

Wilmette Public Schools, District 39 Science Curriculum, Grade 7

Guiding Questions	Scientific and Engineering Practices	CONNECTED/21st Century Learning
<p>How can we analyze design systems considering inputs outputs and the relationship to feedback loops?</p> <p>What is the design process and how can we use it to solve problems?</p> <p>What is the nature of scientific inquiry?</p> <p>How do scientists go about their work?</p> <p>How do theories become accepted or refuted?</p> <p>What is the relationship of scientific claims to evidence?</p>	<p>Design systems have interacting parts that can be analyzed by investigating the complexity of inputs and outputs and their relationship to the feedback loop.</p> <p>Technological design is a dynamic problem-solving process that engages designers in proposing solutions, testing, analyzing and modifying designs.</p> <p>Scientific inquiry is a dynamic process that is not limited to one scientific method. Inquiry engages learners in asking scientifically oriented questions, gathering and prioritizing evidence, formulating explanations, making connections to scientific knowledge and communicating and justifying explanations. leads to new questions.</p> <p>Science is an imaginative endeavor that is subject to modification as new information challenges current theories. It involves the collection of data, the use of logical reasoning, argumentation and the devising of hypotheses and explanations informed by evidence. Scientists keep honest/unbiased, clear and accurate records, value hypotheses and understand that more than one explanation can be given for the same evidence. use a variety of tools to inform their observations. organize information using tables, graphs, diagrams and symbols. question claims based on vague attributions and are skeptical of arguments based on small data samples. embrace unexpected results.</p>	<p>Teaching/Learning Styles and Learning Environment - Small Group Collaborative Work, Claims and Evidence, Creating representation/metaphor</p> <p>Technology - SMART Board, Microscopes, Data Analysis</p>

Unit: Structure and Function of Living Systems

Time Frame (in weeks): 18 Weeks

Essential Question: How are structure and function related in living things?

CROSCUTTING CONCEPTS

Cause and Effect

- Relationships may be used to predict phenomena in natural systems.

Scale, Proportion, and Quantity

- Phenomena that can be observed at one scale may not be observable at another scale.

Systems and system models

- Systems may interact with other systems; they may have sub-systems and be part of larger complex systems.

Structure and Function

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

CONTENT VOCABULARY: organism, microorganism, unicellular, multicellular, cell membrane, cell wall, chloroplasts, nucleus, mitochondria, cytoplasm, prokaryote, eukaryote, photosynthesis, cellular respiration, reproduction, growth, development, energy, stimulus, response, adaptation
 ACADEMIC VOCABULARY: compare, contrast, evidence, claim, support, argue, defend, analyze, justify, systems, interaction, structure, function, relationship

Guiding Questions: <ol style="list-style-type: none"> 1. What do all living organisms have in common? 2. How are organisms structured to help them to perform life's functions? 3. How does growth and development over time connect to reproduction and survival of a species? 4. How is energy used and transformed to support life processes? 5. How is diversity apparent in how organisms meet the common traits of living things? 6. What evidence do we have that life increased in complexity over time? 	Teaching Resources: The STC Secondary Program: <i>Investigating Biodiversity and Interdependence</i> <i>Studying Development and Reproduction of Orga</i>
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Next Generation Science Standards Performance Expectations	Disciplinary Core ideas	Science & Engineering Practices, Skills, & Knowledge
<p>Students who demonstrate understanding can:</p> <ul style="list-style-type: none"> ● MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different number and types of cells. <i>Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living cells, and understanding that living things may be made of one cell or many and varied cells.</i> ● MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. <i>Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall. Assessment of organelle structure/function is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.</i> ● MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. <i>Emphasis on the conceptual understanding that cells from tissues and tissues from organs specialized for particular body functions. Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.</i> ● MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. ● MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. <i>Examples of local environmental conditions could include the availability of food, light, space, and water. Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.</i> ● MS-LS1-6. Construct a scientific explanation based on evidence for 	<p>Connected NGSS Disciplinary Core Ideas:</p> <p>LS1.A Structure and Function</p> <ul style="list-style-type: none"> • All living things are made of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1) • Within cells, special structures are responsible for particular function, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2) • In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS1-3) <p>LS1.B: Growth and Development of Organisms</p> <ul style="list-style-type: none"> • Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4) • Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4) • Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5) <p>LS1.C: Organization for Matter and Energy Flow in Organisms</p> <ul style="list-style-type: none"> • Plants, algae, and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6) • Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. 	<p>Formative Understandings & Skills</p> <ul style="list-style-type: none"> • Write a working definition of the term “organism.” • Compare and contrast the complexity of organization in living systems. • Analyze the relationship between structure and function of cells. • Explain how cells function as “building blocks” of organisms and describe the requirements for cells to live. • Compare and contrast plant and animal cells. • Compare and contrast sexual/asexual reproduction • Compare and contrast prokaryote/eukaryote (Concept-internal structures) • Relate organism structure to function • Analyze the relationship between unique structures and their functions in living organisms and how they change • Compare and contrast unicellular and multicellular organisms. (Primarily Kingdoms Plant & Animal) <p>Science and Engineering Practices</p> <ul style="list-style-type: none"> • Develop and use models • Develop and use a model to describe phenomena. • Plan and carry out investigations • Conduct an investigation • Engage in argument from evidence

<p>the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. <i>Emphasis is on tracing movement of matter and flow of energy. Assessment does not include the biochemical mechanisms of photosynthesis.</i></p> <ul style="list-style-type: none"> ● MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. <i>Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released. Assessment does not include details of the chemical reactions for photosynthesis or respiration.</i> ● MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. <i>Assessment does not include mechanisms for the transmission of this information.</i> 	<p>LS1.D Information Processing</p> <ul style="list-style-type: none"> • Each sense receptor responds to different inputs transmitting them as signals that travel along the nerve cells to the brain. The signals are then processed in the brain resulting in immediate behaviors or memories. (MS-LS1-8) <p>PS3.D: Energy in Chemical Processes and Everyday Life</p> <ul style="list-style-type: none"> • The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (secondary to MS-LS1-6) • Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (secondary to MS-LS1-7) 	<ul style="list-style-type: none"> ● Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. ● Obtain, evaluate, and communicate information ● Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.
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Unit: Dynamic Earth: Earth’s Systems and Processes

Time Frame: 18 Weeks

Essential Question: How does thermal energy affect Earth’s systems?

CROSSCUTTING CONCEPTS:

Theory of Plate Tectonics and Geologic History:

Stability and change

- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale.

Patterns

- Patterns in rates of change and other numerical relationships can provide information about natural systems.

Scale proportion and quantity

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

Weather and Climate:

Cause and effect

- Relationships may be used to predict phenomena in natural or designed systems.

Systems and System Models

- Models can be used to represent systems and their interactions-such as inputs, processes, and outputs- and energy, matter, and information flows within systems.

CONTENT SPECIFIC VOCABULARY: atmosphere, hydrosphere, biosphere, geosphere, convection currents, lithosphere, mantle, core, fossil beds, sedimentary rocks, volcanic flows, glacial deposits, constructive and destructive forces, plate tectonics, continental drift, seismic activity, fossil record, viscosity

TPTGH: Asthenosphere, construction, convection, convergent boundary, core (inner), core (outer), crust, destruction, divergent boundary, earthquake, energy, erosion, fossil, geologic time scale, igneous rock, lava, law of superposition, lithosphere, magma, mantle, metamorphic rock, mineral, ocean ridges, ocean trench, relative dating, rock cycle, sedimentary rock, strata, subduction,

tectonic plate, transform boundary, trench, uniformitarianism, viscosity, volcano, weathering, **WnC:** Air pressure, atmosphere, barometer, climate, cloud, condensation, convection, current, density, evaporation, front, heat, hurricane, storm, temperature, thermal energy, tornado, vortex, weather

ACADEMIC VOCABULARY: forces, dynamic, structure, function, system, properties, **claims, evidence; Nature of Science Vocabulary:** law, model, system, theory, data

<p>Guiding Questions:</p> <ol style="list-style-type: none"> 1. What drives plate tectonics and what happens as plates pull apart or collide? 2. How has the Earth's surface changed over time? 3. What can we learn about geologic history from examining Earth's rock record? 4. How does the heating of Earth affect the atmosphere and hydrosphere and, in turn, cause weather? 5. How can complex weather patterns be used to predict the weather? 6. What evidence do we have to support or negate the theory of climate change? 	<p>STC Secondary Programs: <i>Understanding Weather and Climate</i></p> <p><i>Exploring Plate Tectonics</i></p>	
<p>Next Generation Science Standards Performance Expectations</p>	<p>Disciplinary Core ideas</p>	<p>Science & Engineering Practices, Skills, & Knowledge</p>
<p>Students who demonstrate understanding can:</p> <p>MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. <i>Emphasis is on how analyses of rock formation and the fossils they contain are used to establish relative ages of major events in Earth's history. Assessment does not include recalling the names of specific periods or epochs and events within them.</i></p> <p>MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. <i>Emphasis is placed on the process of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials. Assessment does not include the identification and naming of minerals.</i></p> <p>MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scale. <i>Emphasis is on how processes change Earth's surface at time and spatial scales that can be large or small, and how many geoscience processes usually behave gradually but are punctuated by catastrophic events.</i></p> <p>MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. <i>Examples of data include similarities of rock and fossil types of different continents, the shapes of continents (including continental shelves), and the locations of ocean structures.</i></p>	<p>Connected NGSS Disciplinary Core Ideas:</p> <p>ESS1.C The History of Planet Earth</p> <p>The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1-4)</p> <p>Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (MS-ESS2-3)</p> <p>ESS2.A Earth's Materials and Systems</p> <p>All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)</p> <p>The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2)</p> <p>ESS2.B Plate Tectonics and Large-Scale System Interactions</p> <p>Maps of ancient and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)</p>	<p>Formative Understandings</p> <p>Plot seismic data</p> <p>Explain that energy from earthquakes travels in waves</p> <p>Communicate results through writing, graphs, maps, and charts</p> <p>Predict outcomes of plate movements based on investigations</p> <p>Analyze the constructive and destructive forces of catastrophic events</p> <p>Science and Engineering Practices</p> <ul style="list-style-type: none"> • Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3) • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS1-4, MS-ESS2-2). • Develop and use model to describe phenomena. (MS-ESS2-1) • Scientific knowledge is open to revision in light of new evidence. Science findings are frequently revised and/or reinterpreted based on new evidence. (MS-ESS2-3) • Interpret data on natural and catastrophic events • Research and analyze data sets on climate change projections • Analyze the connection between Earth's physical features and the planet's weather and climate • Conduct scientific investigations on convection