Curriculum Guide for 8th Grade SDP Science Teachers

Please note: Pennsylvania & Next Generation Science Standards as well as Instructional Resources are found on the SDP curriculum Engine

Prepared by; KD Davenport & E. McGady, Science Curriculum Specialist
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8th Grade Life Science Curriculum Term 1 (9/5-11/13/17)

Unit 1: Cells Heredity, and Classification Duration: 3 Weeks

Eligible Content:

- **S6.A.1.1.1: Explain how certain questions can be answered through scientific inquiry and/or technological design (e.g., consumer product testing, common usage of simple machines, modern inventions).**
- **S6.A.1.1.2: Use evidence to support inferences and claims about an investigation or relationship (e.g., common usage of simple machines).**
- **S6.A.1.1.3: Predict the outcome of an experiment based on previously collected data.**
- **S6.B.1.1.2: Identify examples of unicellular and multi-cellular organisms (i.e., plants, fungi, bacteria, protista, and animals).**
- **S6.B.1.1.3: Explain how many organisms are unicellular and must carry out all life functions in one cell.**
- **S7.A.1.1.1: Distinguish between a scientific theory and a general opinion, explaining how a theory is supported with evidence.**
- **S7.B.1.1.1: Describe levels of biological organization from cell to organism.**
- **S7.A.1.3.2: Use evidence, observations, or explanations to make inferences about changes in systems over time (e.g., carrying capacity, succession, fossil evidence in the geologic time scale).**
- **S7.A.3.1.2: Explain the concept of order in a system (e.g., first to last manufacturing steps; trophic levels; simple to complex—levels of biological organization from cell to organism).**
- **S7.A.3.2.1: Make inferences based on scientific models (e.g., charts, graphs, diagrams).**
- **S7.A.3.3.1: Describe patterns as repeated processes or recurring elements in natural and human-made systems.**
- **S7.A.1.1.3: Use evidence such as observations or experimental results to support inferences.**
- **S8.B.1.1.2: Compare similarities and differences in internal structures of organisms (e.g., invertebrate/vertebrate, vascular/nonvascular, single-celled/ multi-celled) and external structures (e.g., appendages, body segments, type of covering, size, shape).**

Key Terms and Definitions

abiotic: A nonliving factor or element (e.g., light, water, heat, rock, energy, mineral).

biological diversity: The variety and complexity of species present and interacting in an ecosystem and the relative abundance of each.

biotic: An environmental factor related to or produced by living organisms.

hypothesis: An assertion subject to verification or proof as a premise from which a conclusion is drawn.

law: Summarizing statement of observed experimental facts that has been tested many times and is generally accepted as true.

model: A description, analogy or a representation of something that helps us understand it better (e.g., a physical model, a conceptual model, a mathematical model).

theory: Systematically organized knowledge applicable in a relatively wide variety of circumstances; especially, a system of assumptions, accepted principles and rules of procedure devised to analyze, predict or otherwise explain the nature or behavior of a specified set of phenomena.

classification: the division of organisms into groups, or classes, based on specific characteristics.

taxonomy: the science of describing, naming, and classifying organisms

dichotomous key: an aid that is used to identify organisms and that consists of the answers to a series of questions

archaebacteria: a kingdom made up of bacteria that live in extreme environments

eubacteria: a kingdom that contains all prokaryotes except archaebacteria

Protista: a kingdom of mostly single-celled organisms that are different from plants, animals, bacteria, and fungi

probability: the likelihood that a possible future event will occur in any given instance

Fungi: a kingdom made up of non-green, eukaryotic organisms that have no means of movement, reproduce by using spores, and get food by breaking down substances in their surroundings and absorbing nutrients

Plantae: a kingdom made up of complex, multicellular organisms that are usually green, have cell walls made of cellulose, cannot move around, and use the sun's energy to make sugar by photosynthesis

Animalia: a kingdom made up of complex, multicellular organisms that lack cell wall, can usually move around, and quickly respond to their environment

virus: An almost lifelike, extremely small particle made of protein and nucleic acid. It needs to parasitize a living cell in order to reproduce; Any of a large group of disease-causing agents consisting of a segment of RNA or DNA within a protein shell. All viruses are parasites because they can reproduce only inside the cells of plants, animals, and bacteria. Viruses are usually not considered living organisms.

organism: a living thing, biotic; anything that can carry out life processes independently
structure: the arrangement of parts in an organism

Essential Questions

How are theories and laws similar and different?

What is a model in scientific terms?

What differentiates non-living and living things?

How and why are living things classified?

How do scientists use models to classify organisms?

What evidence shows that different species are related?

Starting Points

Prerequisite skills needed: Students should have developed an understanding that scientific inquiry and reasoning involves observing, questioning, investigating, recording, and developing solutions to problems.
In addition, throughout this unit, and the entire 8th grade year, students will continue to build on the following eight science and engineering practices:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information (add)

In this unit, students will develop an understanding that science is the pursuit of explanations of the natural world, and technology and engineering are means of accommodating human needs, intellectual curiosity and aspirations. Students will use scientific equipment, measurement tools, and questioning techniques to make observations, collect data, make inferences, and draw conclusions. Students will learn the characteristics that all living things possess and be able to distinguish living from non-living things. Students will develop an understanding that all living things can be classified by observable traits and physical characteristics and will be able to demonstrate ability to classify an organism based on a given classification system.

Unit 2: Cells to Organ Systems Duration: 4 Weeks

Eligible Content:

- **S6.B.1.1.1: Describe how cells carry out the many functions needed to sustain life.**
- **S6.A.2.2.1: Describe ways technology extends and enhances human abilities for specific purposes (e.g., make observations of cells with a microscope and planets with a telescope).**
- **S6.B.1.1.2: Identify examples of unicellular and multi-cellular organisms (i.e., plants, fungi, bacteria, protista, and animals).**
- **S6.A.3.1.1: Describe a system as a group of related parts with specific roles that work together to achieve an observed result.**
- **S7.B.1.1.2: Describe how specific structures in living things (from cell to organism) help them function effectively in specific ways (e.g., chlorophyll in plant cells— photosynthesis; root hairs—increased surface area; beak structures in birds— food gathering; cacti spines—protection from predators).**
- **S7.B.1.2.1: Explain how cells arise from the division of a pre-existing cell.**
- **S7.B.1.2.2: Compare various basic sexual and asexual reproductive processes (e.g., budding, cuttings).**
- **S7.B.1.1.1: Describe levels of biological organization from cell to organism.**
- **S7.A.3.1.2: Explain the concept of order in a system (e.g., first to last manufacturing steps; trophic levels; simple to complex—levels of biological organization from cell to organism).**
- **S7.B.1.1.3: Explain how characteristic similarities and differences (from cell to organism) are used to identify and/or categorize organisms.**
- **S7.A.3.2.2: Describe how engineers use models to develop new and improved technologies to improve scientific study and/or human life.**
- **S7.A.1.1.4: Use evidence to develop descriptions, explanations, and models.**
- **S7.A.3.3.1: Describe patterns as repeated processes or recurring elements in natural and human-made systems.**
- **S7.A.1.1.3: Use evidence such as observations or experimental results to support inferences.**
- **S8.B.1.1.2: Compare similarities and differences in internal structures of organisms (e.g., invertebrate/vertebrate, vascular/nonvascular, single celled/ multi-celled) and external structures (e.g., appendages, body segments, type of covering, size, shape).**
- **S8.A.3.1.2: Explain the concept of order in a system [e.g., (first to last: manufacturing steps, trophic levels); (simple to complex: cell, tissue, organ, organ system)].**

Key Terms and Definitions

embryology: The branch of biology dealing with the development of living things from fertilized egg to its developed state.

mitosis: The sequential differentiation and segregation of replicated chromosomes in a cell's nucleus that precedes complete cell division.

cell: in biology, the smallest unit that can perform all life processes; cells are covered by a membrane and contain DNA and cytoplasm

cell membrane: a phospholipid layer that covers a cell's surface and acts as a barrier between the inside of the cell and the cell's environment

organelle: one of the small bodies in a cell's cytoplasm that are specialized to perform a specific function

nucleus: in eukaryotic cell, a membrane bound organelle that contains the cell's DNA and that has a role in processes such as growth, metabolism, and reproduction

prokaryote: an organism that consists of a single cell that does not have a nucleus

eukaryote: an organism made up of cells that have a nucleus enclosed by a membrane; eukaryotes include animals, plants, and fungi but not bacteria

cell wall: a rigid structure that surrounds the cell membrane and provide support to the cell
ribosome: a cell organelle composed of RNA and protein; the site of protein synthesis

endoplasmic reticulum: a system of membranes that is found in a cell's cytoplasm and that assists in the production, processing, and transport of proteins and in the production of lipids

mitochondrion: in eukaryotic cells, the cell organelle that is surrounded by two membranes and that is the site of cellular respiration

golgi complex: cell organelle that helps make and package materials to be transported out of the call

vesicle: a small cavity or sac that contains materials in a eukaryotic cell; forms when part of the cell membrane surround materials to be taken into the cell or transported within the cell

lysosome: a cell organelle that contains digestive enzymes

tissue: a group of similar cells that perform a common function

organ: a collection of tissues that carry out a specific function of the body

organ system: a group of organs that work together to perform body functions

organism: a living thing, biotic; anything that can carry out life processes independently

structure: the arrangement of parts in an organism

function: the special, normal, or proper activity of an organ or part

diffusion: the spreading of something more widely

osmosis: the diffusion of water through a semipermeable membrane

passive transport: the movement of substances across a cell membrane without the use of energy

active transport: the movement of substances across the cell membrane that requires the cell to use energy

endocytosis: the process by which a living cell takes up molecules bound to its surface

exocytosis: a process by which the contents of a cell vacuole are released to the exterior through fusion of the vacuole membrane with the cell membrane

photosynthesis: the process by which plants, algae, and some bacteria use sunlight, carbon dioxide, and water to make food (sugar)

cellular respiration: what cells do to break up sugars into a form that the **cell** can use as energy. This happens in all forms of life.

cellular respiration takes in food and uses it to create ATP, a chemical which the **cell** uses for energy

fermentation: the breakdown of food without the use of oxygen

cell cycle: the life cycle of a cell

meiosis: a process in cell division during which the number of chromosomes decreases to half the original number by two divisions of the nucleus, which results in the production of sex cells

Essential Questions

How do cells contribute to the function of living organisms?

How do organisms live and grow?

How do organisms obtain and use matter and energy?

How do you explain the relationship between the structures and functions of cell organelles?

How is a living organism the sum of all of its parts?

How do cells, tissues, organs, and organ systems relate to each other and to living organisms?

How does scientific development rely on our knowledge of cells?

Starting Points

Prerequisite Skills Needed: Students should have developed an understanding that scientific inquiry and reasoning involves observing, questioning, investigating, recording, and developing solutions to problems. As they begin this second unit, students should be able to describe the characteristics of all living things and explain that all living things are organized using similarities and differences.

Students will develop an understanding that plants and animals have basic requirements for maintaining life which include the need for air, water, and a source of energy. They will be able to explain the components of the cell theory and understand that all living organisms are composed of cells and exhibit cell growth and division. Students will identify types of cells and functions of cell parts as well as describe how the levels of organization (from cell to organism) in a living thing.

8th Grade Life Science Curriculum Term 2 (11/18-1/29/18)

Unit 3: Heredity and Evolution Duration: 5 Weeks

Eligible Content:

- **S7.A.1.3.2: Use evidence, observations, or explanations to make inferences about changes in systems over time (e.g., carrying capacity, succession, fossil evidence in the geologic time scale).**
- **S7.A.1.1.1: Distinguish between a scientific theory and a general opinion, explaining how a theory is supported with evidence.**
- **S7.A.1.3.2: Use evidence, observations, or explanations to make inferences about changes in systems over time (e.g., carrying capacity, succession, fossil evidence in the geologic time scale).**
- **S7.B.1.1.2: Describe how specific structures in living things (from cell to organism) help them function effectively in specific ways (e.g., chlorophyll in plant cells— photosynthesis; root hairs—increased surface area; beak structures in birds— food gathering; cacti spines—protection from predators).**
- **S7.B.1.2.2: Compare various basic sexual and asexual reproductive processes (e.g., budding, cuttings).**
- **S7.B.1.2.3: Explain why the life cycles of different organisms have varied lengths.**
- **S7.A.3.1.2: Explain the concept of order in a system (e.g., first to last manufacturing steps; trophic levels; simple to complex—levels of biological organization from cell to organism).**
- **S7.A.3.3.1: Describe patterns as repeated processes or recurring elements in natural and human-made systems.**
- **S7.A.1.1.3: Use evidence such as observations or experimental results to support inferences.**
- **S8.A.1.2.2: Identify environmental issues and explain their potential long-term health effects (e.g., pollution, pest controls, vaccinations)**
- **S8.A.1.2.3: Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics).**
- **S8.A.1.1.1: Distinguish between a scientific theory and an opinion, explaining how a theory is supported with evidence, or how new data/information may change existing theories and practices.**
- **S7.B.2.2.2: Recognize evidence that the gene is the basic unit of inheritance and explain the effect of dominant and recessive genes on inherited traits.**
- **S7.B.2.2.3: Explain how mutations can alter a gene and are a source of new variations in a population.**
- **S7.B.2.2.4: Describe how selective breeding or biotechnologies can change the genetic makeup of an organism (e.g., domesticated dogs, horses, cows; crops, hybrid plants; integrated pest management).**
- **S7.B.2.1.1: Explain how inherited traits (genes) and/or behaviors help organisms survive and reproduce in different environments.**
- **S7.B.2.1.2: Describe how natural selection is an underlying factor in a population's ability to adapt to change.**
- **S7.B.2.1.3: Explain that adaptations within species (physical, behavioral, physiological) are developed over long periods of time.**
- **S7.B.2.2.1: Identify and explain differences between inherited and acquired traits.**

Key Terms and Definitions

allele: Any of a set of possible forms of a gene.

biological diversity: The variety and complexity of species present and interacting in an ecosystem and the relative abundance of each.

endangered species: A species that is in danger of extinction throughout all or a significant portion of its range. environment: The total of the surroundings (air, water, soil, vegetation, people, wildlife) influencing each living being's existence, including physical, biological and all other factors; the surroundings of a plant or animals including other plants or animals, climate and location.

evolution: A process of change that explains why what we see today is different from what existed in the past; it includes changes in the galaxies, stars, solar system, earth and life on earth. Biological evolution is a change in hereditary

characteristics of groups of organisms over the course of generations.

extinction: The complete elimination of a species from the earth.

theory of evolution: A theory that the various types of animals and plants have their origin in other preexisting types and that the distinguishable differences are due to modification in successive generations.

fossil: the remains or physical evidence of an organism preserved by geologic processes

extinct: describes a species that has died out completely

plate tectonics: the theory that explains how large pieces of Earth's outermost layer called tectonic plates, move and change shape

adaptation: a characteristic that improves an individual's ability to survive and reproduce in a particular environment

species: a group of organisms that are closely related and can mate to produce fertile offspring

fossil record: a historical sequence of life indicated by fossils found in layers of Earth's crust

trait: a genetically determined characteristic

selective breeding: the human practice of breeding animals or plants that have certain desired characteristics

natural selection: the process by which individuals that are better adapted to their environment survive and reproduce more successfully than less well adapted individuals do; a theory to explain the mechanism of evolution
generation time: the period between the birth of one generation and the birth of the next generation

speciation: the formation of new species as a result of evolution

chromosome: in a eukaryotic cell, one of the structures in the nucleus that are made up of DNA and protein; in prokaryotic cell, the main ring of DNA

mitosis: in eukaryotic cells, a process of cell division that forms two new nuclei, each of which has the same number of chromosomes

heredity: the passing of genetic traits from parent to offspring

dominant trait: the trait observed in the first generation when parents that have different traits are bred

recessive trait: a trait that is apparent only when two recessive alleles for the same characteristic are inherited

gene: one set of instructions for an inherited trait

phenotype: an organism's appearance or other detectable characteristic

genotype: the genetic constitution of an organism

probability: the likelihood that a possible future event will occur in any given instance

homologous chromosomes: chromosomes that have the same sequence of genes and the same structure

meiosis: a process in cell division during which the number of chromosomes decreases to half the original number by two divisions of the nucleus, which results in the production of sex cells

sex chromosome: one of the pair of chromosomes that determine the sex of an individual

pedigree: a diagram that shows the occurrence of a genetic trait in several generations of a family

mutation: a change in the nucleotide-base sequence of a gene or DNA molecule

Essential Questions

How and why do organisms interact with their environment, and what are the effects of these interactions?

How do living organisms pass traits from one generation to the next?

How can individuals of the same species and even siblings have different characteristics?

How do organisms change over time in response to changes in the environment?

What evidence shows that different species are related?

How does genetic variation among organisms in a species affect survival and reproduction?

How does the environment influence genetic traits in populations over multiple generations?

Starting Points

Prerequisite Skills Needed: Students should have developed the understanding that scientific inquiry and reasoning involves observing, questioning, investigating, recording, and developing solutions to problems. Students should have an understanding that all living things are organized using similarities and differences. Students should have an understanding that plants and animals have basic requirements for maintaining life which include the need for air, water, and a source of energy.
They will have also already learned that all living organisms are composed of cells, and they exhibit cell growth and division. Students should understand that all plants and animals have a definite life cycle, body parts, and systems to perform specific life functions.

Throughout this unit, students will develop an understanding that all life forms must reproduce to survive and that characteristics of mature plants and animals may be inherited or acquired and that only inherited traits are passed on to their young. Students will learn that inherited traits can be influenced by changes in the environment and by genetics and that fossils provide evidence that life forms have changed over time and were influenced by changes in environmental conditions. By the end of the unit, students should understand that life forms either change (evolve) over time or risk extinction due to environmental changes and describe how scientists identify the relatedness of various organisms based on similarities in anatomical features.

Unit 4: Modern Genetics Duration: 6 Weeks

Eligible Content:

- **S7.A.1.1.2: Develop questions that can be answered through scientific inquiry and/or technological design. S7.A.1.1.3: Use evidence such as observations or experimental results to support inferences.**
- **S6.B.2.1.2: Recognize that extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival.**
- **S7.A.1.3.2: Use evidence, observations, or explanations to make inferences about changes in systems over time (e.g., carrying capacity, succession, fossil evidence in the geologic time scale).**
- **S7.A.3.3.1: Describe patterns as repeated processes or recurring elements in natural and human-made systems.**
- **S8.A.1.2.2: Identify environmental issues and explain their potential long-term health effects (e.g., pollution, pest controls, vaccinations)**
- **S8.A.1.2.3: Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics).**
- **S8.A.1.1.1: Distinguish between a scientific theory and an opinion, explaining how a theory is supported with evidence, or how new data/information may change existing theories and practices.**
- **S7.B.2.2.2: Recognize evidence that the gene is the basic unit of inheritance and explain the effect of dominant and recessive genes on inherited traits.**
- **S7.B.2.2.3: Explain how mutations can alter a gene and are a source of new variations in a population.**
- **S7.B.2.2.4: Describe how selective breeding or biotechnologies can change the genetic makeup of an organism (e.g., domesticated dogs, horses, cows; crops, hybrid plants; integrated pest management).**
- **S7.B.2.1.1: Explain how inherited traits (genes) and/or behaviors help organisms survive and reproduce in different environments.**

- **S7.B.2.1.2: Describe how natural selection is an underlying factor in a population's ability to adapt to change.**
- **S7.B.2.1.3: Explain that adaptations within species (physical, behavioral, physiological) are developed over long periods of time.**
- **S7.B.2.2.1: Identify and explain differences between inherited and acquired traits.**
- **S7.B.2.2.2: Recognize evidence that the gene is the basic unit of inheritance and explain the effect of dominant and recessive genes on inherited traits.**
- **S8.B.2.1.4: Describe how selective breeding or biotechnology can change the genetic makeup of organisms.**

Key Terms and Definitions

biomedical technology: The application of health care theories to develop methods, products and tools to maintain or improve homeostasis.

biotechnology: The ways that humans apply biological concepts to produce products and provide services.

heterozygous- refers to a pair of genes where one is dominant and one is recessive

homozygous- organism has two copies of the same allele, for example AA or aa, it is **homozygous** for that trait

x-linked inheritance- means that the gene causing the **trait** or the disorder is located on the **X** chromosome. Females have two **X** chromosomes, while males have one **X** and one Y chromosome.

cloning: a plant or animal that is grown from one cell of its parent and that has exactly the same genes as its parent

gene mapping: the process of determining where **genes** are located on individual chromosomes.

genetic engineering: deliberately altering or selecting the characteristics a person or animal will have by manipulating the DNA

genome: the complete set of genes or genetic material present in a cell or organism

Essential Questions

How can a single gene be responsible for causing a genetic condition in humans?

What are some examples of single gene disorders?

How does genetic variation among organisms in a species affect survival and reproduction?

How does the environment influence genetic traits in populations over multiple generations?

What are some risk factors for acquiring certain diseases, such as cancer or heart disease?

Why is genetic counseling useful?

What do population geneticists do?

What is recombinant DNA? Why is it important?

Why are bacteria used in genetic research?

Why is mapping human genes important to scientists' knowledge of the human genome?

How can genetic engineering benefit or harm living organisms?

Starting Points

Students should have an understanding that all life forms must reproduce to survive. Understand that characteristics of mature plants and animals may be inherited or acquired and that only inherited traits are passed on to their young.

Understand that inherited traits can be influenced by changes in the environment and by genetics. Understand that fossils provide evidence that life forms have changed over time and were influenced by changes in environmental conditions. Understand that life forms either change (evolve) over time or risk extinction due to environmental changes and describe how scientists identify the relatedness of various organisms based on similarities in anatomical features.

Students will develop an understanding of how the environment, technology, human activity can change the evolutionary process. Students will develop an understanding of artificial selection. They will also recognize that humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. Students will examine ways that genetic variation can lead mutations that can be beneficial or harmful.

8th Grade Life Science Curriculum Term 3 (1/30-4/9/18)

Unit 5: Energy and Cycles in Ecosystems  Duration: 6 Weeks

Eligible Content

- **S7.C.2.1.1: Describe how energy is obtained and used by organisms throughout their lives.**
- **S7.C.2.1.2: Describe how energy is transferred and conserved in a closed system.**
- **S7.C.2.1.3: Describe energy transformations within an ecosystem.**
- **S7.D.1.1.1: Identify and describe soil characteristics (i.e., particle size, porosity, and permeability) of different biomes.**
- **S7.D.1.2.1: Compare the different water systems on Earth (e.g., wetland, watershed, ocean, river).**
- **S7.D.1.2.2: Compare biotic and abiotic features of freshwater and saltwater systems.**
- **S7.D.1.2.3: Describe the importance of water systems on the diversity and distribution of life on Earth.**
- **S8.A.3.1.1: Describe a system (e.g., watershed, circulatory system, heating system, agricultural system) as a group of related parts with specific roles that work together to achieve an observed result.**
- **S8.A.3.1.2: Explain the concept of order in a system [e.g., (first to last: manufacturing steps, trophic levels); (simple to complex: cell, tissue, organ, organ system)].**
- **S8.A.3.1.3: Distinguish among system inputs, system processes, system outputs, and feedback (e.g., physical, ecological, biological, informational).**
- **S8.A.3.1.4: Distinguish between open loop (e.g., energy flow, food web) and closed loop (e.g., materials in the nitrogen and carbon cycles, closed-switch) systems.**
- **S8.A.3.2.1: Describe how scientists use models to explore relationships in natural systems (e.g., an ecosystem, river system, the solar system).**
- **S8.A.3.2.3: Given a model showing simple cause and effect relationships in a natural system, predict results that can be used to test the assumptions in the model (e.g., photosynthesis, water cycle, diffusion, infiltration)**
- **S8.B.3.2.1: Use evidence to explain factors that affect changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).**
- **S8.B.3.2.2: Use evidence to explain how diversity affects the ecological integrity of natural systems.**
- **S8.B.3.2.3: Describe the response of organisms to environmental changes (e.g., changes in climate, hibernation, migration, coloration) and how those changes affect survival.**

Key Terms and Definitions

abiotic: A nonliving factor or element (e.g., light, water, heat, rock, energy, mineral).

biotic: An environmental factor related to or produced by living organisms.

biomes: A community of living organisms of a single major ecological region.

composting: The process of mixing decaying leaves, manure and other nutritive matter to improve and fertilize soil.

decomposer: An organism, often microscopic in size, that obtains nutrients by consuming dead organic matter, thereby making nutrients accessible to other organisms; examples of decomposers include fungi, scavengers, rodents and other animals.

ecosystem: A community of living organisms and their interrelated physical and chemical environment.

environment: The total of the surroundings (air, water, soil, vegetation, people, wildlife) influencing each living being's

existence, including physical, biological and all other factors; the surroundings of a plant or animals including other plants or animals, climate and location.

hazardous waste: A solid that, because of its quantity or concentration or its physical, chemical or infectious characteristics, may cause or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed.

food chain: a hierarchical series of organisms each dependent on the next as a source of food.

carnivore: an animal that feeds on flesh.

consumer: Those organisms that obtain energy by feeding on other organisms and their remains.

point source pollution: Pollutants discharged from a single identifiable location (e.g., pipes, ditches, channels, sewers, tunnels, containers of various types).

recycling: Collecting and reprocessing a resource or product to make into new products.

renewable: A naturally occurring raw material or form of energy that will be replenished through natural ecological cycles or sound management practices (e.g., the sun, wind, water, trees).

ecological pyramid: An ecological pyramid is a graphical model that illustrates the flow of energy through different forms of life in an ecosystem. The bottom level illustrates species which act as producers, harnessing energy from abiotic sources. Each subsequent level illustrates a level of consumer, each of which receives energy by consuming the group below it

food web: a system of interlocking and interdependent food chains.

herbivore: an animal that feeds on plants.

omnivore: an animal or person that eats food of both plant and animal origin.

producer: An autotrophic organism that serves as a source of food for other organisms in a food chain. Producers include green plants, which produce food through photosynthesis, and certain bacteria that are capable of converting inorganic substances into food through chemosynthesis

evaporate: turn from liquid into vapor.

fossil fuels: a natural fuel such as coal or gas, formed in the geological past from the remains of living organisms.

greenhouse gas: a gas that contributes to the greenhouse effect by absorbing infrared radiation, e.g., carbon dioxide and chlorofluorocarbons.

groundwater: water held underground in the soil or in pores and crevices in rock.

global warming: a gradual increase in the overall temperature of the earth's atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide, chlorofluorocarbons, and other pollutants.

precipitation: rain, snow, sleet, or hail that falls to the ground.

biodegradable: (of a substance or object) capable of being decomposed by bacteria or other living organisms.

habitat: the natural home or environment of an animal, plant, or other organism.

niche (ecological): The role played by an organism in an ecosystem; its food preferences, requirements for shelter, special behaviors and the timing of its activities (e.g., nocturnal, diurnal), interaction with other organisms and its habitat.

nonrenewable resources: Substances (e.g., oil, gas, coal, copper, gold) that, once used, cannot be replaced in this geological age.

competition: an interaction between organisms or species in which the fitness of one is lowered by the presence of another. Limited supply of at least one resource (such as food, water, and territory) used by both can be a factor.

host organism: a **host** is an **organism** that harbors a parasite, typically providing nourishment and shelter, a **host** plant is one that supplies food resources and substrate for certain insects or other fauna
mutualism: symbiosis that is beneficial to both organisms involved.

parasite: an organism that lives in or on another organism (its host) and benefits by deriving nutrients at the host's expense.

predation: the preying of one animal on others.

acid rain: rainfall made sufficiently acidic by atmospheric pollution that it causes environmental harm, typically to forests and lakes. The main cause is the industrial burning of coal and other fossil fuels, the waste gases from which contain sulfur and nitrogen oxides, which combine with atmospheric water to form acids.

CFCs (chlorinated fluorocarbons):any of a class of compounds of carbon, hydrogen, chlorine, and fluorine, typically gases used in refrigerants and aerosol propellants. They are harmful to the ozone layer in the earth's atmosphere owing to the release of chlorine atoms upon exposure to ultraviolet radiation

global warming: a gradual increase in the overall temperature of the earth's atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide, chlorofluorocarbons, and other pollutants.

greenhouse effect: the trapping of the sun's warmth in a planet's lower atmosphere due to the greater transparency of the atmosphere to visible radiation from the sun than to infrared radiation emitted from the planet's surface.

endangered: (of a species) seriously at risk of extinction.

sustainability: The ability to keep in existence or maintain. A sustainable ecosystem is one that can be maintained
watershed: The land area from which surface runoff drains into a stream, channel, lake, reservoir or other body of water; also called a drainage basin.

wetlands: Lands where water saturation is the dominant factor determining the nature of the soil development and the plant and animal communities (e.g., sloughs, estuaries, marshes).

Essential Questions

How are an organism's needs met through its biotic and abiotic surroundings?

How does energy flow through a biological community?

How do living things depend on each other for survival?

Why don't natural systems run out of the materials they need?

How do the biotic and abiotic factors determine the type of biome in an area?

What is the role of the [water, carbon, nitrogen, oxygen] cycle in an ecosystem?

How does the sun provide energy to all organisms?

Starting Points

There are many living and nonliving components that interact to make up an environment. Since all living things When students start this unit, they should have some basic knowledge of both the life science and Earth science topics that will be discussed in more detail throughout this unit. This includes the topics of cellular biology, systems such as the water cycle, rock cycle, weathering and erosion. This knowledge should have been gained throughout students' middle school science classes, and this unit will be their opportunity to connect content and see the relationships between different topics that they have studies.

This unit is the first of a two part unit on ecological behavior and systems. The focus in this first part of the unit will be on the role of energy in an ecosystem and how energy cycles through the ecosystem and on other natural cycles that occur

within an ecosystem and on which living things rely for survival.

By the end of this unit, students will understand the relationship between the sun and plants as producers as well as other organisms as consumers. Students will also understand the processes needed to sustain and reproduce life within a variety of biomes and explore the use of models to observe a variety of natural processes. Throughout the unit, students will explore patterns of change, diversity, systems and interactions, and transfer of energy through various systems.

Unit 6: Changes in Ecosystems Duration: 6 weeks

Eligible Content:

- **S6.B.2.1.2: Recognize that extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival.**
- **S6.B.3.2.1: Compare the usage of fossil fuels and alternative energy resources (e.g., oil, natural gas, coal, wind, solar, water).**
- **S7.D.1.1.1: Identify and describe soil characteristics (i.e., particle size, porosity, and permeability) of different biomes.**
- **S7.C.2.1.1: Describe how energy is obtained and used by organisms throughout their lives.**
- **S7.C.2.1.2: Describe how energy is transferred and conserved in a closed system.**
- **S7.C.2.1.3: Describe energy transformations within an ecosystem. made systems play different roles in a working system.**
- **S6.D.1.1.1: Describe how soil fertility, composition, resistance to erosion, and texture are affected by many factors**
- **S8.A.3.1.1: Describe a system (e.g., watershed, circulatory system, heating system, agricultural system) as a group of related parts with specific roles that work together to achieve an observed result.**
- **S8.A.3.1.2: Explain the concept of order in a system [e.g., (first to last: manufacturing steps, trophic levels); (simple to complex: cell, tissue, organ, organ system)].**
- **S8.C.2.2.2: Compare the time span of renewability for fossil fuels and the time span of renewability for alternative fuels.**
- **S8.C.2.2.3: Describe the waste (i.e., kind and quantity) derived from the use of renewable and nonrenewable resources and their potential impact on the environment.**
- **S7.D.1.2.3: Describe the importance of water systems on the diversity and distribution of life on Earth.**
- **S8.A.3.2.3: Given a model showing simple cause and effect relationships in a natural system, predict results that can be used to test the assumptions in the model (e.g., photosynthesis, water cycle, diffusion, infiltration)**
- **S8.B.3.2.1: Use evidence to explain factors that affect changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).**
- **S8.B.3.2.2: Use evidence to explain how diversity affects the ecological integrity of natural systems.**
- **S8.B.3.2.3: Describe the response of organisms to environmental changes (e.g., changes in climate, hibernation, migration, coloration) and how those changes affect survival.**
- **S8.B.3.3.1: Explain how human activities may affect local, regional, and global environments.**
- **S8.B.3.3.2: Explain how renewable and nonrenewable resources provide for human needs (i.e., energy, food, water, clothing, and shelter).**
- **S8.B.3.3.3: Describe how waste management affects the environment (e.g., recycling, composting, landfills, incineration, sewage treatment).**

Key Terms and Definitions

ecological pyramid: An ecological pyramid is a graphical model that illustrates the flow of energy through different forms of life in an ecosystem. The bottom level illustrates species which act as producers, harnessing energy from abiotic sources. Each subsequent level illustrates a level of consumer, each of which receives energy by consuming the group below it

food web: a system of interlocking and interdependent food chains.

carbonification: conversion of vegetable matter to coal

Essential Questions

How can humans recycle their resources?

How do humans affect other species?

How can a change to an ecosystem affect a population?

What are the potential impacts of renewable and nonrenewable resources on the environment?

Which factors or activities affect biodiversity?

How do species become extinct and what can humans do to prevent this loss of biodiversity?

How can technology help control air and water pollution?

Starting Points

When students start this unit, they should have some basic knowledge of both the life science and Earth science topics that will be discussed in more detail throughout this unit. This includes the topics of cellular biology, systems such as the water cycle, rock cycle, weathering and erosion. This knowledge should have been gained throughout students' middle school science classes, and this unit will be their opportunity to connect content and see the relationships between different topics that they have studies.

This unit is the second of a two part unit on ecological behavior and systems. The focus in this second part of the unit will be on how a change in an ecosystem affects other biotic and abiotic resources with a particular focus on how humans use and impact the environment.

By the end of the unit, students will evaluate the effect of human populations and use of natural resources on living organisms and non-living environments within ecosystems. Students will develop an understanding of ecology within all biomes and discuss the importance of biodiversity and the factors that affect it. Students will consider how they fit into the ecological system, and they will consider and analyze how they affect their local or global environment. Students will realize that their actions or decisions affect others.

8th Grade Life Science Curriculum — Term 4 (4/10-6/15/18)

Unit 7: Properties of Matter Duration: 6 Weeks

Eligible Content

- **S8.A.1.1.1: Distinguish between a scientific theory and an opinion, explaining how a theory is supported with evidence, or how new data/information may change existing theories and practices.**
- **S8.A.1.1.2: Explain how certain questions can be answered through scientific inquiry and/or technological design.**
- **S8.A.1.1.3: Use evidence, such as observations or experimental results, to support inferences about a relationship.**
- **S8.A.1.1.4: Develop descriptions, explanations, predictions, and models using evidence.**
- **S8.A.2.1.3: Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.**
- **S8.A.2.1.4: Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions**
- **S8.A.2.1.5: Use evidence from investigations to clearly communicate and support conclusions.**
- **S8.C.1.1.1: Explain the differences among elements, compounds, and mixtures.**
- **S8.C.1.1.2: Use characteristic physical or chemical properties to distinguish one substance from another (e.g., density, thermal expansion/contraction, freezing/melting points, streak test)**
- **S8.C.1.1.3 Identify and describe reactants and products of simple chemical reactions.**
- **S6.C.1.1.1: Describe how characteristic physical properties of matter can be used to distinguish one substance from another (e.g., boiling point, freezing/melting points).**
- **S6.C.1.1.2: Explain that materials are characterized by having a specific amount of mass in each unit of volume (density)**
- **S6.C.1.2.1: Describe how water changes from one state to another.**
- **S7.C.1.2.2: Compare the behavior of particle motion in solids, liquids, and gasses.**
- **S7.C.1.1.1: Use characteristic physical or chemical properties of matter to distinguish one substance from another (e.g., density, freezing/melting points, solubility, ability to rust).**

Key Terms and Definitions

matter - anything that has mass and takes up space

volume - the amount of space taken up, or occupied by an object

weight - a measure of the gravitational force exerted on an object

mass - the amount of matter in an object

inertia - the tendency of an object to resist a change in motion

physical property - a characteristic of a substance that does not involve a chemical change, such as density, color, or hardness.

density - the ratio of the mass of a substance to the volume of the substance

physical change - a change of matter from one form to another without a change in chemical properties

chemical property - a property of matter that describes a substance's ability to change into new matter that has different properties

chemical change - when one or more substances are changed into new substances that have new or different properties

states of matter - physical forms of matter: solid, liquid, gas

solid - the state of matter that has a definite shape and volume

liquid - the state of matter with a definite volume but not a definite shape; liquid takes the shape of its container

surface tension - the force that acts on the particles at the surface of a liquid

gas - a state of matter with no definite shape or volume

viscosity - the resistance of a gas or liquid to flow

temperature - a measure of how hot or cold something is; a measure of the movement of particles

pressure: the amount of force exerted on a given area of a surface

Boyle's Law: states that the volume of gas is inversely proportional to the pressure of a gas at a constant temperature.

Charles's Law: states that the volume of gas is directly proportional to the temperature of a gas when the pressure is constant

change of state: the change from one physical state to another

melting: the change of state in which a solid becomes a liquid by adding energy, endothermic

freezing: a change of state from a liquid to a solid by losing energy, exothermic

sublimation: the process in which a solid changes directly into a gas, endothermic change

compound: a pure substance composed of two or more elements that are chemically combined

mixture: a combination of two or more elements that are not chemically combined

solution: a mixture that is composed of particles of two or more substances that are distributed evenly among each other

solute: in a solution, the substance that is dissolved

solvent: the substance in which the solute dissolves

concentration: measure of the amount of solute dissolved in a solvent

solubility: the ability of one substance to dissolve in another

suspension: a mixture in which particles of a material are more or less evenly dispersed throughout a liquid or gas

colloid: a mixture whose particle size is intermediate between those of a solution and a suspension

Essential Questions

What is matter?

Why do different types of matter come in different forms and how might this be useful in engineering or technology innovation?

What are the physical properties and chemical properties of matter?

How does matter change from one state to another and how can this be affected by temperature and pressure?

Starting Points

At the beginning of this unit, students should have a basic understanding of the states of matter and changes in states of matter. Specifically, students should have an understanding of the water cycle and the process by which water changes from one state to another. Since students already have an introduction to this topic, the teacher should be able to go more in depth with what causes and happens during a state change, including the behavior of gasses and gas laws.

Prior to this unit, students should have also had the opportunity to observe (collect information using the senses), measure (using the metric system), classify (using a variety of characteristics), communicate (verbally and in writing) , infer (using prior knowledge and new evidence), and predict (provide reasonable explanations). They will need to rely on and continue to build upon these skills throughout the unit.

By the end of this unit, students must learn that all things in the universe are made of matter and that matter has specific physical and chemical properties that can be observed, measured and described. The study of matter and its properties is called chemistry, which affects all of us everyday. Shampoo, cake mixes, paint, cells phones are all the result of chemistry. Students will also be able to explain the differences between elements, compounds, and mixtures and how they are related to each other.

Unit 8: Atomic Structure and the Periodic Table Duration: 4 Weeks

Eligible Content:

- **S8.A.1.1.1: Distinguish between a scientific theory and an opinion, explaining how a theory is supported with evidence, or how new data/information may change existing theories and practices.**
- **S8.A.1.1.2: Explain how certain questions can be answered through scientific inquiry and/or technological design.**
- **S8.A.1.1.3: Use evidence, such as observations or experimental results, to support inferences about a relationship.**
- **S8.A.1.1.4: Develop descriptions, explanations, predictions, and models using evidence.**
- **S8.A.2.1.3: Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.**
- **S8.A.2.1.4: Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions**
- **S8.A.2.1.5: Use evidence from investigations to clearly communicate and support conclusions.**
- **S8.A.2.1.6: Identify a design flaw in a simple technological system and devise possible working solutions**
- **S8.C.1.1.1: Explain the differences among elements, compounds, and mixtures.**
- **S8.C.1.1.2: Use characteristic physical or chemical properties to distinguish one substance from another (e.g., density, thermal expansion/contraction, freezing/melting points, streak test)**
- **S7.C.1.2.1: Identify the reactants and products of simple chemical reactions (e.g., photosynthesis, cellular respiration).**

- **S7.C.1.2.2: Compare the behavior of particle motion in solids, liquids, and gases.**
- **S7.C.1.1.2: Recognize that the atom is the basic building block for all matter.**

Key Terms and Definitions

matter - anything that has mass and takes up space

chemical change - when one or more substances are changed into new substances that have new or different properties

states of matter - physical forms of matter: solid, liquid, gas

solid - the state of matter that has a definite shape and volume

liquid - the state of matter with a definite volume but not a definite shape; liquid takes the shape of its container

gas - a state of matter with no definite shape or volume

metal: element that is shiny, conducts heat and electricity well

nonmetal: element that conducts heat and electricity poorly

metalloid: element that has properties of both metals and nonmetals

atom: the smallest unit of an element that maintains the properties of that element

electron: a subatomic particle that has a negative charge

proton: a subatomic proton with a positive charge

neutron: a subatomic particle with no charge

nucleus: the central region of an atom which is made up of protons and neutrons

electron cloud: a region around the nucleus where electrons are likely to be found

atomic mass unit: the SI unit of mass that describes the masses of the particles of an atom

atomic number: the number of protons in the nucleus of an atom

isotopes: atoms that have the same number of protons but have different numbers of neutrons

mass number: the sum of the protons and neutrons in an atom

atomic mass: the mass of an atom expressed in atomic mass units
fundamental particle: particle of matter that cannot be subdivided into smaller particles

ions: positively or negatively charged atom that has lost or gained an electron

periodic: something that occurs or repeats at regular intervals

periodic law: the law that states that the repeating chemical and physical properties of elements change periodically with the atomic numbers of the elements

period: in chemistry, a horizontal row of elements in the periodic table

group: a vertical column of elements in the periodic table; elements in a group share chemical properties

energy level: the levels that can be occupied by electrons at specific distance from the nucleus of the atom in the Bohr model of an atom

electron cloud model: area where electrons might be found in orbitals around the nucleus

chemical bond: force of attraction between atoms or ions when atoms share electrons

Essential Questions

What is matter?

How are substances in the universe classified and organized?

How has atomic theory evolved over time?

How are elements organized in the modern periodic table and why?

How are chemical bonds created in a chemical reaction?

Starting Points

As a result of the previous unit, students should know that all objects are made of matter and that an element is the purest type of matter. Although students may have heard of the term "atom", they have likely not engage in any formal study of atoms, their parts, or the periodic table. This unit will be students' first introduction to these topics.

By the end of the unit, students should have an understanding of atomic theory and the history of its development. They should know that, just as all living things are made of cells, all materials in the universe are made of smaller particles called atoms, and atoms are made up of smaller parts called neutrons, protons, and electrons. Lastly, students will learn how elements are organized on the periodic table and what information can be learned from the periodic table.

This unit will be provide students with important foundational skills that they will need to succeed in their 9th grade science courses, particularly physical science. This content will also appear on the Biology Keystone Assessment.