

Curriculum Map: Science 7 - Life Science

Course: BIOLOGY Subtopic: Biology

Grade(s): None specified

Course Description: Life Science students learn basic introductory concepts including biology, cell division, genetics, ecology, populations and evolution. Students explore concepts and themes associated with living organisms, structure and function, inheritance, and changes in living forms over time. Students are challenged to think critically, solve problems, and know that biology is an essential addition to their general education. Students are assessed using the concepts and competencies aligned with the eighth grade PSSA Science Test.

Course Textbooks, Workbooks, Materials Citations: Science Matters Diversity of Life Kit
Science Matters Populations and Ecosystems Kit
Holt Science and Technology Animals Book

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Unit: Unit 1: Diversity of Life

Unit/Module Big Ideas: Think about characteristics that are common to all living organisms and develop a definition of life.
Acquaints students with the microscope as a tool used by scientists to study organisms in detail.
To recognize cells as the basic unit of life and to appreciate the diversity of cells that contributes to the diversity of life on Earth.
To recognize that seeds are living organisms in a dormant state. They will also observe and describe the first developmental stages of a plant.
To learn how the vascular system transports water throughout a plant and how stomates on leaves regulate the rate of water flow through a plant.
The adaptations of an insect are related to its' habitat and natural history.
To investigate the reproductive systems in flowers to understand the origin of seeds, and to explore plant adaptations for seed dispersal.
To investigate Monera (bacteria), Protista (algae), and Fungi Kingdom to understand their roles in the scheme of life.

Unit/Module Key Terminology & Definitions : living-things that show the characteristics of life
nonliving- things that have never been alive
dormant-things that do not show the characteristics of life until they are placed in the right environment
dead-things that were alive at one time but no longer are
field of view- area that is seen when looking through the microscope
magnify-make bigger
power-magnification of a lens
total magnification-multiply the magnification of the objective lens and eyepiece
focal plane-distance at which a microscope lens system focuses
base-bottom portion of microscope needed for stability
stage-platform that holds specimen
turret-structure that rotates objective lenses
transmitted light-light from illuminator that passes thru stage and specimen to produce an image
focus-to change the distance between the lens and specimen to get a clear image
eyepiece-lens that is used to view the specimen
neck-used to carry the microscope
coarse focus-a knob that makes large adjustments to the focus
fine focus-a knob that makes small adjustments to the focus
objective lens-lens used to magnify the object
prokaryotic-cells without nuclei
eukaryotic-cells with nuclei
Monera-one of the five kingdoms of life ,commonly known as the bacteria
nucleus-cell organelle that directs the cells activities
cell membrane-semipermeable layer surrounding the cell that separates it from the environment
mitochondria-cell organelle that provides energy to the cell
tissues-masses of cells working together
organs-groups of tissues working together
organ system-groups of organs working together

ribosome-cell organelle that produces proteins
 monocot-seeds with one cotyledon
 dicot-seeds with two cotyledons
 cotyledon-ear-shaped part of the seed
 seed-coat-tough, airtight layer on the outside of the seed
 endosperm-starchy material that makes up the cotyledon and supplies food to the plant as it begins to grow
 germinate-start of growth and development of a seed
 embryo-baby plant
 chlorophyll-green pigment found in chloroplast
 root cap- mass of cells at tip of root
 root tip-area behind the root cap
 zone of elongation-cells behind the root tip
 zone of maturation-cells containing root hairs
 root hairs-fine hair like structures that extend from the roots that take up water and minerals from the soil
 root-first structure to emerge from the seed
 stem-green structures that are flexible or rigid that establish shape of the plant
 leaves-structures that are responsible for the exchange of gas and photosynthesis
 cell wall- surrounds the cell membrane and composed of cellulose
 buttress-large bracing structures on trunks for added stability
 tendrils-structures found on vines that allow them to attach to other structures
 pigments-colored photosynthetic chemicals\
 photosynthesis-process in which plants use light energy, carbon dioxide and water to produce sugar and oxygen
 light reaction-part of photosynthesis in which ATP is formed
 dark reaction-part of photosynthesis in which ATP is broken down into smaller compounds
 carbohydrates-organic compound made up of carbon, oxygen, and hydrogen
 herbivore-animals that feed on plants
 phloem-tubes that carry sugar throughout the plant
 xylem-tubes that carry water, minerals from the roots throughout the plant
 epidermis-tough layer of cells that cover the top and bottom of leaf
 cuticle-waxy layer on outside of leaf
 mesophyll-cells between upper and lower epidermis that contain chloroplasts
 stomates-openings in the leaf surface
 guard cells-surround the stomates and controls the opening and closing of them
 transpiration-process of water vapor leaving the cells through stomates
 osmotic pressure-strength of water movement through a membrane
 Head-body region that has a mouth, sensory equipment, and a brain
 thorax-middle body region that contains the legs and wings
 abdomen-back end that contains most of the vital organs
 antenna-structures that are movable and allow insects to sense vibrations and chemicals in their environment
 compound eyes-eyes that are made of many small lenses that sends messages to the brain
 simple eyes-eyes that register light intensity only
 trachea-network of hollow tubes that collect oxygen
 spiracles-openings on the abdomen that connect to the trachea
 metamorphosis-body structure of insect changes
 incomplete metamorphosis- metamorphosis with three stages
 complete metamorphosis-metamorphosis with four life stages
 instar-nymph stage of an insect
 larva-immature, wingless, feeding stage of an insect
 pupa-non-feeding, resting stage
 class-group of related phyla
 order-group of related classes
 petals-most visible and showy parts of the flower
 sepals-green leaflike structures surrounding the base of the petals
 stamens-the male parts of the flower-composed of a filament and anther
 filament-long, thin stem of the stamen
 anther-tip of the stamen
 pollen grains-found in the anther
 sperm-male sex cells found in the pollen grains
 pistil-female part of the flower-composed of the stigma and ovary
 ovary- structure found at base of the pistil
 ovules-found inside the ovary
 eggs-female sex cells
 pollination-when pollen grains lands on the stigma
 fertilization-when male and female sex cells unite
 fruit-ripened ovary containing the seeds
 microbe-microscopic bacteria
 inoculate-placing a sample of bacteria on sterile agar
 sterile-material that contains nothing alive in it or on it
 Fungus-

**Unit/Module
Student
Learning
Outcomes:**

- Sort pictures of objects and organisms into living and nonliving groups.
- Defend picture-sorting decisions with an operational definition of "living".
- Any free-living thing-plant,animal,or other-is an organism.
- All living organisms exhibit common characteristics; they grow,consume nutrients,exchange gases,respond to stimuli,reproduce,need water,eliminate waste,and are composed of cells.
- Observe five materials for evidence of life when they are placed in suitable environments.
- Differentiate the concepts of living,nonliving,dead, and dormant.
- All living organisms exhibit common characteristics; they grow,consume nutrients,exchange gases,respond to stimuli,reproduce,need water,eliminate waste,and are composed of cells.
- An optical microscope is composed of a two-lens system,a stage on which to mount the material being observed,a light source, and a mechanical system for adjusting the position of the focal plane.
- A microscope image appears reversed and inverted.
- Focal plane is a thin plane at a fixed distance from the objective lens where the image is in focus.
- Optical power is the product of the magnification of the eyepiece and the objective lens.
- Measure the field of view for each objective lens on the microscope.
- Draw scale representations of images seen in a microscope to estimate size accurately.
- Demonstrate proper use of the microscope when studying layers in a sample and structures of brine shrimp.
- Draw scale representations of images seen in a microscope to estimate size accurately.
- Explain how the focal plan affects the image seen through a microscope.
- Prepare a wet mount to observe cheek scrapings and see evidence that humans , too,are made of cells.
- Humans, and all other complex life-forms, are made of cells.
- A major subdivision in cells is whether they have a nucleus or not.
- Bacteria have prokaryotic cells;all other life forms have eukaryotic cells.
- Cells have defining structures,such as membranes,cell walls,nuclei,chloroplast,ribosomes,mitochondria,and cytoplasm.
- Obtain information from a multimedia presentation.
- Cells are the basic unit of life.
- All life is aquatic at the cellular level.
- Seeds contain the dormant,living embryo of a plant.
- The cotyledon is the primary source of energy for seed germination.
- Dissect seeds to discover their structures.
- Germination is the onset of growth and differentiation in plant seeds.
- Observe germinating seeds to determine the sequence of developments.
- Use good lab procedures and data recording to investigate the early development of two groups of complex plants,monocots and dicots.
- Explain the role of cotyledons in early plant growth.
- Growing roots typically have a root tip where cell division takes place, a zone of maturation where root hairs develop.
- Investigate the effect of light on germinated seeds.
- Discuss the development and function of roots in early plant growth.
- Design an experiment to determine what happens to water in a celery stalk.
- Xylem is the system of tubelike connected cells that transports water from the roots to all structures of the plant.
- Stomates are openings on leaves that are controlled by guard cells.
- Prepare and study a leaf peel to discover stomates.
- Explain how stomates open and close to regulate the rate of transpiration.
- Water in the form of water vapor, a gas, continually leaves a plant through stomates.
- Cover the foliage of a plant with a plastic bag to observe condensation-evidence of transpiration.
- Describe how water enters a plant's roots and flows through the plant during transpiration.
- Describe transpiration as a component of the water cycle.
- Insects have three body parts, six legs, and two antennae.
- Adaptations are structures or behaviors of organisms that enhance their chances to survive and reproduce in their habitat.
- Observe hissing cockroaches to identify several behavioral and structural adaptations.
- Ask questions about the purposes of behaviors of the hissing cockroach and design experiments to answer those questions.
- Explain how hissing cockroach structural and behavioral adaptations help them survive.
- Make inferences about habitat of the hissing cockroaches and other insects based on observing their color,body shape,mouthparts,wings/lack of wings, response to stimuli, and speed of movement.
- Dissect and mount the structures of a simple flowers.
- Sepals,petals, stamens,and pistils are the major structures of typical flowers.
- Pollen from the anthers on the stamens and eggs in the ovules of the pistil and are the male and female cells that combine during sexual reproduction to develop into an embryo(seed) of a new plant.
- Explain the function of flowers and pollination.
- Examine a variety of seeds to discover their dispersal mechanisms.

- Explain how seed-dispersal mechanisms contribute to a plant's survival.
- Describe the production of seeds in terms of sexual reproduction.
- Microbe is the general name for microscopic bacteria and fungi, especially those that cause disease and promote fermentation.
- Inoculate sterile nutrient agar with bacteria from the local environment; inoculate bread with fungus spores from the environment.
- Observe the growth of bacteria and fungi.
- Calculate the reproductive potential of bacteria.
- Bacteria, fungi, and algae have the characteristics of living organisms.
- Bacteria have a cell membrane but no internal organelles.
- Explain that bacteria and fungi are found on all surfaces and in the water and air around us.
- Describe the role of microorganisms in transforming foods and recycling nutrients through decomposition.

Lesson Topic: What is Life?

Core Lesson/Topic Description:	Any free-living thing-plant, animal, or other -is an organism. All living organisms exhibit common characteristics; they grow, consume nutrients, exchange gases, respond to stimuli, reproduce, need water, eliminate waste, and are composed of cells.
Core Lesson/Topic Big Ideas:	Think about characteristics that are common to all living organisms and develop a definition of life.
Core Lesson/Topic Key Terminology & Definitions:	living-things that show the characteristics of life nonliving- things that have never been alive dormant-things that do not show the characteristics of life until they are placed in the right environment dead-things that were alive at one time but no longer are
Core Lesson/Topic Student Learning Outcomes:	-Sort pictures of objects and organisms into living and nonliving groups. -Defend picture-sorting decisions with an operational definition of "living". -Any free-living thing-plant, animal, or other-is an organism. -All living organisms exhibit common characteristics; they grow, consume nutrients, exchange gases, respond to stimuli, reproduce, need water, eliminate waste, and are composed of cells. -Observe five materials for evidence of life when they are placed in suitable environments. -Differentiate the concepts of living, nonliving, dead, and dormant. -All living organisms exhibit common characteristics; they grow, consume nutrients, exchange gases, respond to stimuli, reproduce, need water, eliminate waste, and are composed of cells. <!--[if !supportLineBreakNewLine]--> <!--[endif]-->

Lesson Topic: Introduction to the Microscope

Core Lesson/Topic Description:	Measure the field of view for each objective lens on the microscope. Demonstrate proper use of the microscope when studying layers in a sample and structures of brine shrimp. Draw scale representations of images seen in a microscope to estimate size accurately.
Core Lesson/Topic Big Ideas:	Acquaints students with the microscope as a tool used by scientists to study organisms in detail.
Core Lesson/Topic Key Terminology & Definitions:	field of view- area that is seen when looking through the microscope magnify-make bigger power-magnification of a lens total magnification-multiply the magnification of the objective lens and eyepiece focal plane-distance at which a microscope lens system focuses base-bottom portion of microscope needed for stability stage-platform that holds specimen turret-structure that rotates objective lenses transmitted light-light from illuminator that passes thru stage and specimen to produce an image focus-to change the distance between the lens and specimen to get a clear image eyepiece-lens that is used to view the specimen neck-used to carry the microscope coarse focus-a knob that makes large adjustments to the focus fine focus-a knob that makes small adjustments to the focus objective lens-lens used to magnify the object

Core Lesson/Topic Student Learning Outcomes:

- An optical microscope is composed of a two-lens system, a stage on which to mount the material being observed, a light source, and a mechanical system for adjusting the position of the focal plane.
- A microscope image appears reversed and inverted.
- Focal plane is a thin plane at a fixed distance from the objective lens where the image is in focus.
- Optical power is the product of the magnification of the eyepiece and the objective lens.
- Measure the field of view for each objective lens on the microscope.
- Draw scale representations of images seen in a microscope to estimate size accurately.
- Demonstrate proper use of the microscope when studying layers in a sample and structures of brine shrimp.
- Draw scale representations of images seen in a microscope to estimate size accurately.
- Explain how the focal plane affects the image seen through a microscope.

Lesson Topic: The Cell

Core Lesson/Topic Description: A major subdivision in cells is whether they have a nucleus (eukaryotic) or not (prokaryotic). Bacteria have prokaryotic cells; all other life-forms have eukaryotic cells. Cells have defining structures, such as membranes, cell walls, nuclei, chloroplasts, ribosomes, mitochondria, and cytoplasm.

Core Lesson/Topic Big Ideas: To recognize cells as the basic unit of life and to appreciate the diversity of cells that contributes to the diversity of life on Earth.

Core Lesson/Topic Key Terminology & Definitions:

- prokaryotic-cells without nuclei
- eukaryotic-cells with nuclei
- Monera-one of the five kingdoms of life, commonly known as the bacteria
- nucleus-cell organelle that directs the cell's activities
- cell membrane-semipermeable layer surrounding the cell that separates it from the environment
- mitochondria-cell organelle that provides energy to the cell
- tissues-masses of cells working together
- organs-groups of tissues working together
- organ system-groups of organs working together
- ribosome-cell organelle that produces proteins

Core Lesson/Topic Student Learning Outcomes:

- Prepare a wet mount to observe cheek scrapings and see evidence that humans, too, are made of cells.
- Humans, and all other complex life-forms, are made of cells.
- A major subdivision in cells is whether they have a nucleus or not.
- Bacteria have prokaryotic cells; all other life forms have eukaryotic cells.
- Cells have defining structures, such as membranes, cell walls, nuclei, chloroplast, ribosomes, mitochondria, and cytoplasm.
- Obtain information from a multimedia presentation.
- Cells are the basic unit of life.
- All life is aquatic at the cellular level.

Lesson Topic: Seeds of Life

Core Lesson/Topic Description: Seeds contain the dormant, living embryo of a plant. Germination is the onset of growth and differentiation in plant seeds. Growing roots typically have a root tip where cell division takes place, a zone of elongation, and a zone of maturation where root hairs develop. The cotyledon is the primary source of energy for seed germination.

Core Lesson/Topic Big Ideas: To recognize that seeds are living organisms in a dormant state. They will also observe and describe the first developmental stages of a plant.

Core Lesson/Topic Key Terminology & Definitions:

- monocot-seeds with one cotyledon
- dicot-seeds with two cotyledons
- cotyledon-ear-shaped part of the seed
- seed-coat-tough, airtight layer on the outside of the seed
- endosperm-starchy material that makes up the cotyledon and supplies food to the plant as it begins to grow
- germinate-start of growth and development of a seed
- embryo-baby plant
- chlorophyll-green pigment found in chloroplast
- root cap-mass of cells at tip of root
- root tip-area behind the root cap
- zone of elongation-cells behind the root tip
- zone of maturation-cells containing root hairs

root hairs-fine hair like structures that extend from the roots that take up water and minerals from the soil
root-first structure to emerge from the seed

Core Lesson/Topic Student Learning Outcomes:

- Seeds contain the dormant,living embryo of a plant.
- The cotyledon is the primary source of energy for seed germination.
- Dissect seeds to discover their structures.
- Germination is the onset of growth and differentiation in plant seeds.
- Observe germinating seeds to determine the sequence of developments.
- Use good lab procedures and data recording to investigate the early development of two groups of complex plants,monocots and dicots.
- Explain the role of cotyledons in early plant growth.
- Growing roots typically have a root tip where cell division takes place, a zone of maturation where root hairs develop.
- Investigate the effect of light on germinated seeds.
- Discuss the development and function of roots in early plant growth.

Lesson Topic: Transpiration

Core Lesson/Topic Description: Xylem is the system of tubelike connected cells that transports water from the roots to all structures of the plant. Stomates are openings on leaves that are controlled by guard cells. Water in the form of water vapor, a gas, continually leaves a plant through stomates.

Core Lesson/Topic Big Ideas: To learn how the vascular system transports water throughout a plant and how stomates on leaves regulate the rate of water flow through a plant.

Core Lesson/Topic Key Terminology & Definitions:

- stem-green structures that are flexible or rigid that establish shape of the plant
- leaves-structures that are responsible for the exchange of gas and photosynthesis
- cell wall- surrounds the cell membrane and composed of cellulose
- buttress-large bracing structures on trunks for added stability
- tendrils-structures found on vines that allow them to attach to other structures
- pigments-colored photosynthetic chemicals\
- photosynthesis-process in which plants use light energy,carbon dioxide and water to produce sugar and oxygen
- light reaction-part of photosynthesis in which ATP is formed
- dark reaction-part of photosynthesis in which ATP is broken down into smaller compounds
- carbohydrates-organic compound made up of carbon,oxygen, and hydrogen
- herbivore-animals that feed on plants
- phloem-tubes that carry sugar throughout the plant
- xylem-tubes that carry water,minerals from the roots throughout the plant
- epidermis-tough layer of cells that cover the top and bottom of leaf
- cuticle-waxy layer on outside of leaf
- mesophyll-cells between upper and lower epidermis that contain chloroplasts
- stomates-openings in the leaf surface
- guard cells-surround the stomates and controls the opening and closing of them
- transpiration-process of water vapor leaving the cells through stomates
- osmotic pressure-strength of water movement through a membrane

Core Lesson/Topic Student Learning Outcomes:

- Design an experiment to determine what happens to water in a celery stalk.
- Xylem is the system of tubelike connected cells that transports water from the roots to all structures of the plant.
- Stomates are openings on leaves that are controlled by guard cells.
- Prepare and study a leaf peel to discover stomates.
- Explain how stomates open and close to regulate the rate of transpiration.
- Water in the form of water vapor, a gas, continually leaves a plant through stomates.
- Cover the foliage of a plant with a plastic bag to observe condensation-evidence of transpiration.
- Describe how water enters a plant's roots and flows through the plant during transpiration.
- Describe transpiration as a component of the water cycle.

Lesson Topic: Roaches

Core Lesson/Topic Description: Insects have three body parts ,six legs, and two antennae. Adaptations are structures or behaviors of organisms that enhance their chances to survive and reproduce in their habitat.

Core Lesson/Topic Big Ideas: The adaptations of an insect are related to its' habitat and natural history.

Core Lesson/Topic Head-body region that has a mouth,sensory equipment, and a brain
thorax-middle body region that contains the legs and wings

Key Terminology & Definitions:

- abdomen-back end that contains most of the vital organs
- antenna-structures that are movable and allow insects to sense vibrations and chemicals in their environment
- compound eyes-eyes that are made of many small lenses that sends messages to the brain
- simple eyes-eyes that register light intensity only
- trachea-network of hollow tubes that collect oxygen
- spiracles-openings on the abdomen that connect to the trachea
- metamorphosis-body structure of insect changes
- incomplete metamorphosis- metamorphosis with three stages
- complete metamorphosis-metamorphosis with four life stages
- instar-nymph stage of an insect
- larva-immature ,wingless, feeding stage of an insect
- pupa-non-feeding ,resting stage
- class-group of related phyla
- order-group of related classes

Core Lesson/Topic Student Learning Outcomes:

- Insects have three body parts, six legs, and two antennae.
- Adaptations are structures or behaviors of organisms that enhance their chances to survive and reproduce in their habitat.
- Observe hissing cockroaches to identify several behavioral and structural adaptations.
- Ask questions about the purposes of behaviors of the hissing cockroach and design experiments to answer those questions.
- Explain how hissing cockroach structural and behavioral adaptations help them survive.
- Make inferences about habitat of the hissing cockroaches and other insects based on observing their color,body shape,mouthparts,wings/lack of wings, response to stimuli, and speed of movement.

Lesson Topic: Plant Reproduction

Core Lesson/Topic Description: Xylem is the system of tubelike connected cells that transports water from the roots to all structures of the plant. Stomates are openings on leaves that are controlled by guard cells. Water in the form of water vapor, a gas, continually leaves a plant through stomates.

Core Lesson/Topic Big Ideas: To learn how the vascular system transports water throughout a plant and how stomates on leaves regulate the rate of water flow through a plant.

Core Lesson/Topic Key Terminology & Definitions:

- stem-green structures that are flexible or rigid that establish shape of the plant
- leaves-structures that are responsible for the exchange of gas and photosynthesis
- cell wall- surrounds the cell membrane and composed of cellulose
- buttress-large bracing structures on trunks for added stability
- tendrils-structures found on vines that allow them to attach to other structures
- pigments-colored photosynthetic chemicals\
- photosynthesis-process in which plants use light energy,carbon dioxide and water to produce sugar and oxygen
- light reaction-part of photosynthesis in which ATP is formed
- dark reaction-part of photosynthesis in which ATP is broken down into smaller compounds
- carbohydrates-organic compound made up of carbon,oxygen, and hydrogen
- herbivore-animals that feed on plants
- phloem-tubes that carry sugar throughout the plant
- xylem-tubes that carry water,minerals from the roots throughout the plant
- epidermis-tough layer of cells that cover the top and bottom of leaf
- cuticle-waxy layer on outside of leaf
- mesophyll-cells between upper and lower epidermis that contain chloroplasts
- stomates-openings in the leaf surface
- guard cells-surround the stomates and controls the opening and closing of them
- transpiration-process of water vapor leaving the cells through stomates
- osmotic pressure-strength of water movement through a membrane

Core Lesson/Topic Student Learning Outcomes:

- Design an experiment to determine what happens to water in a celery stalk.
- Xylem is the system of tubelike connected cells that transports water from the roots to all structures of the plant.
- Stomates are openings on leaves that are controlled by guard cells.
- Prepare and study a leaf peel to discover stomates.
- Explain how stomates open and close to regulate the rate of transpiration.
- Water in the form of water vapor, a gas, continually leaves a plant through stomates.
- Cover the foliage of a plant with a plastic bag to observe condensation-evidence of transpiration.
- Describe how water enters a plant's roots and flows through the plant during transpiration.
- Describe transpiration as a component of the water cycle.

Lesson Topic: Kingdoms of Life

Core Lesson/Topic Description:	Microbe is the general name for microscopic bacteria and fungi; especially those that cause disease and promote fermentation. Bacteria, fungi, and algae have the characteristics of living organisms. Bacteria have a cell membrane but no internal organelles.
Core Lesson/Topic Big Ideas:	To investigate Monera(bacteria),Protista(algae), and Fungi Kingdom to understand their roles in the scheme of life.
Core Lesson/Topic Key Terminology & Definitions:	microbe-microscopic bacteria innoculate-placing a sample of bacteria on sterile agar sterile-material that contains nothing alive in it or on it Fungus-
Core Lesson/Topic Student Learning Outcomes:	-Microbe is the general name for microscopic bacteria and fungi,especially those that cause disease and promote fermentation. -Inoculate sterile nutrient agar with bacteria from the local environment;inoculate bread with fungus spores from the environment. -Observe the growth of bacteria and fungi. -Calculate the reproductive potential of bacteria. -Bacteria,fungi,and algae have the characteristics of living organisms. -Bacteria have a cell membrane but no internal organelles. -Explain that bacteria and fungi are found on all surfaces and in the water an air around us. -Describe the role of microorganisms in transforming foods and recycling nutrients through decomposition.

Unit: Unit 2: Vertebrates and Invertebrates

Unit/Module Big Ideas:	Animals and animal behavior Invertebrates - simple invertebrates, mollusks, annelid worms, arthropods, and echinoderms Fishes, amphibians and reptiles Birds and mammals
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Unit/Module Key Terminology & Definitions :	Embryo - an organism at an early stage of development Consumer - organism that eats other organisms Innate behavior - behavior that doesn't depend on learning or experience Learned behavior - behavior that has been learned from experience or from observing Territory - an area that is occupied by one animal or by a group of animals that do not allow other members of the species to enter Hibernation - period of inactivity and decreased body temperature that some animals experience in winter Estivation - period of inactivity and lowered body temperature that some animals undergo in summer as a protection against hot weather and lack of food Circadian rhythm - a biological daily cycle Social behavior - the interaction among animals of the same species Communication - a transfer of a signal or message from one animal to another that results in some type of response Pheromone - a substance that is released by the body and that causes another individual of the same species to react in a predictable way Invertebrate - an animal that does not have a backbone Ganglion - mass of nerve cells Gut - digestive tract Coelom - body cavity that contains the internal organs Open circulatory system - circulatory system in which the circulatory fluid is not contained entirely within vessels Closed circulatory system - circulatory system in which the heart circulates blood through a network of blood vessels that form a closed loop Segment - any part of a larger structure, such as the body of an organism, that is set off by natural or arbitrary boundaries Exoskeleton - hard, external, supporting structure Compound eye - eye composed of many light detectors Antenna - feeler that is on the head of an invertebrate, such as a crustacean or an insect, that senses touch, taste, or smell Metamorphosis - phase in the life cycle of many animals during which a rapid change from the immature form of an organism to the adult form takes place Endoskeleton - internal skeleton made of bone or cartilage Water vascular system - system of canals filled with a watery fluid that circulates throughout the body of an echinoderm Vertebrate - animal that has a backbone
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Endotherm - animal that can use body heat from chemical reactions in the body's cells to maintain a constant body temperature
 Ectotherm - organism that needs sources of heat outside of itself
 Lateral line - a faint line visible on both sides of a fish's body that runs the length of the body and marks the location of sense organs that detect vibrations in water
 Gill - respiratory organ in which oxygen from the water is exchanged with carbon dioxide from the blood
 Swim bladder - gas-filled sac that is used to control buoyancy; also known as a gas bladder
 Lung - respiratory organ in which oxygen from the air is exchanged with carbon dioxide from the blood
 Tadpole - aquatic, fish-shaped larva of a frog or toad
 Metamorphosis - phase in the life cycle of many animals during which a rapid changed form the immature form of an organism to the adult form takes place
 Amniotic egg - type of egg that is surrounded by a membrane, the amnion, and that in reptiles, birds and egg-laying mammals contains a large amount of yolk and is surrounded by a shell
 Preening - in birds, the act of grooming and maintaining their feathers
 Molting - the shedding of an exoskeleton, skin, feathers, or hair to be replaced by new parts
 Down feather - a soft feather that covers the body of young birds and provides insulation to adult birds
 Contour feather - one of the most external feathers that cover a bird and that help determine its shape
 Mammary gland - in a female mammal, a gland that secretes milk
 Diaphragm - a dome-shaped muscle that is attached to the lower ribs and that functions as the main muscle in respiration
 Placental mammal - a mammal that nourishes its unborn offspring through a placenta inside its uterus
 Gestation period - in mammals, the length of time between fertilization and birth
 Monotreme - a mammal that lays eggs
 Marsupial - a mammal that carries and nourishes its young in a pouch

Lesson Topic: Animal Behavior

Core Lesson/Topic Description: Identify and learn about animal characteristics and behavior. Describe what makes an organism an animal and discuss a variety of animal behaviors.

Core Lesson/Topic Key Terminology & Definitions: Embryo - an organism at an early stage of development
 Consumer - organism that eats other organisms
 Innate behavior - behavior that doesn't depend on learning or experience
 Learned behavior - behavior that has been learned from experience or from observing
 Territory - an area that is occupied by one animal or by a group of animals that do not allow other members of the species to enter
 Hibernation - period of inactivity and decreased body temperature that some animals experience in winter
 Estivation - period of inactivity and lowered body temperature that some animals undergo in summer as a protection against hot weather and lack of food
 Circadian rhythm - a biological daily cycle
 Social behavior - the interaction among animals of the same species
 Communication - a transfer of a signal or message from one animal to another that results in some type of response
 Pheromone - a substance that is released by the body and that causes another individual of the same species to react in a predictable way

Core Lesson/Topic Student Learning Outcomes:

- Describe the difference between vertebrates and invertebrates
- Describe the five characteristics that all animals share
- Explain the difference between learned and innate behavior
- Describe five kinds of behaviors that help animals survive
- Name three cycles that are influenced by biological clocks
- Describe four ways that animals communicate
- List the advantages and disadvantages of living in groups

Lesson Topic: Invertebrates

Core Lesson/Topic Description: The unit will help to learn about invertebrates, which are animals that do not have backbones. It describes several groups of invertebrates, including simple invertebrates, mollusks, annelid worms, arthropods, and echinoderms.

Core

Lesson/Topic Big Ideas: Invertebrates - simple invertebrates, mollusks, annelid worms, arthropods, and echinoderms

Core Lesson/Topic Key Terminology & Definitions: Invertebrate - an animal that does not have a backbone
Ganglion - mass of nerve cells
Gut - digestive tract
Coelom - body cavity that contains the internal organs
Open circulatory system - circulatory system in which the circulatory fluid is not contained entirely within vessels
Closed circulatory system - circulatory system in which the heart circulates blood through a network of blood vessels that form a closed loop
Segment - any part of a larger structure, such as the body of an organism, that is set off by natural or arbitrary boundaries
Exoskeleton - hard, external, supporting structure
Compound eye - eye composed of many light detectors
Antenna - feeler that is on the head of an invertebrate, such as a crustacean or an insect, that senses touch, taste, or smell
Metamorphosis - phase in the life cycle of many animals during which a rapid change from the immature form of an organism to the adult form taken place
Endoskeleton - internal skeleton made of bone or cartilage
Water vascular system - system of canals filled with a watery fluid that circulates throughout the body of an echinoderm

Core Lesson/Topic Student Learning Outcomes:

- Describe the body plans, nervous systems, and guts of invertebrates
- Explain how sponges get food
- Describe three cnidarian traits
- Describe the three kinds of flatworms
- Describe the body of a roundworm
- Explain how mollusks eat, control body functions, and circulate blood
- Describe the four body parts that most mollusks have in common
- Describe three annelid worms
- List the four main characteristics of arthropods
- Describe the different body parts of the four kinds of arthropods
- Describe the two types of metamorphosis in insects
- Describe the endoskeleton, nervous system, and water vascular system of echinoderms
- Explain how an echinoderm's body symmetry changes with age
- Describe five classes of echinoderms

Lesson Topic: Fish, Amphibians, and Reptiles

Core Lesson/Topic Description: The lesson will help to learn about invertebrates, which are animals that do not have backbones. It describes several groups of invertebrates, including simple invertebrates, mollusks, annelid worms, arthropods, and echinoderms.

Core Lesson/Topic Big Ideas: Invertebrates - simple invertebrates, mollusks, annelid worms, arthropods, and echinoderms

Core Lesson/Topic Key Terminology & Definitions: Invertebrate - an animal that does not have a backbone
Ganglion - mass of nerve cells
Gut - digestive tract
Coelom - body cavity that contains the internal organs
Open circulatory system - circulatory system in which the circulatory fluid is not contained entirely within vessels
Closed circulatory system - circulatory system in which the heart circulates blood through a network of blood vessels that form a closed loop
Segment - any part of a larger structure, such as the body of an organism, that is set off by natural or arbitrary boundaries
Exoskeleton - hard, external, supporting structure
Compound eye - eye composed of many light detectors
Antenna - feeler that is on the head of an invertebrate, such as a crustacean or an insect, that senses touch, taste, or smell
Metamorphosis - phase in the life cycle of many animals during which a rapid change from the immature form of an organism to the adult form taken place
Endoskeleton - internal skeleton made of bone or cartilage
Water vascular system - system of canals filled with a watery fluid that circulates throughout the body of an echinoderm

Core Lesson/Topic Student Learning Outcomes:

- Describe the body plans, nervous systems, and guts of invertebrates
- Explain how sponges get food
- Describe three cnidarian traits
- Describe the three kinds of flatworms
- Describe the body of a roundworm
- Explain how mollusks eat, control body functions, and circulate blood

- Describe the four body parts that most mollusks have in common
- Describe three annelid worms
- List the four main characteristics of arthropods
- Describe the different body parts of the four kinds of arthropods
- Describe the two types of metamorphosis in insects
- Describe the endoskeleton, nervous system, and water vascular system of echinoderms
- Explain how an echinoderm's body symmetry changes with age
- Describe five classes of echinoderms

Lesson Topic: Birds and Mammals

Core Lesson/Topic Description: Discusses birds and mammals. Describes several characteristics of both kinds of animals. Lessons will explain flightless birds, water birds, perching birds, and birds of prey. Explanations about placental mammals, monotremes, and marsupials.

Core Lesson/Topic Key Terminology & Definitions:
 Preening - in birds, the act of grooming and maintaining their feathers
 Molting - the shedding of an exoskeleton, skin, feathers, or hair to be replaced by new parts
 Down feather - a soft feather that covers the body of young birds and provides insulation to adult birds
 Contour feather - one of the most external feathers that cover a bird and that help determine its shape
 Mammary gland - in a female mammal, a gland that secretes milk
 Diaphragm - a dome-shaped muscle that is attached to the lower ribs and that functions as the main muscle in respiration
 Placental mammal - a mammal that nourishes its unborn offspring through a placenta inside its uterus
 Gestation period - in mammals, the length of time between fertilization and birth
 Monotreme - a mammal that lays eggs
 Marsupial - a mammal that carries and nourishes its young in a pouch

Core Lesson/Topic Student Learning Outcomes:

- Describe two kinds of feathers
- Describe how a bird's diet, breathing, muscles, and skeleton help it fly
- Explain how lift works
- Describe how birds raise their young
- Identify the differences between flightless birds, water birds, perching birds and birds of prey.
- Explain how early mammals lived
- Describe seven common characteristics of mammals
- Explain how placental mammals develop
- Give an example of each type of placental mammal
- Describe the difference between monotremes and marsupials
- Name the two kinds of monotremes
- Give three examples of marsupials
- Explain why many marsupials are endangered or extinct

Unit: Unit 3: Populations and Ecosystems

Unit/Module Big Ideas:

- A population is all the interacting individuals of one kind in an area.
- A community is all the interacting populations in a specified area.
- An ecosystem is a system of interacting organisms and nonliving factors in a specified area.

An organism is any living thing.

- An organism's habitat is where it lives—the place where it can meet all of its requirements.
- Milkweed bugs have a predictable life cycle.
- A kind of organism that is different from other kinds is a species
- The sequence of organisms that eat one another is a food chain.
- All the feeding relationships in an ecosystem define the food web for that system.
- The Mono Lake ecosystem is defined by interactions among organisms and physical factors.
- Food is energy-rich organic matter that organisms need for life.
- Energy is measured in kilocalories.

- In photosynthesis, food is made from water and carbon dioxide with light.
 - Feeding relationships define trophic levels: producers, consumers, and decomposers.
 - Reproductive potential is the theoretical unlimited growth of a population over time.
 - A limiting factor is any biotic or abiotic component of the ecosystem that controls the population size.
 - Variation is the range of expression of a feature in a population.
 - An adaptation is any trait of an organism that helps it survive and reproduce in its environment.
 - Variation in a population helps the population survive when the environment changes.
- To learn the basic genetic mechanisms that determine the traits expressed by individuals in a population.
Natural selection is the mechanism that produces change in the genetic makeup of a population.

Unit/Module Key Terminology & Definitions :	<p>Lithosphere - rocky, mineral part of the planet that extends from the solid surface into the mantle</p> <p>Atmosphere - the thin layer of gases that extends no more than 600 km above the surface</p> <p>Hydrosphere - all the water on the Earth, which includes the oceans, lakes, rivers, streams, and aquifers; the polar icecaps, glaciers, snowpacks, and permafrost; and the aerial water vapor and condensates in the form of clouds, fog and precipitation</p> <p>Biosphere - the sum total of all the living organisms on Earth</p> <p>Ecosphere - all four spheres can be bundled into one global sphere</p> <p>Species - life is found in millions of different forms</p> <p>Individual - organism of its kind</p> <p>population - group of individuals of the same species that lives and reproduces together</p> <p>Community - the sum of all the populations living and interacting in an area</p> <p>Biotic - living part of a system</p> <p>Ecosystem - the biotic and abiotic factors interacting in a specified area</p> <p>Environment - surroundings that impinge on an organism</p> <p>Carbohydrates - simple organic molecules</p> <p>Organism - term used to describe a free-living unit of life</p> <p>Species - a kind of organism that is different from all other kinds of organisms</p> <p>Population - all the members of a species living together</p> <p>Life cycle - when an organism produces a new generation of its kind</p> <p>Life span - how long an individual organism lives</p> <p>Bugs - have the same structures as just about all other insects: six legs, three body parts and two antennae</p> <p>Simple or incomplete metamorphosis - the insect emerges from an egg looking like a tiny version of the adult, with slight differences in body proportions and incompletely developed wings</p> <p>Nymphs- immature bugs</p> <p>Instars - five stages of bug development as they mature</p> <p>Ecosystem - dynamic functional unit of the natural world</p> <p>Ecology - study of ecosystems</p> <p>Food web - useful diagram for displaying the feeding relationships among all the organisms in an ecosystem</p> <p>Producers - organisms that make the food directly or indirectly</p> <p>Primary or first-level consumers - organisms that eat the producers</p> <p>Secondary or second-level consumers - organisms that eat primary consumers</p> <p>Tertiary or third-level consumers - organisms that feed on secondary consumers</p> <p>Decomposers - "eat" producers and consumers that die</p>
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Unit/Module Student Learning Outcomes:	<ul style="list-style-type: none"> - An individual is one single organism - A population is all the individuals of one kind (one species) in a specified area at one time - A community is all the interacting populations in a specified area - An ecosystem is a system of interacting organisms and nonliving factors in a specified area
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- Biotic factors are living elements in an ecosystem; abiotic factors are nonliving elements
- Analyze and sort images on cards to determine which represent individuals, populations, communities, and ecosystems
- Identify biotic and abiotic elements in an ecosystem
- Explain the defining characteristics of an individual, population, community, and ecosystem
- An organism is any living thing.
- Observe adult milkweed bugs to determine gender differences
- An organism's habitat is where it lives - the place where it can meet all its requirements for life
- Construct a habitat suitable for raising milkweed bugs
- Monitor events and changes that yield information about milkweed-bug reproduction
- Describe the sequence of changes that constitute the milkweed bug's life cycle
- A kind of organism that is different from all other kinds of organisms is called a species
- Mono Lake is an example of an alkaline lake ecosystem
- The Mono Lake ecosystem is defined by the interactions among the organisms and physical factors that exist in Mono Lake Basin
- The sequence of organisms that eat one another is a food chain
- All the feeding relationships in an ecosystem define the food web for that ecosystem
- Research the functional roles of 12 organisms in the Mono Lake ecosystem in order to construct a food web
- Diagram a food web using arrows to indicate what eats what
- Explain the functional roles and feeding relationships that constitute a food web
- Food is energy-rich organic matter that organisms need to conduct their life processes.
- Burn food to confirm that it contains energy and that energy in food can be measured
- Energy in food is measured in kilocalories
- Photosynthesis is the process by which energy-rich molecules (food) are made from water, carbon dioxide, and light
- Analyze experimental data to confirm that plants require water, carbon dioxide, and light to increase in biomass (food).
- Discuss how photosynthesis makes energy available to organisms
- Describe how every activity undertaken by living organisms involves expenditure of energy
- Explain how organisms get the energy they need for life
- Feeding relationships define trophic levels: producers, consumers, and decomposers
- Use a simulation to reinforce the 10% rule of energy transfer across trophic levels
- Describe how energy moves from one trophic level to another in an ecosystem
- Reproductive potential is the theoretical unlimited growth of a population over time
- A limiting factor is any biotic or abiotic factor that controls the growth of a population
- Calculate theoretical growth of a milkweed-bug population
- Analyze laboratory experiments to determine the effects of abiotic factors on population size
- Analyze field observations to determine the effects of biotic factors on population size
- Discuss how biotic and abiotic factors in an environment can limit a population
- Explain the roles of both lab experimentation and field observation in the study of populations
- Describe the population fluctuations in Mono Lake in terms of limiting factors and feeding relationships
- An adaptation is any trait of an organism that enhances its chances of surviving and reproducing in its environment
- Explain how adaptations help organisms survive in an environment
- A feature is a structure, characteristic, or behavior of an organism, such as eye color, fur pattern, or timing of migration
- A trait is the way a feature is expressed in an individual organism, such as brown eyes, small spots or early migration
- Variation is the range of expression of feature within a population, such as eye color, size of spots and date of onset of migration
- Use a multimedia simulation to investigate the adaptive value of protective coloration
- Conduct simulated predator/prey interactions over multiple generations to investigate the effect of protective coloration on the color characteristics of a population of walkingsticks
- Describe how a population can change over time in response to environmental factors
- The individuals in every population vary from one another in their traits
- Observe variation in human traits and larkey traits
- Heredity is the passing of information from one generation to the next
- Chromosomes are structures that contain hereditary information and transfer it to the next generation; they occur in nearly identical pairs in the nucleus of every cell
- Genes are the basic units of heredity carried by chromosomes. Genes code for features of organisms
- Alleles are variations of genes that determine traits; the two alleles on paired chromosomes constitute a gene
- Alleles can be dominant or recessive. Dominant alleles exhibit their effect if they are present on one chromosome; recessive alleles exhibit their effect only when both chromosomes have the allele
- An organism's particular combination of paired alleles is its genotype; the traits produced by those alleles result in the organism's phenotype
- Environmental factors put selective pressure on populations
- Use a game simulation to experience change in a population, resulting from selective pressure

- Describe how selective pressure can affect the genetic makeup of a population
- Members of a species are all the same kind of organisms and are different from all other kinds of organisms
- Natural selection is the process by which the individuals best adapted to their environment tend to survive and pass their traits to subsequent generations
- Record and process information presented in a video about natural selection
- Use a multimedia simulation to explore the effects of natural selection on a population
- Explain how the traits expressed by the members of a population can change naturally over time

Lesson Topic: Sorting Out Life

Core Lesson/Topic Description: Use ecosystem sorting cards to reflect on organizing concepts in ecology and develop the vocabulary associated with those concepts. Through a Jane Goodall video, students become familiar with a specific population study of chimpanzees.

Core Lesson/Topic Big Ideas:

- A population is all the interacting individuals of one kind in an area.
- A community is all the interacting populations in a specified area.
- An ecosystem is a system of interacting organisms and nonliving factors in a specified area.

Core Lesson/Topic Key Terminology & Definitions:

Lithosphere - rocky, mineral part of the planet that extends from the solid surface into the mantle
 Atmosphere - the thin layer of gases that extends no more than 600 km above the surface
 Hydrosphere - all the water on the Earth, which includes the oceans, lakes, rivers, streams, and aquifers; the polar icecaps, glaciers, snowpacks, and permafrost; and the aerial water vapor and condensates in the form of clouds, fog and precipitation
 Biosphere - the sum total of all the living organisms on Earth
 Ecosphere - all four spheres can be bundled into one global sphere
 Species - life is found in millions of different forms
 Individual - organism of its kind
 population - group of individuals of the same species that lives and reproduces together
 Community - the sum of all the populations living and interacting in an area
 Biotic - living part of a system
 Ecosystem - the biotic and abiotic factors interacting in a specified area
 Environment - surroundings that impinge on an organism
 Carbohydrates - simple organic molecules

Core Lesson/Topic Student Learning Outcomes:

- An individual is one single organism
- A population is all the individuals of one kind (one species) in a specified area at one time
- A community is all the interacting populations in a specified area
- An ecosystem is a system of interacting organisms and nonliving factors in a specified area
- Biotic factors are living elements in an ecosystem; abiotic factors are nonliving elements
- Analyze and sort images on cards to determine which represent individuals, populations, communities, and ecosystems
- Identify biotic and abiotic elements in an ecosystem
- Explain the defining characteristics of an individual, population, community, and ecosystem

Lesson Topic: Milkweed Bugs

Core Lesson/Topic Description: In an 8-week investigation, students raise milkweed bugs in a supportive habitat to study the insect's reproductive biology. The information from this study is used to study milkweed-bug population dynamics in Investigation 6.

Core Lesson/Topic Big Ideas:

An organism is any living thing.

- An organism's habitat is where it lives—the place where it can meet all of its requirements.
- Milkweed bugs have a predictable life cycle.
- A kind of organism that is different from other kinds is a species

Core Lesson/Topic Key Terminology & Definitions:

Organism - term used to describe a free-living unit of life
 Species - a kind of organism that is different from all other kinds of organisms
 Population - all the members of a species living together
 Life cycle - when an organism produces a new generation of its kind
 Life span - how long an individual organism lives
 Bugs - have the same structures as just about all other insects: six legs, three body parts and two antennae
 Simple or incomplete metamorphosis - the insect emerges from an egg looking like a tiny version of the adult, with slight differences in body proportions and incompletely developed wings
 Nymphs- immature bugs
 Instars - five stages of bug development as they mature

Core Lesson/Topic Student Learning Outcomes:

- An organism is any living thing.
- Observe adult milkweed bugs to determine gender differences
- An organism's habitat is where it lives - the place where it can meet all its requirements for life
- Construct a habitat suitable for raising milkweed bugs
- Monitor events and changes that yield information about milkweed-bug reproduction
- Describe the sequence of changes that constitute the milkweed bug's life cycle
- A kind of organism that is different from all other kinds of organisms is called a species

Lesson Topic: Mono Lake

Core Lesson/Topic Description: Students use Mono Lake, an important alkaline lake, as a simple ecosystem case study. They study the functional roles of populations to construct a food web.

Core Lesson/Topic Big Ideas:

- The sequence of organisms that eat one another is a food chain.
- All the feeding relationships in an ecosystem define the food web for that system.
- The Mono Lake ecosystem is defined by interactions among organisms and physical factors.

Core Lesson/Topic Key Terminology & Definitions:

Ecosystem - dynamic functional unit of the natural world
 Ecology - study of ecosystems
 Food web - useful diagram for displaying the feeding relationships among all the organisms in an ecosystem
 Producers - organisms that make the food directly or indirectly
 Primary or first-level consumers - organisms that eat the producers
 Secondary or second-level consumers - organisms that eat primary consumers
 Tertiary or third-level consumers - organisms that feed on secondary consumers
 Decomposers - "eat" producers and consumers that die

Core Lesson/Topic Student Learning Outcomes:

- Mono Lake is an example of an alkaline lake ecosystem
- The Mono Lake ecosystem is defined by the interactions among the organisms and physical factors that exist in Mono Lake Basin
- The sequence of organisms that eat one another is a food chain
- All the feeding relationships in an ecosystem define the food web for that ecosystem
- Research the functional roles of 12 organisms in the Mono Lake ecosystem in order to construct a food web
- Diagram a food web using arrows to indicate what eats what
- Explain the functional roles and feeding relationships that constitute a food web

Lesson Topic: Finding Energy

Core Lesson/Topic Description: Students measure energy in food by burning it. They learn that food is produced by photosynthetic organisms and explore how food energy moves from one trophic level to another through feeding relationships.

Core Lesson/Topic Big Ideas:

- Food is energy-rich organic matter that organisms need for life.
- Energy is measured in kilocalories.
- In photosynthesis, food is made from water and carbon dioxide with light.
- Feeding relationships define trophic levels: producers, consumers, and decomposers.

Core

**Lesson/Topic
Key
Terminology &
Definitions:**

- Core Lesson/Topic Student Learning Outcomes:**
- Food is energy-rich organic matter that organisms need to conduct their life processes.
 - Burn food to confirm that it contains energy and that energy in food can be measured
 - Energy in food is measured in kilocalories
 - Photosynthesis is the process by which energy-rich molecules (food) are made from water, carbon dioxide, and light
 - Analyze experimental data to confirm that plants require water, carbon dioxide, and light to increase in biomass (food).
 - Discuss how photosynthesis makes energy available to organisms
 - Describe how every activity undertaken by living organisms involves expenditure of energy
 - Explain how organisms get the energy they need for life
 - Feeding relationships define trophic levels: producers, consumers, and decomposers
 - Use a simulation to reinforce the 10% rule of energy transfer across trophic levels
 - Describe how energy moves from one trophic level to another in an ecosystem

Lesson Topic: Population Size

Core Lesson/Topic Description: Students explore some of the variables in an ecosystem that limit population size. Based on their milkweed-bug study, they predict what the population would be in 12 months. Students use simulations to explore population interactions and outcomes.

Core Lesson/Topic Big Ideas:

- Reproductive potential is the theoretical unlimited growth of a population over time.
- A limiting factor is any biotic or abiotic component of the ecosystem that controls the population size.

Core Lesson/Topic Student Learning Outcomes:

- Reproductive potential is the theoretical unlimited growth of a population over time
- A limiting factor is any biotic or abiotic factor that controls the growth of a population
- Calculate theoretical growth of a milkweed-bug population
- Analyze laboratory experiments to determine the effects of abiotic factors on population size
- Analyze field observations to determine the effects of biotic factors on population size
- Discuss how biotic and abiotic factors in an environment can limit a population
- Explain the roles of both lab experimentation and field observation in the study of populations
- Describe the population fluctuations in Mono Lake in terms of limiting factors and feeding relationships

Lesson Topic: Adaptations

Core Lesson/Topic Description: Students are introduced to adaptation first through a video and then by working with a multimedia simulation of a population of walkingsticks that exhibit color variation. Students study the impact of predation on the insects in different environments.

Core Lesson/Topic Big Ideas:

- Variation is the range of expression of a feature in a population.
- An adaptation is any trait of an organism that helps it survive and reproduce in its environment.
- Variation in a population helps the population survive when the environment changes.

Core Lesson/Topic Student Learning Outcomes:

- An adaptation is any trait of an organism that enhances its chances of surviving and reproducing in its environment
- Explain how adaptations help organisms survive in an environment
- A feature is a structure, characteristic, or behavior of an organism, such as eye color, fur pattern, or timing of migration
- A trait is the way a feature is expressed in an individual organism, such as brown eyes, small spots or early migration
- Variation is the range of expression of feature within a population, such as eye color, size of spots and date of onset of migration
- Use a multimedia simulation to investigate the adaptive value of protective coloration
- Conduct simulated predator/prey interactions over multiple generations to investigate the effect of protective coloration on the color characteristics of a population of walkingsticks
- Describe how a population can change over time in response to environmental factors

Lesson Topic: Genetic Variation

Core Lesson/Topic Description: Students investigate the underlying mechanisms of change in population by breeding imaginary animals called larkeys. They learn how organisms inherit traits from their parents and how dominant and recessive alleles interact to produce traits in a population.

Core Lesson/Topic Big Ideas: To learn the basic genetic mechanisms that determine the traits expressed by individuals in a population.

Core Lesson/Topic Student Learning Outcomes:

- The individuals in every population vary from one another in their traits
- Observe variation in human traits and larkey traits
- Heredity is the passing of information from one generation to the next
- Chromosomes are structures that contain hereditary information and transfer it to the next generation; they occur in nearly identical pairs in the nucleus of every cell
- Genes are the basic units of heredity carried by chromosomes. Genes code for features of organisms
- Alleles are variations of genes that determine traits; the two alleles on paired chromosomes constitute a gene
- Alleles can be dominant or recessive. Dominant alleles exhibit their effect if they are present on one chromosome; recessive alleles exhibit their effect only when both chromosomes have the allele
- An organism's particular combination of paired alleles is its genotype; the traits produced by those alleles result in the organism's phenotype

Lesson Topic: Natural Selection

Core Lesson/Topic Description: Environmental factors put selective pressure on populations. Natural selection is the process by which the individuals best adapted to their environment tend to survive and pass their traits to subsequent generations. Members of a species are all the same kind of organisms and are different from all other kinds of organisms.

Core Lesson/Topic Big Ideas: Natural selection is the mechanism that produces change in the genetic makeup of a population.

Core Lesson/Topic Student Learning Outcomes:

- Environmental factors put selective pressure on populations
- Use a game simulation to experience change in a population, resulting from selective pressure
- Describe how selective pressure can affect the genetic makeup of a population
- Members of a species are all the same kind of organisms and are different from all other kinds of organisms
- Natural selection is the process by which the individuals best adapted to their environment tend to survive and pass their traits to subsequent generations
- Record and process information presented in a video about natural selection
- Use a multimedia simulation to explore the effects of natural selection on a population
- Explain how the traits expressed by the members of a population can change naturally over time