions** • Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena.	**ESS2.C: The Roles of Water in Earth's Surface Processes** • Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4) • The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5)	**Patterns** • Macroscopic patterns are related to the nature of microscopic and atomic-level structure. • Graphs, charts and images can be used to identify patterns in data. **Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. • Cause and effect relationships may be used to predict phenomena in natural or

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Obtaining, Evaluating, and Communicating Information
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.**
- Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings.

Planning and Carrying Out Investigations
- Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.**
- Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation.**
- Collect data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.

Engaging in Argument from Evidence
- Construct and present oral and written arguments supported by empirical evidence and scientific

- Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)
- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6)

ESS2.D: Weather and Climate
- Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)
- The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)

PS1.A: Structure and Properties of Matter
- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)**
- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4)
- In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4)
- The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of

designed systems.

Scale, Proportion, and Quantity
- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

Energy and Matter
- Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).*
- The transfer of energy can be tracked as energy flows through a designed or natural system.
- Within a natural system, the transfer of energy drives the motion and/or cycling of matter.

Systems and System Models
- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems.
- Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.

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 and designed structures/systems can be analyzed to determine how they function.

Stability and Change
- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.

reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. • Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. ---------- **Connections to Nature of Science** **Scientific Knowledge is Based on Empirical Evidence** • Science knowledge is based upon logical and conceptual connections between evidence and explanations.	matter. (MS-PS1-4) **PS3.A: Definitions of Energy**** • The term "heat" as used in everyday language refers both to thermal motion (the motion of atoms or molecules within a substance) and radiation (particularly infrared and light). In science, heat is used only for this second meaning; it refers to energy transferred when two objects or systems are at different temperatures. (secondary to MS-PS1-4) • Temperature is not a measure of energy; the relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (secondary to MS-PS1-4) **PS3.B: Conservation of Energy and Energy Transfer** • The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4)** • Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)	• Small changes in one part of a system might cause large changes in another part. **Influence of Science, Engineering, and Technology on Society and the Natural World** • Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. ---------- **Connections to Nature of Science** **Science is a Human Endeavor** • Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** • Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.

Unit 2: How Does Carbon Flow through the Ocean, Land, and Atmosphere?

Performance Expectations
Students, who have engaged in the practices, content and concepts described in the table, in multiple combinations, should be able to demonstrate the following performances:

MS-ESS2 Earth's Systems
- MS-ESS2-4. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

MS-ESS3 Earth and Human Activity
- MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

MS-LS1 From Molecules to Organisms: Structures and Processes
- MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic** factors influence the growth of organisms. [**genetics not addressed]
- 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.
- 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.

MS-LS2 Ecosystems: Interactions, Energy, and Dynamics
- 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.**
- MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
- MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-PS1 Matter and Its Interactions
- MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

** Introduces some aspects of the Performance Expectations as well as the Practices and/or the Disciplinary Core Ideas below.

Science and Engineering Practices	Disciplinary Core Ideas (DCI)	Crosscutting Concepts
Developing and Using Models • Develop and use a model to describe phenomena.	**ESS2.A: Earth's Materials and Systems** • All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is	**Patterns** • Graphs, charts and images can be used to identify patterns in data.

- Develop a model to describe unobservable mechanisms.

Analyzing and Interpreting Data

- Analyze and interpret data to provide evidence for phenomena.

Obtaining, Evaluating, and Communicating Information

- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. **
- Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings.

Planning and Carrying Out Investigations

- Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation and to answer scientific questions.

Constructing Explanations and Designing Solutions

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Collect data to serve as the

derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)
- The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2)

ESS3.A: Natural Resources

- Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)

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

- 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)
- 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)

PS3.D: Energy in Chemical Processes and Everyday Life

- 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. (secondary to MS-LS1-6)
- 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 dioxide and

- Patterns can be used to identify cause and effect relationships.
- Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems.

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Scale, Proportion, and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

Energy and Matter

- Matter is conserved because atoms are conserved in physical and chemical processes.
- Within a natural system, the transfer of energy drives the motion and/or cycling of matter. *

Systems and System Models

- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems.
- Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.

Structure and Function

- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their

basis for evidence to answer scientific questions or test design solutions under a range of conditions.

Engaging in Argument from Evidence
- Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

Analyzing and Interpreting Data
- Analyze and interpret data to provide evidence for phenomena.**

Asking Questions and Defining Problems
- Ask questions to identify and clarify evidence of an argument.

Connections to Nature of Science
Scientific Knowledge is Based on Empirical Evidence
- Science knowledge is based upon logical and conceptual connections between evidence and explanations.
- Science findings are frequently revised and/or reinterpreted based on new evidence.**

other materials. (secondary to MS-LS1-7)

LS2.A: Interdependent Relationships in Ecosystems
- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)
- Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)**

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems
- 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
- 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)

PS1.A: Structure and Properties of Matter
- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)
- Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2), (MS-PS1-3)**

PS1.B: Chemical Reactions**
- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are

function depends on the relationships among its parts, therefore complex natural and designed structures/systems can be analyzed to determine how they function.

Stability and Change
- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.
- Small changes in one part of a system might cause large changes in another part.

Influence of Science, Engineering, and Technology on Society and the Natural World
- Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations.
- 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.

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems
- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.

	regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2), (MS-PS1-3), (MS-PS1-5) • The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5) • Some chemical reactions release energy, others store energy. (MS-PS1-6)	

Unit 3: What Are the Causes and Effects of Climate Change?

Performance Expectations
Students, who have engaged in the practices, content and concepts described in the table, in multiple combinations, should be able to demonstrate the following performances:

MS-ESS3 Earth and Human Activity

- MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
- MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- 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.
- MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

MS-ESS1 Earth's Place in the Universe

- MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.**

MS-ESS2 Earth's Systems

- MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. *[revisited from Unit 2]*
- MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

MS-LS2 Ecosystems: Interactions, Energy, and Dynamics

- MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-PS4 Waves and Their Applications in Technologies for Information Transfer**

- MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

MS-ETS1 Engineering Design

- 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.
- MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

** Introduces some aspects of the Performance Expectations above, as well as the Practices and Disciplinary Core Ideas below.

Science and Engineering Practices	Disciplinary Core Ideas (DCI)	Crosscutting Concepts
Developing and Using Models • Develop and use a model to describe phenomena. • Develop a model to describe unobservable mechanisms. **Analyzing and Interpreting Data** • Analyze and interpret data to provide evidence for phenomena. • Analyze and interpret data to determine differences and similarities in findings. **Constructing Explanations and Designing Solutions** • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. • Collect data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. • Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena.** **Obtaining, Evaluating, and Communicating Information** • Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used,	**ESS3.A: Natural Resources** • Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1) **ESS3.C: Human Impacts on Earth Systems** • Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3) • Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MSESS3-3), (MS-ESS3-4) **ESS3.D: Global Climate Change** • Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5) **ESS1.C: The History of Planet Earth** • The geologic time scale interpreted from rock strata provides a way to organize	**Patterns** • Graphs, charts and images can be used to identify patterns in data. • Patterns can be used to identify cause and effect relationships. • Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. **Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. **Scale, Proportion, and Quantity** • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. **Energy and Matter** • Within a natural system, the transfer of energy drives the motion and/or cycling of matter. **Systems and System Models** • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. • Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. **Structure and Function**

and describe how they are supported or not supported by evidence. **
- Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings.

Planning and Carrying Out Investigations
- Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions**.

Engaging in Argument from Evidence
- Use and/or construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

Analyzing and Interpreting Data
- Analyze and interpret data to provide evidence for phenomena.
- Analyze and interpret data to determine similarities and differences in findings.

Asking Questions and Defining Problems
- Ask questions to identify and clarify evidence of an argument.
- Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.**

Using Mathematics and Computational Thinking**

Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1-4)**

ESS2.A: Earth's Materials and Systems
- All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)
- The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2)

ESS2.C: The Roles of Water in Earth's Surface Processes *(revisited from Unit 1)*
- The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5)
- Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)
- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6)

ESS2.D: Weather and Climate
- Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)
- Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)
- The ocean exerts a major influence on weather and climate by absorbing

- 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 and designed structures/systems can be analyzed to determine how they function.
- Structures can be designed to serve particular functions.

Stability and Change
- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.
- Small changes in one part of a system might cause large changes in another part.
- Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

Influence of Science, Engineering, and Technology on Society and the Natural World
- Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations.
- 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.
- The uses of technologies and any 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,

• Use mathematical representations to describe and/or support scientific conclusions and design solutions. --- **Connections to Nature of Science** **Scientific Knowledge is Based on Empirical Evidence** • Science knowledge is based upon logical and conceptual connections between evidence and explanations. • Science findings are frequently revised and/or reinterpreted based on new evidence.**	energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6) **LS2.A: Interdependent Relationships in Ecosystems** • Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1) • Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)** **LS2.C Ecosystem Dynamics, Functioning, and Resilience** • 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) **PS4.B: Electromagnetic Radiation** • When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2) **ETS1.A: Defining and Delimiting Engineering Problems** • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1) **ETS1.B: Developing Possible Solutions** • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2) • Models of all kinds are important for testing solutions. (MS-ETS1-4)**	and economic conditions. Thus technology use varies from region to region and over time.** --- **Connections to Engineering, Technology, and Applications of Science** **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. --- **Connections to Nature of Science** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** • Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. **Science Addresses Questions About the Natural and Material World**** • Science knowledge can describe consequences of actions but does not make the decisions that society takes. **Science is a Human Endeavor** • Advances in technology influence the progress of science and science has influenced advances in technology.