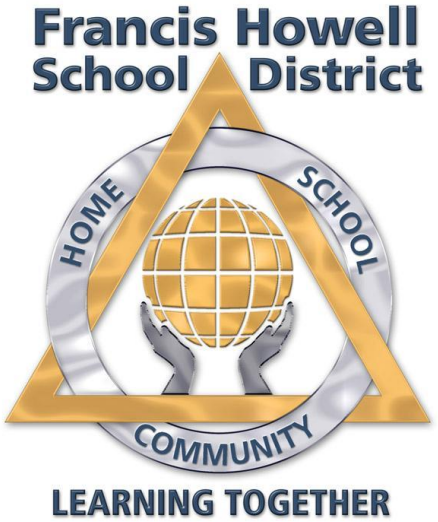
Life Science 7

Curriculum



Board Approved:

Francis Howell School District

Mission Statement

The mission of the Francis Howell School District is to prepare students today for success tomorrow.

Vision Statement

Every student will graduate with college and career readiness skills.

Values

Francis Howell School District is committed to:

- Providing a consistent and comprehensive education that fosters high levels of academic achievement
- Operating safe and well-maintained facilities
- Providing a safe learning environment for all students
- Promoting parent, community, student, and business involvement in support of the school district
- Ensuring fiscal responsibility
- Developing responsible citizens
- Operating as a professional learning community
- Making appropriate use of technology

Francis Howell School District Graduate Goals

Upon completion of their academic study in the Francis Howell School District, students will be able to:

1. Gather, analyze and apply information and ideas.
2. Communicate effectively within and beyond the classroom.
3. Recognize and solve problems.
4. Make decisions and act as responsible members of society.

Science Graduate Goals

The students in the Francis Howell School District will graduate with the knowledge, skills, and attitudes essential to leading a productive, meaningful life. Graduates will:

- Understand and apply principles of scientific investigation.
- Utilize the key concepts and principles of life, earth, and physical science to solve problems.
- Recognize that science is an ongoing human endeavor that helps us understand our world.
- Realize that science, mathematics, and technology are interdependent, each with strengths and limitations that impact the environment and society.
- Use scientific knowledge and scientific ways of thinking for individual and social purposes.

Life Science 7th Grade Course Rationale

Science education develops science literacy. Scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity. A sound grounding in science strengthens many of the skills that people use every day, like solving problems creatively, thinking critically, working cooperatively in terms, using technology effectively, and valuing lifelong learning. Scientific literacy has become a necessity for everyone.

Life Science 7th Grade Course Description

This course is designed to focus on two main topics: the characteristics of and interactions within living organisms, and how all organisms interact with one another and their environment to survive. Throughout all units, students will ask and explore questions with hands-on-activities using scientific inquiry. Students will collaboratively design and conduct an in-depth investigation modeling the inquiry process. Technology and literacy will be embedded throughout as a tool to support learning and give evidence of learning.

Life Science 7th Grade Curriculum Team

Curriculum Committee

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Curriculum Notes

All FHSD performance tasks and sample learning activities are aligned not only to understandings and standards, but also the Rigor and Relevance Framework and 21st Century Skills. Information on these two things is provided below or by clicking on the hyperlinks.

Rigor and Relevance Framework

The Rigor/Relevance Framework is a tool developed by the International Center to examine curriculum, instruction, and assessment along the two dimensions of higher standards and student achievement.

The Rigor/Relevance Framework has four quadrants.
Quadrant A represents simple recall and basic understanding of knowledge for its own sake. Examples of Quadrant A knowledge are knowing that the world is round and that Shakespeare wrote Hamlet.

Quadrant C represents more complex thinking but still knowledge for its own sake. Quadrant C embraces higher levels of knowledge, such as knowing how the U.S. political system works and analyzing the benefits and challenges of the cultural diversity of this nation versus other nations.

Quadrants B and D represent action or high degrees of application. Quadrant B would include knowing how to use math skills to make purchases and count change. The ability to access information in wide-area network systems and the ability to gather knowledge from a variety of sources to solve a complex problem in the workplace are types of Quadrant D knowledge.

A	B	C	D
Students gather and store bits of knowledge and information. Students are primarily expected to remember or understand this knowledge.	Students use acquired knowledge to solve problems, design solutions, and complete work. The highest level of application is to apply knowledge to new and unpredictable situations.	Students extend and refine their acquired knowledge to be able to use that knowledge automatically and routinely to analyze and solve problems and create solutions.	Students have the competence to think in complex ways.

21st Century Skills

These skills have been pared down from 18 skills to what are now called the 4Cs. The components include critical thinking, communication, collaboration, and creativity. Critical thinking is focused, careful analysis of something to better understand and includes skills such as arguing, classifying, comparing, and problem solving. Communication is the process of transferring a thought from one mind to others and receiving thoughts back and includes skills such as choosing a medium (and/or technology tool), speaking, listening, reading, writing, evaluating messages. Collaboration is working together with others to achieve a common goal and includes skills such as delegating, goal setting, resolving conflicts, team building, decision-making, and managing time. Creativity is expansive, open-ended invention and discovery of possibilities and includes skills such as brainstorming, creating, designing, imagining, improvising, and problem-solving.

Standards

If Missouri has changed the standard from NGSS, the code is a MO 6-8 LS code. If the MO standard and the NGSS standard are identical, the NGSS code has been used.

Standards aligned to this course can be found:

Science Standards

Missouri Science Standards 6-12

Next Generation Science Standards

Next Generation Science Standards

National Educational Technology Standards

http://www.iste.org/STANDARDS

Units & Standards Overview

Semester 1 **Semester 2**

Unit 1: Cells, Tissues, Systems	**Unit 2:** Growth, Development, and Reproduction of Organisms	**Unit 3:**Matter and Energy in Organisms in Ecosystems	**Unit 4:**Interdependent Relationships in Ecosystems
Evidence Statements 6-8 LS1-1 MS LS1-2 6-8 LS1-3 **6-8 LS1-4** MS-ETS1-1	Evidence Statements **6-8 LS1-5** **MS LS1-5** 6-8 LS4-1 6-8 LS4-2 6-8 LS4-4 MS LS4-5 ISTE 3b	Evidence Statements **6-8 LS1-7** MS LS2-3 6-8 LS 2-5 HS LS1-7 MS ETS1-3	Evidence Statements **MS LS2-4** **MS LS2-1** 6-8 LS2-2 **MS ETS1-2** MS ETS1-4
Disciplinary Core Ideas ETS1.A LS1.A LS1.B	Disciplinary Core Ideas **LS1.B** LS4.A **LS4.B** LS4.C	Disciplinary Core Ideas **LS1.C** **PS3.D** LS2.C LS4.D ETS1.B LS2.B	Disciplinary Core Ideas LS2.C LS2.A ETS1.B ETS1.C ISTE 1a ISTE 2a, b ISTE 4a, b, c, d,
Science Engineering Practices: 1, **2,** 3, 4,	Science Engineering Practices: **1, 3,** 4, 8	Science Engineering Practices: 1, 2, **3,** 4, 5**, 6,** 7, **8,**	Science Engineering Practices: ***1, 3, 4, 7***
Cross Cutting Concepts: 1, **2,** 3, **4, 6**	Cross Cutting Concepts **1, 2**, 3, 6, 7	Cross Cutting Concepts 1, 2, 3, **5,** 6, **7**	Cross Cutting Concepts 1**, 2, 3, 6, 7**
PE Assessment: Interactions of Systems Strips Activity Interactions of Systems Strips	PE Assessment: Artificially Selecting Dogs Performance Event	PE Assessment: Photosynthesis Photosynthesis Evidence Make a Claim Tchart	PE Assessment: The Great Pacific Garbage Patch

Course Map

	Unit Description	PE Summary	PE Standards
Unit: 1 Interactions of Body Systems **9 weeks**	Students will understand how to, plan and carry out investigations to develop evidence that living organisms are made of cells and to determine the relationship of organisms to the environment. They will can construct explanations for the interactions of systems in cells and organisms. How do the structure of organisms contribute to life's functions?	Students will sequence different components of how two body systems will work together including: Cardiovascular & Digestive,Nervous & Muscular, Respiratory & Cardiovascular.Then, students will select only one of the interactions and sketch a system model including structures, labels and arrows to show the flow of movement.	**Evidence Statement:** **MS-LS1-3** **DCI:LS1.A** **SEP: 2** **CCC: 2, 4, 6**
Unit: 2 Growth, Development, & Reproduction of Organisms **9 weeks**	Students will understand how to plan and execute investigations to show the cause and effect relationship between animal behavior and probability of survival and reproduction. Students will use evidence to explain how genetic and environmental factors can influence an organism's growth. Students will demonstrate their knowledge of natural selection by explaining why advantageous traits over time while undesirable traits will decrease. Students will organize data and patterns to show how fossils can identify geological time.	Students will develop new dog breeds with characteristics that make the dogs capable of performing a desirable task. The students are expected to examine canine features and their functions and select two existing breeds they feel will most likely produce a successful new breed and determine the resulting offsprings. Students will construct scientific explanations, based on valid evidence, on how artificial selection can influence the probability of specific genetic traits.	**Evidence Statement:** **MS-LS1-5** **6-8 LS 1-5** **DCI: LS4.B, LS1.B** **SEP: 1, 3** **CCC: 2**
Unit: 3: Matter & Energy in Organisms **9 weeks**	Students will models to explain the transfer of energy and cycling of matter in the role of photosynthesis in cycling matter ecosystems. Students will construct explanations for the cycling of matter in organisms and the interactions of organisms to obtain the matter and energy from the ecosystem to survive and grow. Students will understand that sustaining life requires substantial energy and matter inputs and the structure and functions of organisms contribute to the capture, transformation, transport, release, and elimination of matter and energy.	Students will read 4 pieces of evidence about the process of photosynthesis. They will write an essay in which they provide the major steps in photosynthesis. Students must support their discussion with evidence from the text, tables, and scientists' excerpts that are provided. Students will be required to include one piece of evidence from at least 3 of the sources provided.	**Evidence Statement:** **6-8 LS1-7** **DCI:LS1.C,PS3.D** **SEP: 6, 8** **CCC: 5, 7**
Unit: Interdependent Relationships in Ecosystems **9 weeks**	Students construct explanations for the interactions in ecosystem and the scientific, political and social justifications used in making decisions about maintaining biodiversity in ecosystems. Students understand that organisms and populations of organisms are dependent on their environmental interactions both with other organisms and with nonliving factors. They also understand the limits of resources influence the growth of organisms and populations, which may result in competition for those limited resources.	Students complete an engineering challenge to design a solution regarding the Great Pacific Garbage Patch.	**Evidence Statement:** **MS-LS2-4** **MS-LS2-1** **MS-ETS1-2** ISTE 1, 2a, 2b, 4a 4b, 4c, 4d **DCI: LS2.C, LS2.A, ETS1.A, ETS1.B, ETS1.C**

			SEP: 1, 3, 4, 7 **CCC: 2, 3, 6, 7**

Unit 1: Cells, Tissues, Systems

Content Area: Science	**Course:** 7th Grade Life Science	**UNIT:** Cells, Tissues, Systems

Unit Description Middle school students will understand how to, plan and carry out investigations to develop evidence that living organisms are made of cells and to determine the relationship of organisms to the environment. They will can construct explanations for the interactions of systems in cells and organisms. How do the structure of organisms contribute to life's functions?	**Unit Timeline:** 9 weeks.

DESIRED Results

Transfer Goal - ***Students will be able to independently use their learning to……***

1. Ask questions and define problems.
2. Develop and use models.
3. Plan and carry out investigations.
4. Analyze and interpret data.
5. Use mathematical and computational thinking.
6. Construct explanations and design solutions.
7. Engage in arguments from evidence.
8. Obtain, evaluate, and communicate information.

Understandings (Cross Cutting Concepts) – *Students will understand… (Big Ideas)*

1. Patterns
2. Cause and Effect
3. Scale, Proportion, & Quantity
4. Systems & System Models
5. Energy and Matter
6. Structure and Function
7. Stability and Change

Essential Questions: ***Students will keep considering…***

- How do individual cells contribute to the survival of the whole organism?
- How can scientists determine if an unknown sample is living or nonliving?
- How are difference in plant and animal structures contribute to their survival?
- How do single-celled and multicellular organisms meet their basic needs for survival?

Phenomena for unit: Discovery Education Cells Video

Standards Addressed
Students who demonstrate understanding can: 6-8-LS1-1: Provide evidence that organisms (unicellular and multicellular) are made of cells and that a single cell must carry out all of the basic functions of life. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and nonliving things, and understanding that living things may be made of one cell or many and varied cells.] Linked to NGSS MS-LS1-1 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. [Clarification Statement: 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.] 6-8-LS1-3**:** Develop an argument supported by evidence for how multicellular organisms are organized by varying levels of complexity; cells, tissue, organs, organ systems. [Linked to NGSS: MS-LS1-3] **6-8-LS1-4: Present evidence that body systems interact to carry out key body functions, including providing nutrients and oxygen to cells, removing carbon dioxide and waste from cells and the body, controlling body motion/activity and coordination, and protecting the body.** MS-ETS1.1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Disciplinary Core Ideas **Students will know...**	**Science and Engineering Practice** **Students will be able to...**	**Cross Cutting Concepts** **Students will understand...**
ETS1.A: The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)	Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or solution to a problem.	Cause and effect to show that a phenomena may have more than one cause, and some cause and effect relationships in systems can one be described using probability.
ETS1.B: There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2)	Develop, design, and use a system for successfully building a given model.	Systems and system models to recognize that specific criteria and constraints must be in place to design a successful solution. Structure and Function to show structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. Stability and change to show that stability might be disturbed either by sudden events or gradual changes that accumulate over time.
LS1.A All living things are made up 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).	Identify and describe the phenomenon under investigation, which includes the idea that living things are made up of cells. Engage in an argument that all living things are made of cells (either one cell or many different numbers and types of cells) and that the cell is the smallest unit that can be said to be alive.	Patterns to recognize that all living things have cells and non-living things do not have cells. Scale, proportion, and quantity to recognize similarities and differences of plant and animal cells that cannot be seen with the unaided eye in the

	Collect and record data on the cellular composition of living organisms.	absence of a microscope.
LS1.A: Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. **Nucleus:**in a 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 **Chloroplasts**:an organelle found in plant and algae cells where photosynthesis occurs **Cell Wall:** a rigid structure that surrounds the cell membrane and provides support to the cell **Mitochondria**:in eukaryotic cells, the cell organelle that is surrounded by two membranes and that is the site of cellular respiration, which produces ATP **Cell Membrane:**a phospholipid layer that covers a cell's surface and acts as a barrier between the inside of a cell and the cell's environment **Vacuoles:** a fluid-filled vesicle found in the cytoplasm of plant cells or protozoans **Golgi Complex:**a cell organelle that helps make and package materials to be transported out of the cell	Develop a model in which they identify the parts of cells relevant for the given phenomenon. Using models of plant and animal cells, students will describe the relationships between components of a cell including the particular functions of parts of cells in terms of their contributions to overall cellular functions. For example, cell walls provide structure and stability for plants acting as bone cells in animals. Describe how the cell membrane and mitochondria work together to provide energy (cellular respiration) for an animal cell. Use a model to describe how different parts of a cell contribute to how the cell functions as a whole.	Patterns in short video segments to recognize different types of cellular activities (For example white blood cells attacking bacteria, or paramecium feeding). The structure and function of each component within a plant and an animal cell. A system model to describe how matter is used to make energy for a cell.
LS1.A: 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.	Develop a model that represents cells that make up tissues within a specific organ system including the circulatory, excretory, digestive, respiratory, skeletal, muscular, and nervous systems.	Structure and function between cells, tissues, organs and body systems to recognize that although the level of organization may differ, there are many similar functions, and the way an object is shaped or structured determine many of its properties and functions.

		Scale, proportion and quantity to recognize how smaller units (cells) make up the larger structures (systems).
Body systems interact with each other to carry out key functions to maintain homeostasis. **Circulatory:** the heart and vessels that move blood through the body **Integumentary:** the body system that includes the skin and the structures produced by the skin, such as hair and nails, and that forms a protective body covering **Excretory:** removes excess, unnecessary materials from the body fluids of an organism, so as to help maintain internal chemical homeostasis and prevent damage to the body **Digestive:** the organs that break down food so that it can be used by the body **Respiratory**: a collection of organs whose primary function is to take in oxygen and expel carbon dioxide; the organs of this system include the lungs, the throat, and the passageways that lead to the lungs **Skeletal:** the bones, cartilage, ligaments, and tendons whose primary function is to support and protect the body and to allow the body to move **Muscular:** a collection of muscles whose primary function is movement and flexibility **Nervous system:** the structures that control the actions and reactions of the body in response to stimuli from the environment; it is formed by billions of specialized nerve cells, called neurons	**Present evidence that the digestive, cardiovascular, and respiratory systems interact to provide nutrients and remove waste from cells in a body.**	**Systems and system models to demonstrate understanding of the interactions between body systems.**

Unit 1: Interactions of Body Systems Performance Assessment

EVIDENCE of LEARNING				
Understandings **#2 Cause and Effect** **# 4 Systems and Systems Models** **#6 Structure and Function**	**Standards** **MS-LS1-3 LS1.A** **2-Develop and use models**	**Unit Performance Assessment**: Interactions of Body Systems Strips **Description of Performance Task:** This performance event will be in two different parts. In part 1, students will sequence different sentence strips on their desks in the correct order of how the two body systems will work together. The three interactions of the systems will be: 1. Cardiovascular & Digestive 2. Nervous & Muscular 3. Respiratory & Cardiovascular Next, students will write down their sequence of three different interactions on their Interactions of Systems Strips Activity. In part 2, students will select only one of the interactions and sketch a system model to represent it. The system model should include structures, labels and arrows to show the flow of movement. All underlined words should be included as labels in the system model. The teacher will need to provide copies of Interactions of Systems Strips and cut sentence strips and place them in the appropriate envelope with the question written on the outside. **Teacher will assess:** The correct sequencing of the body systems strips and a system model. Interactions of Systems Strips Key is for SMART Notebook. **Performance:** **Mastery:** Students scoring an 80% (23/28) or higher will demonstrate mastery. **Scoring Guide:** Interactions of Systems Strips Worksheet has the scoring guide on the bottom of it.	**Instructional Strategy Category:** Nonlinguistic Representation	**R/R Quadrant** **21 Century** C Critical Thinking Communication Creativity

Unit 1: Sample Activities

Understanding	Standards	Major Learning Activities:	Instructional Strategy Category:	R/R Quadrant: 21C:
#1 Patterns **# 2 Cause and Effect** **# 6 Structure and Function**	ETS1.A ETS1.B 1- Analyze & Interpret data 2- Ask questions & define problem 3- Plan & Carry out investigation	**1.Lesson:** Pyramid Challenge **Objective:** Students will be able to develop and evaluate a design process. **Activity:** 1. At the beginning of the class, split the kids into teams. The teams are completely random. 2. Each team receives a stack of plastic cups and and explain that they have to make a pyramid with the tools included. Then they have to put a Lego Character on the top of their tower. All without touching the cups or the figure with their hands. Those are the ONLY rules given at the beginning! Tools the kids receive: ● 10 Red Plastic Cups ● 2 Straws per person in the team ● 1 – 2ft length of string per person in the team ● 1 cotton ball per person in the team ● 1 rubber band per kiddo ● 1 Lego Figure per team 3. The kids need to work together to come up with a way to move the cups. Some kids might lift the cups with the straws, others tie the string to the cups and then lift the string ends to lift the cups. Other teams may stretch the rubber bands to place them around the cups, then lifted the cups as a team. 4. After a team “wins” the challenge, ask them to show how they did it… and then remove a tool (that they relied upon) or add a handicap. This	Identifying Similarities and Differences Cooperative learning Non-linguistic representation	C Creativity, Collaboration, Communication Critical Thinking

		will require them to re-think the challenge and re-do it. (e.g. for the team that lifted the cups with the straws, take the straws away, for a team that had struggles communicating, make everyone silent except for the child who was the quietest, for a team who was super, super fast, have them put their left hands into their back pockets or behind their backs). Examples of the challenge **Check for understanding:** Students will be able to successfully build the assigned pyramid following the given criteria and constraints.		
#1 Patterns # 3 Scale Proportion and Quantity	**LS1.A** 3-Plan and carry out investigations 4-Analyze and interpret data.	**2. Lesson:** Living and Nonliving Microscope Mania Lab **Objective:** Students will be able to provide evidence that all living things are made up of cells. **Learning Activity:** Students will work in groups of 3-4 and complete the Microscope Mania stations Lab activity. The complete lesson plan can be found here: Microscope Mania Stations Lab This stations lab will help show the differences between living (biotic) and nonliving (abiotic). Students should be placed in groups of 3-4. The lab consists of two parts: 1. In the microscope portion, students are expected to observe 8 mystery objects under magnification, make sketches, make observations, and look for patterns and record data in an advance organizer. 2. Then, students will read the article within this Teacher guide and all student materials 3. Students will classify each observation as abiotic or biotic based on their understandings from the article. 4. As a class, the teacher will lead a summarizing discussion about the similarities and differences between the observations. Students will summarize their own thinking in a paragraph to be turned in describing how all living things have cells and all non-living things do not have cells.	Non-linguistic Representation Advance organizers Summarizing and Note Taking Identifying Similarities and differences	A Critical Thinking
#1 Patterns	**LS1.A**	**3. Lesson**: Photosynthesis, Cell Respiration, and Cell Membranes	Similarities and Differences	C

# 2 Cause and Effect	4- Analyze and Interpret data 1- Ask questions and define problems	**Objective:** Students will be able to explain the cause effect relationship between animals and plants. **Activity:** Using the Plant and Snail and Cell Structure Gizmo investigation, students will measure the oxygen and carbon dioxide levels in a test tube containing snails and elodea (a type of plant). Students will explore concepts of the interdependence of plants and animals modeled in a relationship between snails and plants. Students will measure and interpret data collected from interactive test tubes that holds snails and plants. Students will use this data to make connections between the amount of oxygen and carbon dioxide produced by the snails and the number of plants. Students should record their work on the Plants and Snails Student Exploration sheet to record their thinking. Teachers can use the Teacher Resource Plant and Snail and Cell Structure for directions on implementing the gizmo.	Non-linguistics Representation	Critical Thinking Communication
#1 Patterns **#2 Cause and Effect** **#4 Systems and System Models**	**LS1.A** 1-Ask questions and define problems **2- Develop and use models**	**4. Lesson:** System Models for Cellular Respiration **Objective:** Students will be able to create a system model to illustrate the interactions between photosynthesis and cellular respiration. **Activity:** 1. In Parts 1 and 2, students will use the Modeling Molecules Activit#y to create models of photosynthesis and cellular respiration using toothpicks, marshmallows, and markers, then explaining the process for each. 2. In Part 3, students will construct a system model to demonstrate that photosynthesis and cellular respiration are opposite processes.	Nonlinguistic Similarities and Differences	C Communication Creativity
# 1 Patterns **#4 Systems and System**	**LS1.A** **2- Develop and use**	**5.Lesson:** Cell parts foldable **Objective:** Students will be able to create a cell parts foldable by following given criteria and constraints.	Non-linguistic representation Similarities and Differences	B Critical Thinking

Models	**models**	**Activity:** 1. Explain to students they will be creating a organelle foldable. The purpose of the foldable is to organize what they learned so that it will be easier to remember and to reinforce the vocabulary. Creating the foldable is also a mini-engineering design challenge. Criteria and Constraints for their work: ● Folded paper. (5 points) ● 10 panels: You may cut the paper to create the different panels. (10 points) ● Each front panel should be labeled with one of the 10 cell organelles (cell membrane, cell wall, cytoplasm, nucleus,chloroplast, mitochondria, vacuoles, ribosomes, Golgi Complex, and Endoplasmic reticulum). (5 points) ● The front panels must be decorated with at least 1 hand-drawn color picture that represents each organelle. (1 point each) ● Include the following information inside each panel. (3 points each panel - total 30 points) 1. List the function of the organelle. 2. Provide a description of the cell part. 3. Write the organelle is located in the cell and in which type of cell it's found (plant, animal, or both). Constraints: ● No more than one piece of paper may be used. ● It has to be finished by the end of class today. ● Legibility, creativity and neatness count! **Check for understanding:** Students will score at least 42 out of the 60 points available on the foldable	Summarizing and note taking	Communicatio n
#1 Patterns	LS1.A	**6. Lesson:** Cell Analogy	Nonlinguistic	C

#6 Structure and Function	1- Ask questions and define problems 4- Analyze and Interpret Data	**Objective**: Students will be able to compare the structure and functions of various organelles located in a cell through writing analogies. **Pre- Activity: Video** -Introduction to Cells The video provides information needed for direction and discussions during the activity. Students will receive the handout and rubric for the Cell Analogy project. Cell Analogy handout/rubric. The students' goals are to choose a theme such as a zoo or our government. **Part 1--** Students need to write a 4 sentence paragraph for each of the 8 cell parts on their sheets. **Format**: 1. The first sentence should only be the analogy. 2. The second and third sentences should describe in detail using scientific terms. One sentence for the cell part, the other sentence for the compared item. 3. The fourth sentence should describe the comparison of the item to the cell part. (eg. The cell membrane is like the school walls. The cell membrane controls what shape the cell is and what is allowed to go in and out of the cell. The school walls control who or what comes into and out of the school. Therefore, the cell membrane and school walls are similar because both are in charge of entrance and exit of materials in and out of them). **Part 2--** Students need to include appropriate graphics for each of the 8 parts. One picture should include the cell part, the other a picture of the compared item. (eg. a picture of a cell membrane and a picture of school walls).	Similarities and Differences	Creativity, Communication Critical Thinking
#1 Patterns	ETS1.A LS1.A	**7. Lesson**: Reaction Time Lab	Cooperative Learning	D

#2 Cause and Effect **#6 Structure and Function**	1- Ask questions and define problems 3- Plan and carry out investigations 5- Using mathematics and computational thinking	**Objective:** Students will understand how fast the nervous system responds to stimuli by calculating the average distance (time) it takes to catch ruler being dropped. It also demonstrates the interactions with the nervous and muscular systems. **Activity:** In this activity, students will be working in pairs. First, distribute the Reaction Time Lab to students and read the introduction about neurons and have them define key words. This introduction can also be a pre-lab that needs to be completed before the actual lab. In this experiment, you will be measuring reaction time with your dominant hand, non-writing hand, a distraction and auditory stimuli by catching a meter stick when dropped from another student. Before actually performing each experiment, have students predict (write a hypothesis) which stimuli will be their fastest reaction time. When the partner drops the stick, it should be caught as quickly as possible. Record the number of centimeters the stick fell before it's caught. The measurement can be taken at the bottom, middle or top of your grasp, but be consistent. Take at least three measurements for each type of stimulus. Repeat the procedure for each partner. Because the distance an object falls is a function of time, you can measure the distance the meter stick drops and use mathematical formula (on the second page of the lab worksheet) to calculate the reaction time. Teacher will demo that the catching hand needs to be like a crab pincher, not in a cup that would make it easier to catch and go over other constants, such as forearm on table, and meterstick being dropped directly over the catching hand.	Generating and Testing Hypotheses	Critical Thinking
#6 Structure and Function	**LS1.A** 1- Plan and carry out investigation	**8. Lesson:** Frog Dissection Pre-Lab **Objective:** Students will be able to show they are ready for the frog dissection by mastering the pre-lab activities to show they understand internal and external frog anatomy.	Summarizing and Note-Taking Cues, Questions, and Advance	C Critical Thinking

	2- Obtaining, Evaluating & Communicate information	**Learning Activity:** Students will complete the activities on the frog dissection pre-lab. 1. Students will watch the virtual dissection sections “Introduction” and “External Anatomy” and complete questions #1-19. 2. Students will complete the “Internal Anatomy” portion by using the Frog Anatomy Notes to label the diagram.	Organizers	
# 1 Patterns **# 6 Structure and Function**	**LS1.A** 1- Plan and carry out investigations 3- Plan & Carry out investigation	**9. Lesson:** Frog Dissection **Objective:** Although many differences exist between humans and frogs, the basic body plans are similar. Humans and frogs both belong to the phylum Chordata. By studying the anatomy of the frog, you will better understand the human body systems. **Learning activity:** This activity students will be placed in groups of 3-4 for the dissection. Group Roles: Every other step will be hands on. Pick one person to start and then alternate. If you are the person dissecting, then the other members are assisting and others are recording data. Materials for dissection frog, dissection kit, safety goggles, plastic bag for storage and marking pens. After the dissection is completed, share your observations so that both people have a completed frog identification diagram. Conclusion questions will be individual work. Students need a Frog Dissection worksheet and each group will receive one frog for dissection.	Non-linguistic representations Modeling Identifying Similarities and Differences	C Communication, Critical Thinking
#2 Cause and Effect **#6 Structure and Function**	**LS1.A** 1- Ask questions and define problems 2-Plan and carry out investigations	**10. Lesson:** Chicken Wing Dissection **Objective**: Students will be able to describe how the muscles, bones, and tendons work together to move a joint of a chicken wing and how do they compare to a human arm? **Learning activity**: This activity demonstrates how the skeletal, muscular, cardiovascular, nervous and integumentary systems work together in a chicken wing. Students should be placed in small groups (2-3) for the dissection and given a metal tray, dissecting scissors, forceps, probe and disposable gloves. The teacher should remind students that they are handling	Non-linguistic representations Modeling Identifying Similarities and Differences	C Communication, Critical Thinking

		raw food that carries harmful bacteria and should be careful with it. Students need a Chicken Wing Dissection Worksheet and each group will receive one chicken wing for observation and dissection.		
#1 Systems and System Models	**LS1.A** 4- Analyze and interpret data **2- Develop and use models**	**11. Lesson**: Cells to Tissues to Organs Cells to Tissues to Organs **Objective**: Students will be able to relate single cells to tissues to organs to organ systems to an organism by creating an analogy using a model train or rope. **Learning Activity:** *Prior to this lesson, students should have already learned about cells and their components.* To begin this lesson, distribute Page Keeley's "Human Body" probe (Keeley, Page. "Human Body." Uncovering Student Ideas in Life Science. Arlington, VA: NSTA, 2011. 141-44). In this probe, students are to identify the cellular makeup of the human body. Do students recognize that the human body is an organized collection of cells? After students have finished their answers have students place them in the center of their table, so they can revisit them at the end of the lesson. 1. Use this powerpoint Cells to Tissues to Organism to present the activity. Have students record information into their notebooks. Also, during the presentation, students use the wooden tracks or rope to layout an "organ system". 2. Slide 7: Each student gets a cell (piece of track or rope). 3. Slide 11: In table groups, students join their individual pieces of track or rope to form a "tissue". Discuss how this "tissue" can carry out the function of having a train or rope go back and forth (but not all the way around). 4. Slide 16: Two or more table groups join their "tissues" to form an "organ" capable of performing the function of going all the way around. 5. Slide 19: Two or more "organs" are connected to each other in an "organ system". 6. Using the From Cells to Organisms Sheet have students create their own	Non-linguistic representation Summarizing and Notetaking	C Creativity, Collaboration Communication, Critical Thinking

		sheet to show their understanding of their conceptual model.		
#4 Systems and System Models	**LS1.A** 1 -Ask questions and define problems 2- Obtaining, Evaluating and Communicating Information	**12. Lesson:** Human Body Flip Book **Objective:** Students will discover how much they already know about the sizes and placement of different organs and their systems. They will also discover how much they didn't know about them too. **Learning Activity:** This is a 2 day activity. Day 1: Body of Knowledge Flip Book Instructions Students will be working in groups of 3 and each student will be responsible for three different organs. One student will lay down on the paper with their head turned to their right side. Draw an outline of the person from the waist up with a permanent marker. Students should also label the right and left side of the outline. Each student will draw three organs with the correct colors on the body. The goal is to draw the organs relative size and location. They should draw them based on prior knowledge only, no books, computers, posters to help them. Students can only use the knowledge of students in their group. Warning: Students will be nervous about doing this and will ask you tons of questions. Remind them about the importance of prior knowledge and assure them that it's okay to make mistakes. Day 2: After organs are sketched in, obtain life size patterns of organs and place them correctly on the outline over your drawings. NOTE: Students will need 3 sheets of small intestine and 2 sheets of large intestine. They will have to cut them out and tape together to make it the proper lengths. Tape the top of each organ onto the paper (so it can flip up and you can see your prior knowledge drawings. However, the intestines will not flip do to the length of them. They will need to rolled and taped several times.) Students	Cooperative Learning Nonlinguistic Representation	B Collaboration Communication Critical Thinking

		can use any resource to help them with the placement of the organs. Warning: I have an example to demonstrate how to place organs on; students want to just memorize my example instead of looking it back up. I cover it up after I am done explaining. Next, each student should write 2 interesting facts (something that they did not know about the organ). If they already know it...then it is probably not that interesting. **Teacher will access:** The Body of Knowledge Scoring Guide will be used to assess students' individual work on the project.		

Unit 1: Resources

UNIT RESOURCES
Teacher Resources: ● Life Science, Holt, Rinehart and Winston © 2007 ● Discovery Education http://app.discoveryeducation.com/ - The Characteristics of Living Things, Cell Structure, Life in a Drop of Water, and many others applicable videos ● You Tube: Introduction to the Characteristics of Life https://www.youtube.com/watch?v=juxLuo-sH6MYou Tube: Cells - Parts of the Cell Rap https://www.youtube.com/watch?v=-zafJKbMPA8 ● You Tube: Cell Rap (compares plant and animal cells) https://www.youtube.com/watch?v=Yu21ShnKhHk ● Brain Pop – https://www.brainpop.com Cell Structures and Cell Specialization ● Bill Nye "Cells" DVD ● Websites: Cell Structures ● Explore Learning (Gizmo) Digestion ● Discovery Education ● Textbook Appendix Documents
Student Resources: ● Life Science, Holt, Rinehart and Winston © 2007, ● Online textbook http://my.hrw.com/

- http://www.cellsalive.com – Interactive site for students

Vocabulary:

Unicellular:single celled organisms

Multicellular: organisms that consist of specialized cells that depend on each other for the organism to survive.

Nucleus:in a 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

Chloroplasts:an organelle found in plant and algae cells where photosynthesis occurs

Cell Wall: a rigid structure that surrounds the cell membrane and provides support to the cell

Mitochondria:in eukaryotic cells, the cell organelle that is surrounded by two membranes and that is the site of cellular respiration, which produces ATP

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

Vacuoles: a fluid-filled vesicle found in the cytoplasm of plant cells or protozoans

Golgi Complex:a cell organelle that helps make and package materials to be transported out of the cell

Circulatory: the heart and vessels that move blood through the body

Integumentary: the body system that includes the skin and the structures produced by the skin, such as hair and nails, and that forms a protective body covering

Excretory:removes excess, unnecessary materials from the body fluids of an organism, so as to help maintain internal chemical homeostasis and prevent damage to the body

Digestive: the organs that break down food so that it can be used by the body

Respiratory: a collection of organs whose primary function is to take in oxygen and expel carbon dioxide; the organs of this system include the lungs, the throat, and the passageways that lead to the lungs

Skeletal :the bones, cartilage, ligaments, and tendons whose primary function is to support and protect the body and to allow the body to move

Muscular: a collection of muscles whose primary function is movement and flexibility

Nervous system: the structures that control the actions and reactions of the body in response to stimuli from the environment; it is formed by billions of specialized nerve cells, called neurons

Unit 2: Growth, Development, and Reproduction of Organisms

Content Area: Science	**Course:** 7th Grade Life Science	**UNIT:** Growth, Development, and Reproduction of Organisms

Unit Description:	**Unit Timeline:**
Middle school students will understand how to plan and execute investigations to show the cause and effect relationship between animal behavior and probability of survival and reproduction. Students will use evidence to explain how genetic and environmental factors can influence an organism's growth. Students will demonstrate their knowledge of natural selection by explaining why advantageous traits over time while undesirable traits will decrease. Students will organize data and patterns to show how fossils can identify geological time. How do organisms grow, develop, and reproduce? How does the environment influence genetic traits in populations over multiple generations?	9 weeks

DESIRED Results

<u>Transfer Goal</u> - ***Students will be able to independently use their learning to……***

1. Ask questions and define problems.
2. Develop and use models.
3. Plan and carry out investigations.
4. Analyze and interpret data.
5. Use mathematical and computational thinking.
6. Construct explanations and design solutions.
7. Engage in arguments from evidence.
8. Obtain, evaluate, and communicate information.

<u>Understandings (Cross Cutting Concepts)</u> – *Students will understand… (Big Ideas)*

1. Patterns
2. Cause and Effect
3. Scale, Proportion, & Quantity
4. Systems & System Models
5. Energy and Matter
6. Structure and Function

7. Stability and Change

Essential Questions: ***Students will keep considering…***
How do special structures and functions affect growth and development in different environments?

Phenomena for Unit : Bird of Paradise Mating Dance
(For teacher only) The bizarre dances of birds-of-paradise aren't mere flights of fancy. Young males inherit those dance steps from their fathers, then refine them through practice and watching adults. Less obvious but equally important are the watchful females. It's ultimately their choices that decide which dances reach the next generation.

Standards Addressed

Students who demonstrate understanding can:

6-8 LS1-5 Construct an explanation for how characteristic animal behaviors as well as specialized plant structures affect the probability of successful reproduction of animals and plants respectively. [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.] Linked to NGSS: MS-LS1-4

MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.[Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.]

6-8-LS4-1: Analyze and interpret evidence from the fossil record to infer patterns of environmental change resulting in extinction and changes to life forms throughout the history of the Earth. [Clarification Statement: Examples of emphasis include sets of fossils that indicate an environment, anatomical structures that indicate the function of an organism in the environment, and fossilized tracks that indicate behavior of organisms.] Linked to NGSS: MS-LS4-1

6-8-LS4-2: Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.] Linked to NGSS: MS-LS4-4

MS-LS4-5 Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. [Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, and farming practices).]

6-8-LS4-4: Interpret graphical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. Linked to: MS-LS4-6

Disciplinary Core Ideas Students will know...	Science and Engineering Practice Students will be able to...	Cross Cutting Concepts Students will understand...
LS1.B Animals engage in characteristic behaviors that increase the odds of reproduction.	Use arguments based on evidence of behaviors affecting probability of animal reproduction (For example, nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding.)	Cause and effect to show that likelihood of evidence of behaviors affecting reproduction can be accurately reflected only in terms of probability.
LS1.B Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. **predator:**an animal that lives by killing and eating other animals : an animal that preys on other animals **prey**:an animal taken by a predator as food **structure:** the arrangement of particles or parts in a substance or body **function:**the action for which a thing is specially fitted or used or for which a thing exists **pollination:**the transfer of pollen from an anther to the stigma in flowers **adaptation:**modification of an organism or its parts that makes it more fit for existence under the conditions of its environment **asexual reproduction:** reproduction (as cell division, spore formation, fission, or budding) without union of individuals or gametes **sexual reproduction:**reproduction involving the union of sex cells from 2 parents; offspring will half half of each parent's genes	Construct explanations of animals behaviors that affect the probability of plant reproduction (For example, transferring pollen to seeds, and creating conditions for seed germination and growth.)	Cause and effect to demonstrate some plants are dependant on animals for reproduction and survival.

LS1.B Genetics factors as well as local conditions affect the growth of the adult plant.	Explain the cause and effect relationships between plant reproduction and the animal behaviors related to plant reproduction (ie. bees carrying pollen). Create an argument that because successful reproduction has several causes and contributing factors, the cause and effect relationships between any of these characteristics, separately or together, and reproductive likelihood can be accurately reflected only in terms of probability. To be included: animal behavior and specialized structures, plant structures, by using evidence from data and scientific literature. Dissect a flower and develop an explanation/model to explain the process of reproduction in flowers.	Cause and effect to show that reproduction depends upon specialized structures and functions. Cause and effect to show that likelihood of reproduction can be accurately reflected only in terms of probability. Structure and function to recognize that the way an object is shaped or structured determines many of its properties and functions (pertaining to reproduction). Cause and effect to show the relationship between plant reproduction and animal behavior. Structure and function of flower organs to be identified during dissection.
LS1.B Genetic factors as well as local conditions affect the growth of the adult plant.	**Explain the idea that both environmental and genetic factors influence the growth of organisms.** **Construct a scientific explanation based on valid and reliable evidence obtained from sources (can include students' own experiments) that environmental factors can influence growth. (ie. availability of light, space, water,size of habitat).** **Identify and explain evidence that shows genetic factors and how they can influence growth. (ie.specific breeds of plants and animals and their**	**Cause and Effect to show that growth rates may have more than one cause.** **Cause and effect to show that environmental and genetic factors, working together, can influence organism growth.** **Discuss the patterns in genetic breeds of plants and types of animals.**

	typical sizes), multiple environmental factors (such as drought, food availability), and genetic factors (such as specific breed).. **Reason that because both environmental and genetic factors can influence organisms simultaneously, organism growth is the result of environmental and genetic factors working together (eg. water availability influences how tall dwarf fruit trees will grow,) including using only probability (eg. not every fish in the same pond grows to the same size).**	**Cause and effect to that environmental and genetic factor can influence organisms growth.**
LS4.A:The collection of fossils and their placement in chronological order is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms through the history of the Earth. **fossil record:** a historical sequence of life indicated by fossils found in layers of Earth's crust	Organize given data (e.g. using tables, graphs, charts, images) in a way that allows for using fossil records as a function of time, as well as to identify, analyze, and interpret the similarities and differences in the data. Identify patterns between given sets of sedimentary layers and the relative age of those layers, as well as identification of the time period during which a given fossil is present in the fossil record. Identify and explain patterns of change in the level of complexity of anatomical structures in organisms on the fossil record, as a function of time. Analyze and interpret data to identify similarities and differences in the observed patterns of fossil records to provide evidence for mass extinctions, emergence/extinction of organisms, evolution of organisms, and the increase in the diversity and complexity of Earth's organisms.	Graphs, charts and images to identify patterns in data. Patterns to identify cause and effect relationships. Probability to describe some cause and effect relationships in systems. Patterns to identify changes in fossil and records over time. Structure and function of fossils to show evidence of change over time in organisms.
LS4.B:Natural selection leads to the predominance of certain traits in a population,	Explain the cause-effect relationship between the inheritance of traits increasing the chances of	Patterns of inheritance in populations that increase chances of

and suppression of others. Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. **adaptation**: the process of becoming adapted to an environment; an anatomical, physiological, or behavioral change that improves a population's ability to survive **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 **artificial selection**:The breeding of plants and animals to produce desirable traits. Organisms with the desired traits, such as size or taste, are **artificially:** mated or cross-pollinated with organisms with similar desired traits.	successful reproduction and natural selection. Explain, based on evidence, that individuals in a species have genetic variations that can be passed onto offspring, based on probability (e.g. particular genetic variations). Explain the cause-effect relationship between specific traits and the probability of survival and reproduction of a given organism in a specific environment. Analyze evidence and create a supported explanation describing the relationship between genetic variations and the success of organisms in a specific environment (e.g. populations in a given environment contain a variety of available inheritable genetic traits, some traits have advantages that increase the probability that an organism will be able to survive and reproduce there). Use evidence to explain why and how advantageous traits will increase from generation to generation due to natural selection and disadvantageous traits will decrease from generation to generation.	being successful. Patterns of variation in traits will be passed from parents to offsprings. Structure and function of organisms that ensure specific traits will be passed on and the survival of the organism. Patterns in data that show the advantage organisms have and their ability to reproduce and survive. Patterns that are advantageous for traits will be passed on to each new generation.
LS4.B:In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring. **artificial selection:**the selective breeding of organisms (by humans) for specific desirable characteristics	Investigate and explain at least two technologies that have changed the way humans influence the inheritance of desired traits in plants and animals through artificial selection by choosing desired parental traits determined by genes, which are then often passed on to offspring. (e.g.gene therapy, genetic modification, and selective breeding of plants and animals).	Cause-effect relationships in how traits occur in organisms has led to advances in technology that provide a higher probability of being able to influence the inheritance of desired traits in organisms.

	Use information to identify and describe how a better understanding of cause-effect relationships in how traits occur in organisms has led to advances in technology that provide a higher probability of being able to influence the inheritance of desired traits in organisms.	
LS4.C: Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.	Identify explanations for: a) characteristics of a species change over time(generations) through adaptation by natural selection in response to changes in environmental conditions, b) traits that better support survival and reproduction in a new environment become more common within a population in that environment, c) traits that do not support survival and reproduction become less common, and d) when environmental shifts are too extreme, populations cannot adapt and may become extinct. Use mathematical/computational representations (e.g.trends, averages, histograms, graphs, spreadsheets) to identify components and relationships in population changes, distribution of specific traits, how environmental conditions affect natural selection, and that increases/decreases of some traits can have more than one environmental cause. Analyze mathematical/computational representations to provide and describe evidence that distribution of traits in populations change over time in response to changes in environmental conditions. Use mathematical/computational representations as evidence to support the cause-effect explanations that: through natural selection, traits that better support survival and reproduction are more common in a	Cause and effect to show how environmental factors can influence natural selection. Observed patterns to show how adaption occur over time to response to changes in environments. Observe patterns that show relationships in population changes and how conditions in the environment prompt questions about relationships and the factors that influence them.

	population than less-effective traits, populations are not always able to adapt because adaptation by natural selection occurs over generations, and that it is not possible to predict with 100% accuracy what will happen.	

Unit 2: Artificially Selecting Dogs Performance Assessment

EVIDENCE of LEARNING			
Understanding	**Standards**	**Unit Performance Assessment**	**R/R Quadrant 21 Century**
#2 Cause and Effect	**MS-LS1-5** **6-8 LS 1-5** **LS4.B** **LS1.B** **1-Ask questions and define problems** **3-Plan and carry out investigations**	**Description of Performance Task:** Artificially Selecting Dogs Artificially Selecting Dogs Performance Event Different Dog Breeds Artificially Selecting Dogs Scoring Guide with Answers, Students will develop new dog https://drive.google.com/open?id=0Bz82sn0ywng8bjlGTDZucFhJUVUbreeds with characteristics that make the dogs capable of performing a desirable task. The students are expected to examine canine features and their functions and select two existing breeds they feel will most likely produce a successful new breed and determine the resulting offsprings. Students will construct scientific explanations, based on valid evidence, on how artificial selection can influence the probability of specific genetic traits. **Teacher will assess:** ● Students will gather information about technologies that have changed the way humans influence the inheritance of desired traits in animals through artificial selection. ● Students will use their knowledge of artificial selection and additional sources to describe how the information they gather is or is not supported by evidence. **Performance:** **Mastery:** Students will show mastery of disciplinary core idea with 80% (16/20) **Scoring Guide:** included in the Artificially Selecting Dogs Performance Event	C Critical Thinking Communication Creativity

Unit 2: Sample Activities

SAMPLE LEARNING PLAN				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy Category:**	**R/R Quadrant: 21C:**
# 1 Patterns **# 2 Cause and Effect**	**LS1.B** **1- Ask questions and define problems** 4- Analyze and Interpret data	**1. Lesson**: Woodlands Dwellers (2 day lesson) **Objective**: Students will be able to recognize cause-effect patterns among fluctuations in wildlife populations. **Activity:** *This lesson has been adapted from a Project Wild lesson, entitled, "Oh Deer!" Engage: 1. Begin the lesson by having students turn to a partner and each take turns listing two of the four basic needs provided by a suitable habitat. After providing 1-2 minutes to review, I play the cartoon clip. 2. After watching the video, ask the students to think about how the coyote and/or the roadrunner are trying to meet their four basic needs. Provide a minute or two of think-time and then call on random students to explain their thinking. As the students provide their responses, I call randomly on others to add to what the student before them has said. (This holds all students accountable for engaging in the discussion and for actively listening to their peers.) I ask the students to think about the many ways this cartoon could have ended differently. 3. Move the kids outside to a field or parking lot. While it can be done indoors, it is not only more fun to complete outside, but it also provides more authenticity. The goal for the next activity is to replicate the natural environment, and it is difficult to do so from	Non-linguistic representation Summarizing and note taking Cooperative learning	C Critical Thinking Creativity

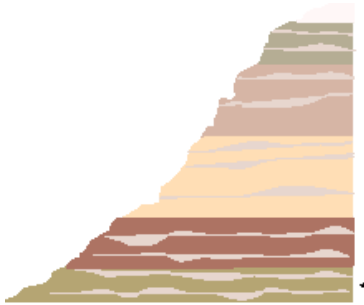
		inside the classroom! 4. Follow the procedure on the Teacher Sheets. and also needed, Game Cards: Shelter Water Food 5. Hand out the Student Sheet **Check for understanding:** Students will score a 75% or higher on the Day 2 assessment questions from the Student Sheet.		
# 2 Cause and Effect #6 Structure and Function #7 Stability and Change	**LS4.B** **LS1.B** **3- Plan and carry out investigation** **1- Ask questions and define problem**	**2.Lesson**: Create a Monster Plant Activity **Objective**: Students will understand that genetic factors can affect the growth and/or appearance of a plant. **Activity:** Engage: Watch the Spongebob PPT and discuss with students. Explore: 1. Ask the class, *"Does SpongeBob looks exactly like one of his parents? Do you look exactly like your Mom or Dad? Why?*". Explain that the inheritance of traits is almost like flipping a coin and introduce the term probability as the likeness of some event occurring. Bring out a coin, and ask, *"What is the probability of flipping and the coin landing heads up? What if I do it twice, does that increase my chances?"* Finally, ask, *"What does flipping a coin and talking about probability have to do with the inheritance of traits?* Think for a minute and then tell your neighbor what you think (Turn and Talk). After the turn and talk, ask for a couple of volunteer pairs to share their conversation with the class. 2. Tell the class that today they will become parents to some monster plants. Their job is to determine the genotype and phenotype of their offspring. I distribute the Monster Factory sheet and one coin for each set of "parents". If you have an uneven number of students, you can have the odd student do the activity on his/her own, but I'd suggest that he/she join a partnership and use their own flips and the "partner data".	Modeling Identifying Similarities and Differences Cooperative Learning	C Creativity Critical Thinking

		3. Once students have created the genotypes for their offspring, they move on to drawing pictures of them (phenotypes). Tell the students to make sure that their drawings are based on the data they obtained because they might be called upon to defend their explanations. **Check for understanding:** To close this lesson, ask the students to look at the different offspring created by their tablemates, and respond to the following statement, "All of the offspring created at your table are different in the ways they have grown and developed, even though they all come from heterozygous parents. Evaluate why all the offspring are different." In their answers, look for the idea that "an offspring randomly inherits half of his genetic traits from each parent. As a result, each of their offspring inherited a different combination of genetic traits. These different genetic factors influence the growth and appearance of the plant."		
# 1 Patterns **# 2 Cause and Effect** #6 Structure and Function	**LS1.B** 4- Analyze & Interpret data **1-Ask questions & define problems**	**3.Lesson:** Effect of Environment on Plant Growth **Objective:** Students will read about an experiment using rice plants. The scientists altered the environment in which each group of plants grew. Raw data is provided. The students are expected to read the scenario, then answer the cause and effect investigative questions. Students will construct scientific explanations, based on valid evidence, on how genetic and environmental factors can influence the growth of rice plants. **Activity:** *Effect of Environment on Plant Growth* article, questions, and scoring guide. **Teacher will assess:** 1. Students will use evidence and reasoning to construct a scientific explanation for environmental factors that can influence plant growth. 2. Students will identify and describe evidence necessary for constructing the explanation, including: environmental factors. 3. Students will reason that an organism's growth is influenced by multiple environmental factors.	Summarizing and note taking Effort and Providing Feedback	B Creativity Collaboration

		Check for Understanding: **Mastery:** Students will score a 75% to demonstrate mastery.		
# 2 Cause and effect # 6 Structure and Function	**LS1.B** **LS4.B** 3- Plan & Carry out investigation 4 Analyze & Interpret data	**4.Lesson**: Effect of Temperature on Gender Gizmo **Objective**: Students will: 1. Understand the importance of conducting multiple trials in a scientific investigation. 2. Determine whether temperature affects the gender of developing bird or gecko embryos. 3. Analyze and draw conclusions from the collected data. **Activity:** Observe the gender of birds and geckos as they hatch in an incubator. Vary the temperature of the incubator and measure the percentages of male and female hatchlings to determine if temperature has an effect on gender. https://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=621 Effect of Temperature on Gender Gizmo Student Sheet Teacher Guide Gizmo Answer Key	Summarizing and note taking Identifying Similarities and Differences	C Critical Thinking Communication
# 3 Scale, Proportion and Quantity #6 Structure and Function #7 Stability and Change	6-8 LS4-1 LS4.A 4- Analyze & Interpret data 1- Ask questions & define problem	**5.Lesson:** Say What? A Whale is a Mammal (60 -70 minutes) **Objective:** Students will be able to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. **Activity:** To engage students in this lesson, show the TEDEd video *How to fossilize...yourself*. This video covers the formation of fossils, which will be a major topic of this lesson. Fossils are one source of evidence used by scientists to support the theory of evolution. Students will need to be accountable to answer the following questions as they watch the video clip. Now students explore whale evolution by completing an interactive activity	Non-linguistic representations Summarizing and note taking Provide Feedback Cooperative Advance Organizer	C Critical Thinking Communication Creativity

		by WGBH: Evolution (Unit Three) What is Evidence for Evolution? Part 2: Directions: Pass out copies of Whales in the Making and Whale Evolution Data Table Worksheet handouts. 1. Students are required to work in teams of two and directed to cut out the six fossil boxes from the handout and research information about each fossil using the internet. 2. Each team of two are required to prepare an Eocene epoch timeline on paper (scale, 1 in=1 million years). The timeline should be twenty-one inches long. The top of the millions years should be labeled with 34 Millions years ago and 55 Millions years ago at the bottom. The timeline the students are making represents the indicated section below. 3. Have teams place fossil boxes 1 and 2 from the handout at the proper locations on their timelines. Point out the large gap between these two fossils. Then have students add the remaining fossils in order by the age of the fossil (from youngest to oldest). <u>Discussion Questions:</u> 1. What typical whale-like traits were apparently the earliest to appear? What apparently evolved much later? 2. As each "missing link" was found, how many new gaps were formed? What is the relationship between gaps and fossils? 3. To find fossil evidence to fill the largest remaining gap in whale evolution, what age sediments would you search? 4. What distinguishing traits would you expect to find in whale fossils of that age? Part 3: In this section of lesson, show students the Evolution of Whales animation. This animation does a great job showing the evolutionary changes that occurred in whales common ancestor. As the animation states, "From land to water, whales evolved rapidly in response to a changing environment." As students watch, they are required to take notes specifically on the		

		following key points: 1. Describe the physical appearance of PAKICETUS. 2. How did the environment change from time of PAKICETUS to that of AMBULOCETUS? 3. What were some of the changes that evolved in AMBULOCETUS? 4. What is the relationship between the environment and the physical characteristics (adaptations) of the various animals that appeared? Part 4: In this section of lesson, show students a video that elaborates on how fossil evidence has been used to explain the evolution of the whale. The video *Evolving Ideas: How do we Know Evolution Happens?* discusses two types of evidence, fossil and molecular, that are used to support the theory of evolution, specifically that of the whale. As students watch the video, they listen for answers for the following guiding questions: ● What can we learn from fossil evidence? ● What specific fossil evidence points to the whale's evolution from land to water? Prior to watching the evolution video, students read a text on Whale Evolution that previews and provides background knowledge on the content covered by the video. Part 5: Exit Slip To close our lesson, students complete an Exit Slip where they are required to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.		

				
# 2 Cause and effect # 6 Structure and Function	6-8 LS4-1 LS4.C **1-Ask questions & define problem**	**6.Lesson**: Fins, Feathers, and Fur: How Animals Adapt (85 minutes) **Objective**: Students will be able to describe how various adaptations allow animals to thrive successfully in their environment. **Activity:** Engage: 1. Start the lesson by passing out the Animal Adaptation Advance Organizer and explain how to use it. Animal Adaptation Advance Organizer Have students complete the "Before Watching" section on their own. This will give them a good idea of what they will be studying, as well as set them up to be actively engaged throughout the movie. 2. Play the video (below) on a repeating loop WITHOUT ANY SOUND to further prepare students for the topic. Animal Survival and Adaptation Video Clip Explore: Watch the two short videos as a class, pausing in one minute increments for students to write their responses and justifications. Video clips:. Animal Adaptations Adaptations	Advance Organizers Summarizing Identifying Similarities and Differences	B Communication

		Explain: After watching both videos (and replaying any portions that need extra clarification), the students complete the "After Watching" portion of their organizer and answer the questions at the bottom of the page.		
# 2 Cause and effect # 6 Structure and Function	6-8 LS4-4 6-8 LS4-2 LS4.C LS4.B 1-Plan & carryout investigation **3- Plan & carry out investigation** 4- Analyze & Interpret data	**7.Lesson**: Natural Selection (Moth Gizmo) (50 minutes) **Objective**: In the Natural Selection Gizmo™, you play the role of a bird hunting for moths resting on tree trunks. The moths are found in light (speckled) and dark varieties, and tree trunks can be either light or dark in color. Students can track the populations of light and dark moths over a five-year period. Natural Selection Teacher Version Natural Selection Student Version **Activity:** 1) Assign students to computers. Students can work individually or in small groups. Ask students to work through the activities in the Student Exploration using the Gizmo. 2) Understand the importance of conducting multiple trials in a scientific investigation. 3) Predict the color of moth that will survive better on various colors of tree trunks. 4) Understand how camouflage can promote survival. Explain the process of natural selection. **Check for understanding:** Students will demonstrate mastery by scoring a 75% or higher on the Gizmo activity questions.	Advance Organizer Summarizing and note taking Non-linguistic representation	B Communication Critical Thinking
# 2 Cause and effect #6 Structure and Function #7 Stability and Change	6-8 LS4-1 LS4.C 4- Analyze & Interpret data **1- Ask questions & define problem**	**8.Lesson:** Opposable Thumb Adaptation Lab **Objective:** Students will be able to to determine the importance of the opposable thumb to humans. **Activity:** In this activity, students will first brainstorm and observe how humans use their hands. They will then conduct a short experiment to determine the importance of the opposable thumb to humans. This experiment involves	Non-linguistic representation Identifying Similarities and Differences	*B* *Communication* *Creativity*

	3- Plan & carry out investigations	students taping their thumb to render it useless while they proceed to do some everyday activities. In the end, students will have the opportunity to reflect on why the opposable thumb is an adaptation important to humans. Finger Adaptation Activity		
# 1 Patterns # 2 Cause and effect	6-8 LS1-5 LS1.B 4- Analyze & Interpret data 8- Obtaining, Evaluating & Communicating information	**9.Lesson**: Mammal Reproduction (45 minutes) **Objective**: Students will understand specialized features mammals have that increase the odds of reproduction. **Activity:** 1. Students will read the short paragraph titled "Urban Coyote", then watch the following video clip: Urban Coyotes Mate for Life 2. Students will use the resources listed at the bottom of the article to answer the listed questions. **Check for understanding:** Students will demonstrate mastery by scoring a 75% or higher on the questions.	Summarizing and note taking Non-linguistic representation	B Communication Creativity
#1 Patterns #2 Cause and Effect #6 Structure and Function	**LS1.B** **3- Plan & carry out investigation** 4- Analyze & Interpret Data	**10.Lesson**: Flower Dissection lab and evaluation (90-100 minutes) **Objective**: In this lab students are expected to: 1. Dissect a flower and sketch it, labeling all the parts. 2. Observe pollen grains and make a labeled drawing. 3. Observe a pistil, which has been dissected, and make a labeled drawing of the ovary. In the evaluation: 1. Students are required to make up empirical data that can be used as evidence to support their claim. 2. Students are required to complete their claim using scientific reasoning to support their explanation. **Activity:**	Cooperative learning Non-linguistic representation Summarizing and note taking Identifying Similarities and Differences	C Creativity, Collaboration, Communication Critical Thinking

		Engage: To engage students in lesson, show students the following visually stunning video https://youtu.be/xW_AsV7k42o After the video students will engage in group discussion around the following questions: 1. What is the purpose (i.e. function) of flowers? 2. What were some of the similarities that you observed between flowers? (example: similar structures) 3. How is the structure of the flower well suited for its function? The purpose of these questions is to guide students toward the lesson objective, which is for students to be able to explain how the structure of the flower increases the probability of its function, which is to increase the probability of successful plant reproduction. Explore:Flower Dissection Lab In this section of the lesson, students explore the structure of a flower by completing a Flower Dissection Lab. Evaluate: In this section of the lesson, have students design a flower whose structure will allow it to have optimal probability of having reproductive success. 1. Have students work in groups to design models of flowers that are pollinated various ways. 2. Once students have designed their flowers students are required to make a claim that states why their flowers design is well suited for pollination. 3. Students are required to make up empirical data that can be used as evidence to support their claim (i.e. % success rate, time needed for pollination, germination time). To complete their claim students use scientific reasoning to support their explanation. (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.) 4. Students use a Claims-Evidence-Reasoning (CER) format for their argument. Template for CER		

		5. Students will score 22/30 on scoring rubric to demonstrate mastery.. Design a Flower Scoring Guide		

UNIT RESOURCES
Teacher Resources: ● Flower Dissection ● Fins, Feathers, and Fur ● Monster Plant ● Deer Game ● Say What? A Whale is a Mammal ● Explore Learning Gizmos www.explorelearning.com ● Explore Learning Gizmo Natural Selection (Moth) ● Actively Learn www.activelylearn.com ● http://www.ck12.org/life-science/Mammal-Reproduction-in-Life-Science/rwa/Urban-Coyote/?referrer=concept_details ● BrainPop www.brainpop.com ● Discovery Education ● PBS Evolution WGBH interactive activity
Student Resources: ● Explore Learning Gizmos www.explorelearning.com ● Actively Learn articles www.activelylearn.com ● Discovery Education ● BrainPop
Vocabulary: ● **adaptation**: modification of an organism or its parts that makes it more fit for existence under the conditions of its environment ● **artificial selection:**the selective breeding of organisms (by humans) for specific desirable characteristics ● **asexual reproduction**: reproduction (as cell division, spore formation, fission, or budding) without union of individuals or gametes **fossil record:** a historical sequence of life indicated by fossils found in layers of Earth's crust ● **function**: the action for which a thing is specially fitted or used or for which a thing exists ● **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 ● **artificial selection**:The breeding of plants and animals to produce desirable traits. Organisms with the desired traits, such as size or taste, are **artificially** mated or cross-pollinated with organisms with similar desired traits. ● **pollination**: the transfer of pollen from an anther to the stigma in flowers ● **predator**: an animal that lives by killing and eating other animals **:** an animal that preys on other animals

- **prey**:an animal taken by a predator as food
- **sexual reproduction**: reproduction involving the union of sex cells from 2 parents; offspring will half half of each parent's genes
- **structure**: the arrangement of particles or parts in a substance or body

Unit 3: Matter and Energy in Organisms in Ecosystems

Content Area: Science	**Course:** 7th Grade Life Science	**UNIT:** Matter and Energy in Organisms in Ecosystems

Unit Description: MIddle School students will use conceptual and physical models to explain the transfer of energy and cycling of matter as they construct explanations for the role of photosynthesis in cycling matter ecosystems. Students will construct explanations for the cycling of matter in organisms and the interactions of organisms to obtain the matter and energy from the ecosystem to survive and grow. Students will understand that sustaining life requires substantial energy and matter inputs and the structure and functions of organisms contribute to the capture, transformation, transport, release, and elimination of matter and energy.	**Unit Timeline:** 9 weeks

DESIRED Results

Transfer Goal - ***Students will be able to independently use their learning to……***

1. Ask questions and define problems.
2. Develop and use models.
3. Plan and carry out investigations.
4. Analyze and interpret data.
5. Use mathematical and computational thinking.
6. Construct explanations and design solutions.
7. Engage in arguments from evidence.
8. Obtain, evaluate, and communicate information.

Understandings (Cross Cutting Concepts) – *Students will understand… (Big Ideas)*

1. Patterns
2. Cause and Effect
3. Scale, Proportion, & Quantity
4. Systems & System Models
5. Energy and Matter
6. Structure and Function
7. Stability and Change

Essential Questions: ***Students will keep considering…***

- How do organisms obtain and use the matter and energy they need to live and grow?
- How do matter and energy move through an ecosystem?
- What is biodiversity, how do humans affect it, and how does it affect humans?
- How do food and fuel provide energy?
- If energy is conserved, why do people say it is produced or used?
- What is a design for?
- What are the criteria and constraints of a successful solution?
- What is the process for developing potential design solutions?

Phenomena for Unit: https://www.opened.com/video/people-and-plants/184207 (People and Plants)
Learn more about photosynthesis and cellular respiration through a classic story: Jack and the Beanstalk.

Standards Addressed
Students who demonstrate understanding can: **6-8-LS1-7: Construct a scientific explanation based on evidence for the role of photosynthesis and cellular respiration in the cycling of matter and flow of energy into and out of organisms. Linked to NGSS: MS-LS1-6.** MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, including food chains and food webs.] 6-8-LS2-5: Evaluate benefits and limitations of differing design solutions for maintaining an ecosystem. [Clarification Statement: Examples of design solutions could include water, land, and species protection, and the prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.] Linked to NGSS: MS-LS2-5. MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. [Clarification Statement: Emphasis is

on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] [Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.]		
Disciplinary Core Ideas **Students will know...**	**Science and Engineering Practice** **Students will be able to...**	**Cross Cutting Concepts** **Students will understand...**
LS1.C Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. **glucose:** a simple sugar that is an important energy source in living organisms and is a component of many carbohydrates. **photosynthesis:** the process by which plants, algae, and some bacteria use sunlight, carbon dioxide, and water to produce carbohydrates and oxygen **reactant**: a substance or molecule that participates in a chemical reaction **product:** a substance that forms in a chemical reaction	Identify and use multiple valid and reliable sources of evidence and reasoning to explain the idea that photosynthesis results in the cycling of matter and energy into and out of organisms. Create an explanation that shows that all animals take in food and oxygen to provide energy and materials for growth and survival; yet some animals eat photosynthetic organisms, and some animals eat other animals which have themselves eaten photosynthetic organisms. **Students will use a chain of reasoning to provide evidence and support for the explanation that energy and matter cycles during photosynthesis, including: photosynthetic organisms take in matter (carbon dioxide and water) and use energy from the sun to produce carbon-based molecules (food) which they can immediately use or store, and release oxygen into the environment through photosynthesis.**	**Energy and matter to show that photosynthesis causes cycling of matter and uses energy.**
PS3.D The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (ie. sunlight) to	Students will construct an explanation that plants, algae, and photosynthetic microorganisms require energy from the sun	Energy changes to understand photosynthesis reaction and during processes such as cellular respiration. This

occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen.	and must take in carbon dioxide and water to survive. Explain that energy from the sun is used to combine simple non-food molecules (e.g. carbon dioxide and water) into food molecules (e.g. sugar) and oxygen, which can be stored by the plant. Reason and explain that all food and most of the oxygen plants and animals use for life processes are the result of energy from the sun driving matter flows through the process of photosynthesis. Explain that plants and animals depend on matter from plants for energy, growth, repair, and survival.	includes energy stored by photosynthesis is released.
LS1.C As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. LS1.C As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new	**From a given model, students should identify and describe the components of the model relevant for their illustration of cellular respiration including:** **-Matter in the form of food molecules, oxygen, and the products of their reaction (e.g., water and CO_2)** **-The breaking and formation of chemical bonds** **-Energy from the chemical reactions** **From a model, students describe the**	**Structure and function of photosynthesis and cellular respiration ensure the survival of human and plants.** Energy from the chemical reactions to describe cellular respiration.

compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. **matter:** anything that has mass and takes up space **energy:** the capacity to do work **cellular respiration:** the process by which cells produce energy from carbohydrates; atmospheric oxygen combines with glucose to form water and carbon dioxide	**relationship between:** **-Carbon dioxide and water are produced from sugar and oxygen by the process of cellular respiration.** **-The process of cellular respiration releases energy because the energy released when the bonds that are formed in CO2 and water is greater than the energy required to break the bonds of sugar and oxygen.** **Use system mode to illustrate that:** **-The chemical reaction of oxygen and food molecules releases energy as the matter is rearranged, existing chemical bonds are broken, and new chemical bonds are formed, but matter and energy are neither created nor destroyed.** **-Food molecules and oxygen transfer energy to the cell to sustain life processes, including the maintenance of body temperature despite ongoing energy transfer to the surrounding environment.**	
LS2.C Biodiversity describes variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of ecosystem's biodiversity is often used as a measure of its health. **biodiversity:** the variety of organisms in a given area, the genetic variation within a population, the variety of species in a community, or the variety of communities in an ecosystem	Identify evidence, in the form of data or information, to describe biodiversity or ecosystem problems and analyze the given solutions in order to explain why biodiversity and/or ecosystem services are necessary for a healthy ecosystem. This includes: varieties of species in ecosystem, factors that affect the stability of the biodiversity of the ecosystem, and ecosystem services (e.g. water purification, nutrient recycling, prevention of soil erosion).	Stability and Change to describe how small changes in one part of an ecosystem might cause large changes in another part. Specifically, with regards to maintaining biodiversity and ecosystem services.

ecosystem: a community of organisms and their abiotic environment **population:** a group of organisms of the same species that live in a specific geographical area and interbreed **community:** a group of various species that live in the same habitat and interact with each other **organism:** a living thing; anything that can carry out life processes independently	Identify and describe the different criteria and constraints for a design solution for maintaining a healthy ecosystem.	
LS4.D Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on--for example, water purification and recycling.	Evaluate and critique different design solutions for the stability of biodiversity and/or ecosystems by explaining strengths and weaknesses of each solution's criteria and constraints (e.g. scientific, social, and economic considerations), as well as determining any potential side effects of the design solution on other parts of the ecosystem (e.g. a small change in one area can cause a large change in another area of the ecosystem). Students identify and describe the additional evidence (in the form of data, information, or other appropriate forms) that is relevant to the problem, design solutions, and evaluation of the solutions, including: -The variety of species (biodiversity) found in the given ecosystem. -Factors that affect the stability of the biodiversity of the given ecosystem. -Ecosystem services (e.g., water purification, nutrient recycling, prevention of soil erosion) that affect the stability of the system.	Stability and change to describe the factors that affect the stability of the biodiversity of a given ecosystem.

ETS1.B There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success(e.g. water filtration methods). Describe the consequences of actions but does not necessarily prescribe the decisions that society takes.	The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.
LS2.B Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. **food web:** a diagram that shows the feeding relationships between organisms in an ecosystem **food chain:** the pathway of energy transfer through various stages as a result of the feeding patterns of a series of organisms **producer:** an organism that can make organic molecules from inorganic molecules; a photosynthetic or chemosynthetic autotroph that serves as the basic food source in an	Develop a model of a specific ecosystem (e.g. pond, meadow, stream, whole forest) to describe how every species is linked with others in an ecosystem, including the following components: producers, consumers, decomposers, non-living parts (e.g. water, minerals, air), and energy. Describe the relationships between the components in the ecosystem model, including transfer of energy into and out of the system, matter cycling among the producers, consumers, and decomposers. Describe the relationship between organisms and the nonliving parts of the ecosystem. Use the created system model of an ecosystem to track the energy and matter cycling in the system. (eg. atoms that make up the organisms in an ecosystem are cycled repeated through the living and nonliving areas, and that matter and energy are conserved through transfers within and outside the ecosystem).	Matter and Energy relationships between components within the ecosystem, including: -Energy transfer into and out of the system. -Energy transfer and matter cycling (cycling of atoms): 1. Among producers, consumers, and decomposers (e.g., decomposers break down consumers and producers via chemical reactions and use the energy released from rearranging those molecules for growth and development). 2. Between organisms and the nonliving parts of the system (e.g., producers use matter from the nonliving parts of the ecosystem and energy from the sun to produce food from nonfood materials).

ecosystem **consumer**: an organism that eats other organisms or organic matter instead of producing its own nutrients or obtaining nutrients from inorganic sources **decomposer:** an organism that feeds by breaking down organic matter from dead organisms; examples include bacteria and fungi **Law of Conservation of energy:** the law that states that energy cannot be created or destroyed but can be changed from one form to another		

Unit 3: Assessment

EVIDENCE of LEARNING			
Understanding	**Standards**	**Unit Performance Assessment**:	**R/R Quadrant 21 Century**
#5 Energy and Matter **#7 Stability and Change**	**6-8 LS1-7** **LS1.C PS3.D** **8- Obtain, Evaluate & Communicate Information** **6- Construct Explanations and design solutions**	**Description of Performance Task:** *Photosynthesis Performance Event* *Performance Event Evidence articles* *Performance Event T-Chart* Students will read 4 pieces of evidence about the process of photosynthesis. They will write an essay in which they provide the major steps in photosynthesis. Students must support their discussion with evidence from the text, tables, and scientists' excerpts that are provided. Students will be required to include one piece of evidence from at least 3 of the sources provided. **Teacher will assess:** What criteria will be used in each assessment to evaluate attainment of the desired results? 1. Students will use evidence and reasoning to construct a scientific explanation for the process of photosynthesis. 2. Students will identify and describe evidence (e.g., from students' own investigations, observations, reading material, archived data) necessary to constructing the explanation that: ● Plants, algae, and photosynthetic microorganisms require energy (in the form of sunlight) and must take in carbon dioxide and water to survive. ● Energy from sunlight is used to combine simple non food molecules (e.g., carbon dioxide and water) into food molecules (e.g., sugar) and oxygen, which can be used immediately or stored by the plant. ● Animals take in food and oxygen to provide energy and materials for growth and survival. 3. Students will reason that plants, algae, and photosynthetic microorganisms take in matter (in the form of carbon dioxide and water) and use energy from the sun to produce carbon-based organic molecules (food), which they can use immediately or store, and release oxygen into the environment through photosynthesis. ● Plants use the food they have made for energy, growth, and other necessary functions (e.g., repair, seed production). ● The process of photosynthesis has an important role in energy and matter cycling within	C Critical thinking communication

		plants (i.e., the conversion of carbon dioxide and water into complex carbon-based molecules (sugars) and oxygen, the contribution of sugars to plant growth and internal processes) as well as from plants to other organisms. **<u>Performance:</u>** **Mastery:** Students will score a 75% to demonstrate mastery. **Scoring Guide:** See Photosynthesis Performance Event and additional resources for assessment	

Unit 3: Sample Activities

SAMPLE LEARNING PLAN				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy Category:**	**R/R Quadrant: 21C:**
# 1 Patterns #2 Cause & effect **#5 Energy and Matter**	**6-8 LS1-7** **LS1.C** **PS3.D** 1- Ask questions and define problems 4- Analyze and Interpret data 6-Construct Explanations	**1.Lesson**: The Effect of Light on Photosynthesis of Elodea **Objective**: Students will understand how changing the amount of light affects the amount of oxygen produced. **Activity:** Virtual Photosynthesis Lab 1. Opening Question: *How will changing the amount of sunlight change the way photosynthesis works?* 2. *Students will fill in the purpose and hypothesis on their lab sheet . Show students the virtual lab and have them write down the procedure. They will be conducting three trials for each distance from the light.* 3. *Students will work through the lab, writing their data on their lab sheet. Once they have their data, they will find the average number of oxygen bubbles per minute for each distance. The average will be the data they will graph.* **Check for understanding:** Students will have correctly answered the opening question in the conclusion section of their lab sheet, based on the data obtained during trials.	*Summarizing and note taking* *Generate and Testing Hypothesis*	C Communication Critical Thinking
2. Cause and Effect 1. Patterns 6. Structure and Functions **5. Energy and**	**6-8-LS1-7** **LS1.C** **PS3.D** 1- Plan and carry out investigations 4- Analyze and	**2.Lesson**: Cellular Respiration-Discovery **Objective**: Students will understand where energy comes from. **Activity:** **Engage-**1. Pose the following question to the students: Where do you think the energy we use in our lives comes from? 2. Have students think-pair-share their ideas 3. Watch the Where Does Energy Come From video clip,	Summarizing and note taking Cues, Questions Advance Organizers	C Critical Thinking Collaboration

Matter	Interpret data **6-Construct Explanations**	encourage students to see if their ideas were right or not. Video clip is from the perspective of a caveman. 4. Pre-assessment question-What is energy? To answer the pre-assessment question, have students draw a circle map in their notes. They put the word energy in the middle. Then give the students 30 seconds to write some ideas down. Once they write their ideas down they get to visit three other people in the room to get more ideas. **Explore--** 1. The purpose of this section is to raise the amount of ideas that students have about energy. To do this the student make two lists. The first list is titled, **"*Ways I have used energy today*."** To get students started on this list model - thinking about my day and offering a small list of ways I used energy before I got to school. For example: 2. -The alarm went off (sound, light energy).-I took a hot shower (heat energy).-I turned up the heater in the house (energy).-I got dressed. 3. Kids get the idea and start offering their own ideas. At this point tell them that they have one minute to list all the ways they've used energy so far today. 4. Once the kids have their list it is time to start on the second list, ***"What types of energy did I use?"*** 5. This time instead of modeling, ask one student to share a way they used energy. Generally, someone says something like, "I turned on the lights." Then ask them to identify what that type of energy is. The kids will all say that it was electricity. At that point, ask them to make a new list of all the different types of energy they can think of and tell them they have two minutes. 6. This is a point where the students tend to naturally diverge. Some students with very little idea of energy come up with only a few ideas. Other students will come up with many and varied ideas. 7. Once the 2 minutes are up, ask all the students to stand up. Use the strategy, "The last one standing." Say, *"If you have one type of energy listed stay standing. If you thought of two types of energy stay standing."* Continue this until only one student is standing and then ask that student to read their list. This is always interesting because invariably you will find some misconceptions to address.	Non-linguistic representation	

		Put the types of energy on the board, breaking in only to correct any serious errors. Generally, the students are very engaged in this because they are trying to "bust" the "last student standing". It's important to keep this competition friendly and focused. 8. Now that students have a better idea of the concept of energy and some solid examples of energy uses and types, it is time to get to crux of the lesson, determining where the energy came from. The students again use their notes and they will be making flow maps. 9. Energy, and its sources, are tough concepts to master. Model several examples for students before turning them loose. Start with an example that takes them back to photosynthesis. Choose one of the ways you used energy today as an example, walking into school. Then trace back where the energy came from while making a flow map. 10. Example--Walking into school -----> food -----> sugar------> photosynthesis-------> sunlight! Example-- Alarm clock----> Electricity----->oil---->dead plants and animals---->photosynthesis---->sunlight 11. Depending on the students, you can do several more examples getting help from the students along the way. At some point, the students are ready to work with a partner making their own flow maps. **Check for understanding:** **Is It Food For Plants probe Teacher Materials** **Closing Statement:** *"Today we looked at different types of energy and traced those all back to the sun. Now we know that the sun is the source of most energy on Earth!"* **Closing Question:** *We know that we get our energy from the food we eat like plants and animals. Where do plants get their food from? What substances do they use to produce energy?* *Students will complete the Page Keeley Probe "Is It Food For Plants?" Students will show they understand by correctly answering the probe question.*		

#1 Patterns #2 Cause and Effect **5 Energy and Matter**	**6-8 LS1-7** **LS1.C** **PS3.D** 1- Ask questions and define problems 4- Carry out investigations **6- Construct Explanations**	**3.Lesson:** Cell Energy Cycle Gizmo **Objective:** Students will be able to explain how cellular respiration and photosynthesis are related. **Activity:** Student Gizmo Sheet Teacher Answer Key Teacher Guide Students will complete a series of 3 virtual activities: a. Activity A – Students explore the process of photosynthesis. b. Activity B – Students explore the process of cellular respiration. c. Activity C – Students determine how photosynthesis is related to cellular respiration.	Summarizing and note taking Modeling Non-linguistic representation	B Critical Thinking
#1 Patterns **5 Energy and Matter**	HS-LS1-7 **LS1.C** **PS3.D** 4- Analyze and interpret data 1- Ask questions and define problem **6- Construct Explanations**	**4.Lesson:** Photosynthesis and Cellular Respiration in the Carbon Cycle Children's Book **Objective:** Students will be able to identify and compare the major steps, reactants, and products of photosynthesis and cellular respiration. **Activity:** 1. Tell students that today they will be working with a partner to create a children's book discussing the processes of cellular respiration and photosynthesis. 2. Pass out the Cellular Respiration and Photosynthesis Book document and review the directions with the class. ● *Note: The key to a good book seems to be to have an engaging narrator. This gives students opportunities to show their creativity and humor and prevents the book format from becoming too similar to a textbook. Tell students that you want their narrator to speak in the first person…either they are an expert talking about the processes or they are a carbon or other atom going through the processes.* Once students have been assigned a partner, ask them to move to a space around the room where they can begin to brainstorm. Post these questions on the board to help them with this conversation:	Non-linguistic representation Summarizing and note taking Cues, Questions and advance organizers	C Critical Thinking Creativity

		• What kind of theme or narrator do we want to have for this book? • How do we want to break up the work load? • What is the most important information we need to include for photosynthesis? • What is the most important information we need to include for cellular respiration? Give students at least ten minutes to work through these big topics before circulating to answer questions. This gives these students time and space to establish their working groups independently. As you circulate, observe closely how groups are interacting and be sure to ask each pair for clarifying questions about the project or the processes. Students will need 2-3 class periods to complete the activity with their partner. Students are also encouraged to work together outside of the class setting to finish their book.		
#2 Cause and effect #7 Stability and Change	LS2.C LS4.D ETS1.B 1- Ask questions and define problems 3- Carry out investigations **6- Construct Explanations**	**5.Lesson**: Biodiversity: What's the Big Deal? **Objective**: Students will be able to explain why maintaining biodiversity is important to the health of an ecosystem and develop suggestions for maintaining biodiversity. **Activity:** Students work to recognize that changes to part of an ecosystem can have positive or negative impacts on the entire ecosystem. This activity focuses on the spread of disease through two different environments: one with high biodiversity and one without. The goal of the activity is for students to recognize that disease spreads much further and more quickly through an ecosystem with only one type of plant (mono-culture) than it does when there are a variety of organisms (diversity). This is because in a mono-culture the plants are typically close together (think of a corn field), allowing disease to spread quickly through the population. In an ecosystem with high diversity, there are more organisms between any two plants, which slows the spread of disease and increases the likelihood of containment to just a few individuals.	Reinforcing Effort and Providing recognition cooperative learning Cues, Questions, and Advance organizers Non-linguistic representations Identifying Similarities and Differences	C Creativity, Collaboration, Communication Critical Thinking

		In this activity students are given a card; one side of the card is labeled as Douglas Fir, representing a mono-culture, and the opposite side of the card is labeled with a wide variety of tree species including Douglas Fir, Noble Fir, Western Red Cedar, Vine Maple, Western Hemlock, White Fir, Lodgepole Pine, White Pine, Bigleaf Maple, and Western Dogwood. Begin by showing students the following image (image) and have them count how many different types of plants they can see. At their tables, ask them to quietly discuss if they believe this is good, bad, or has no effect at all on an ecosystem and to explain why they think so. Activity Instruction Douglas Fir Cards Other tree Cards **Check for understanding:** Students will score a 75% or higher on the Post Activity Questions		
#1 Patterns #2 Cause and Effect #6 Structure and Function	LS2.C LS4.D ETS1.B 1- Ask questions and define problems 3- Carry out investigations **6- Construct Explanations**	**6.Lesson:** Water Filtration **Objective:** Students will be able to understand the issue of water pollution and the importance of access to clean water. Students will be able to experiment with filtering various substances from water by making their own filtration devices. Students will be able to observe and draw conclusions based on their experiment. **Activity:** All detailed plans and directions are located in the earthday.org link. 1. Warm-up: Water in Your Life 1. Begin this lesson by discussing with your class the importance of water in our daily lives. Have your students brainstorm how many times today they have used water, and write their answers on the board. (Examples: drinking, flushing the toilet, taking a bath or shower, brushing teeth, watering yard or garden, washing dishes, filling a pet's water dish or fish tank, cleaning, doing laundry, swimming, fishing, etc). 2. Activity One: Water, Water, Everywhere? 1. Lead students in a discussion about the overall scarcity of clean water on our planet, and the impact this has on humans around the world: a) Although	Generating and testing hypothesis Carrying out investigation Ask questions and define problems Summarizing and note taking Summarizing	C Critical Thinking

		Earth is covered with water (over 70% of Earth's surface), only about 3% of the water on our planet is not saltwater. Of this tiny amount of freshwater, much is locked up in ice and glaciers, and of the remainder, less and less is available to humans because of rising populations and increased pollution. b) What are some sources of water pollution? Oil spills, bacteria and other organisms, toxic chemicals, litter, runoff from city streets, industrial waste, human waste, agricultural waste, etc. c) In the United States, we are lucky to have sources of freshwater, and sanitation facilities and water treatment plants to clean our water. We are also lucky that most of us have running water in our homes, schools and other buildings, and we can access clean water any time of day. d) What would you do if you turned on your faucet at home, and no water came out? Where would you find water? Think of nearby bodies of water in your area. Is there a stream or river? A lake? The ocean? e) What do these places look like? Could you drink the water? Cook with it? Bathe with it? Feed your pet? f) Many people around the world do not have running water in their homes, or even access to clean water. They must gather water from sources near their homes such as communal wells, sewers, rivers, streams, ponds, lakes or swamps. What do you think they find in this water? Fish, plants and other wildlife, trash, wastes, chemicals etc. g) Depending on where they live, there could be all kinds of things in their water. 3. Activity Two: Water Filter Activity 1. Break students into small groups, and pass out Worksheet #1 – Water Filter Procedure (one for each student, or one for each lab group) and Worksheet #2 – Water Filter Lab Worksheet (one for each student). Distribute lab supplies to each station (2-liter soda bottle pre-cut in half, filtration materials, "pollution" materials). 2. Have students think about the types of pollution they discussed in the first activity. How could they represent these with the materials provided? 3. Have each group follow the procedure outlined in Worksheet #1 – Water Filter Procedure and answer the questions in Worksheet #2 – Water Filter Lab Worksheet.Procedure and worksheets are included in link to lesson plan. 4. Wrap Up/Exit Slip: Have your students imagine again that they have		

		no running water and no water treatment facilities, and they must collect water from sources near their homes. They will answer the questions on the exit slip to show they know about filtration.		
#1 Patterns # 4 Systems and System Models **#5 Energy and Matter**	LS2.B 1- Ask questions and define problems 3- Carry out investigation 4- Analyzing and Interpreting Data	**7.Lesson**: Food Web Relationships **Objective**: Students will be able to analyze data from a simple food chain and explain complex relationships in food webs. **Activity:** **Engage:** Play the "Energy Flow" song to hook the students. As the song is playing have students write down the vocabulary words they recognize. Look for terms such as *photosynthesis*, *producers*, *decomposers*, *food chains*, *food webs*, *omnivores*, etc. Invite students to share one of the words they wrote down, along with it's definition. The goal of this exercise is to provide students with an opportunity to review the vocabulary. **Explore:** Tell students that today they will first work on a simulation to deepen their understanding of the relationship between producers and consumers. Distribute the Food Chains and Food Webs sheet, and display the Sunny Meadows Food Chain Simulator. Go over the instructions for this simulator with the students, pointing out what data needs to be collected (numbers at the start, end and number of cycles). Watch as students make sense of the data the simulation provides and discover the importance of predators and prey to maintain equilibrium in an ecosystem. **Check for understanding:** Students will correctly answer the following exit question: *"What do you think would happen if ALL of the decomposers became extinct?" Their answers recognize that decomposers are responsible for recycling nutrients back into the ecosystem, and that without them, organisms would not rot.*	Non-linguistic representation Summarizing and note taking Cues, Questions and Advance organizers	B Critical Thinking
#1 Patterns **#5 Energy and Matter**	LS2.B 1- Ask questions and define problems	**8.Lesson:** The Nitrogen Cycle Game (45-50 minutes) Requires teacher to prepare game pieces. **Objective:** ● Students understand that nitrogen cycles indefinitely through the Earth system.	Non-linguistic representation Summarizing and note taking Reinforcing	C Critical Thinking Communication

	3-Carry out investigations 4- Analyze and interpret data	● Students understand the places that it is found on Earth. ● Students understand that nitrogen is essential for life. ● Students learn that the cycle is nonlinear traveling between living things and the physical environment. **Activity:** Materials and Teacher Plans Stamp Sheet Resevoir Sheet Passport Worksheet Introduce nitrogen. Where is nitrogen found on Earth? Why is it important? 1. Read through the Nitrogen cycle article with students. 2. Explain that nitrogen travels with the help of bacteria, water, lightning, plants, and animals. 3. Show the nitrogen reservoir signs around the room and explain that these are the places to which nitrogen can travel. These places are called *reservoirs*. 4. Tell students that for this activity they are each playing the role of a nitrogen atom. They will travel through the nitrogen cycle (i.e., to different stations around the room) based on dice rolls. 5. Tell students that they will each carry a nitrogen passport with them and stamp it (or paste a stamp in it) each time they get to a nitrogen reservoir station. 6. They will then toss the die at the reservoir to determine their next destination. Remind students to note in the passport how they get from one place to another based the roll of the die. 7. Spread students so that there are a few at each station and allow them to start traveling with their passport.		

Unit 3: Resources

UNIT RESOURCES

Teacher Resources:

- *Exploring Relationships*
- *Photosynthesis Lab*
- *Cellular respiration*
- *Photosynthesis Claims and Evidence*
- *Biodiversity Activity*
- *https://scied.ucar.edu/activity/nitrogen-cycle-game*
- *https://www.explorelearning.com/*

Student Resources:

This may include:

- *Photosynthesis Virtual Lab*
- *Sunny Meadows Food Chain Simulation*

Vocabulary:

biodiversity: the variety of organisms in a given area, the genetic variation within a population, the variety of species in a community, or the variety of communities in an ecosystem
photosynthesis:the process by which plants, algae, and some bacteria use sunlight, carbon dioxide, and water to produce carbohydrates and oxygen
cellular respiration:the process by which cells produce energy from carbohydrates; atmospheric oxygen combines with glucose to form water and carbon dioxide
community:a group of various species that live in the same habitat and interact with each other
consumer:an organism that eats other organisms or organic matter instead of producing its own nutrients or obtaining nutrients from inorganic sources
decomposer: an organism that feeds by breaking down organic matter from dead organisms; examples include bacteria and fungi
ecosystem:a community of organisms and their abiotic environment
energy:the capacity to do work
food chain:the pathway of energy transfer through various stages as a result of the feeding patterns of a series of organisms
food web:a diagram that shows the feeding relationships between organisms in an ecosystem
Law of Conservation of energy: the law that states that energy cannot be created or destroyed but can be changed from one form to another
matter:anything that has mass and takes up space
organism:a living thing; anything that can carry out life processes independently
population:a group of organisms of the same species that live in a specific geographical area and interbreed
product:a substance that forms in a chemical reaction
producer:an organism that can make organic molecules from inorganic molecules; a photosynthetic or chemosynthetic autotroph that serves as the basic food source in an ecosystem

reactant:a substance or molecule that participates in a chemical reaction

Unit 4: Interdependent Relationships in Ecosystems

Content Area: Science	Course: 7th Grade Life Science	UNIT: How do organisms interact with other organisms in the physical environment to obtain matter and energy?

Unit Description:	Unit Timeline: 9 weeks
Students will be able to construct explanations for the interactions in ecosystem and the scientific, political and social justifications used in making decisions about maintaining biodiversity in ecosystems. Students can use models, construct, evidence-based explanations, and use argumentation from evidence. Students understand that organisms and populations of organisms are dependent on their environmental interactions both with other organisms and with nonliving factors. They also understand the limits of resources influence the growth of organisms and populations, which may result in competition for those limited resources. Crosscutting concepts of matter and energy, systems and system models, and cause and effect are used by students to support understanding the phenomena they study.	

DESIRED Results

Transfer Goal - ***Students will be able to independently use their learning to……***

1. Ask questions and define problems.
2. Develop and use models.
3. Plan and carry out investigations.
4. Analyze and interpret data.
5. Use mathematical and computational thinking.
6. Construct explanations and design solutions.
7. Engage in arguments from evidence.
8. Obtain, evaluate, and communicate information.

Understandings (Cross Cutting Concepts) – *Students will understand… (Big Ideas)*

1. Patterns
2. Cause and Effect
3. Scale, Proportion, & Quantity
4. Systems & System Models
5. Energy and Matter
6. Structure and Function
7. Stability and Change

Essential Questions: *Students will keep considering…*

- How and why do organisms interact with their environment and what are the effects of these interactions?
- How do organisms interact with living and nonliving environments to obtain matter and energy?
- What happens to ecosystems when the environment changes?
- What is biodiversity, how do humans affect it, and how does it affect humans?
- What is the process for developing potential design solutions?

Phenomena used to anchor this unit Great Pacific Garbage Patch

Standards Addressed
MS-LS2-4 Construct an argument supported by empirical evidence that explains how changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.] **MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on individual organisms and populations of organisms in an ecosystem. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]** 6-8-LS2-2 Construct an explanation that predicts the patterns of interactions among and between the biotic and abiotic factors in a given ecosystem. [Clarification Statement: Relationships may include competition, predation, and symbiosis.] Linked to NGSS: MS-LS2-2

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

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

Disciplinary Core Ideas **Students will know...**	**Science and Engineering Practice** **Students will be able to...**	**Cross Cutting Concepts** **Students will understand...**
LS2.C Ecosystems are dynamic in nature, their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all of its populations.	**State a supported claim and provide multiple sources of evidence to explain how changes in physical or biological components of an ecosystem can influence population sizes.** **Evaluate given evidence to support claim, interpret alternate interpretations of the evidence given, and use reasoning to construct an oral/written argument that includes: a) specific changes in the physical/biological components that can affect survival and reproductive likelihood of organisms in that ecosystem (e.g. scarcity of food or elimination of a predator). b) factors that affect the survival and reproduction of organisms can cause population changes of the organisms, c) identification of patterns and cause of patterns that suggest that many different types of changes correlate with changes in organisms populations, d) explanation that small changes in one part of the ecosystem can cause large changes in another part of the same ecosystem.**	**Cause and effect to explain how environmental factors can affect populations of organisms.** **Stability and change shows that changes in one part of an ecosystem will impact another part of the ecosystem.**

LS2.A Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with nonliving factors. **population:** a group of organisms of the same species that live in a specific geographical area and interbreed	**Organize data from tables, graphs, and charts in order to analyze relationships between resource availability and organisms in an ecosystem (e.g. population sizes, reproduction rates, and growth of individual organisms).**	**Cause and effect analysis to determine that resources can impact organism populations.**
LS2.A Growth of organisms and population increases are limited by access to resources.	Analyze data to determine the relationships between the size of a population, the growth and survival of individual organisms, and resource availability in order to provide evidence of a causal link between the factors.	Cause and effect analysis to determine that resources can impact organism populations.
LS2.A In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.	Analyze and interpret data in order to make evidence-based predictions of cause and effect relationships for the following: changes in the amount and/or availability of a given resource may result in organism population changes (e.g. less food causes fewer organisms),changes in the amount and/or availability of a resource can result in changes in an organism's growth (e.g. more food causes faster growth), resource availability drives competition among organisms (both within a population as well as between populations), and resource availability can affect a population's rate of reproduction.	Cause and effect analysis to determine that resources can impact organism populations. Cause and effect to make predictions that resource amount and availability causes changes in populations.

LS2.A Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. **commensalism:** a relationship between two organisms in which one organism benefits and the other is unaffected **competition:**the relationship between two species (or individuals) in which both species (or individuals) attempt to use the same limited resource such that both are negatively affected by the relationship **mutualism:** a relationship between two species in which both species benefit **parasite:** an organism that feeds on an organism of another species (the host) and that usually harms the host; the host never benefits from the presence of the parasite **parasitism:** a relationship between two species in which one species, the parasite, benefits from the other species, the host, which is harmed **predation:** an interaction between two species in which one species, the predator, feeds on the other species, the prey **symbiosis:** a relationship in which two different organisms live in close association	Construct an explanation based on valid and reliable evidence and reasoning to determine patterns and explain: a) competition occurs when organisms compete for shared resources, b) predator-prey relationships occur in ecosystems, c) mutually beneficial interaction occur in an ecosystem, d) resource amounts/availability can affect interactions between organisms, and e) competition, predation, and mutually beneficial interactions occur across multiple ecosystems.	Patterns are used to show cause and effect relationships among organisms in an ecosystem or across multiple ecosystem. Patterns in data show shifts in populations. Stability and change: small changes in one part of a system might cause large changes in another part. (MS-LS2-5)

with each other		
ETS1.B There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	**Analyze and interpret data in order to construct an explanation and design solution to show that increases in human populations can change the environment.** **Using evidence and reasoning, develop an argument to show that increases in human populations can change the environment.**	**Cause effect to show that changing human populations can cause changes to the environment.**
ETS1.B A solution needs to be tested, and then modified on the basis of the test results, in order to improve it.	**Create an ecological disaster (e.g. oil spill), then plan and execute a solution to clean up the oil spill. Solutions need to be modified based on failures and successes in the testing.**	**Cause and effect to show that solutions may need to be modified because they failed to achieve success.** **Stability and change to show that changes in the ecosystem occurred and designed models are created to return stability to the ecosystem.**
ETS1.C The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.	Develop a model for cleanup of ecological disaster (e.g. oil spill) to test and modify for optimal design.	Cause and effect to show that solutions may need to be modified because they failed to achieve success. Stability and change to show that changes in the ecosystem occurred and designed models are created to return stability to the ecosystem.

Unit 4: Assessment

EVIDENCE of LEARNING			
Understanding **#2 Cause and Effect** **#3 Scale, Proportion & Quantity** **#6 Structure and Function** **#7 Stability and Change**	Standards **MS-LS2-4** **MS-LS2-1** **MS-ETS1-2** **LS2.C** **LS2.A** **ETS1.A** ISTE 4a 4b, 4c, 4d ISTE 2a, 2b ISTE 1a **1- Ask questions and define problems** **7- Engaging in argument from evidence** **3- Plan and carry out investigation**	**Unit Performance Assessment**: **Description of Performance Task:** The Great Pacific Garbage Patch **Day 1** Have students watch The Majestic Plastic Bag - A Mockumentary. This video is satirical in nature, but not too difficult to understand the content or the humor. At the end of the video, ask students to explain which aspects of the video are true, which are exaggerated, and which merely are added for entertainment value. Next project a map to show the location that is north of Guam; this is where a region known as The Great Pacific Garbage Patch (GPGP) is located. Inform students that this area of the ocean where marine debris has converged together due to the ocean's currents. This area contains a high density of plastics and other debris, estimated to be TWICE THE SIZE OF TEXAS! (This should take about 5 minutes to complete.) Post the following videos where students can easily access them. Students will watch each video at their own pace, stopping to take notes, and rewind sections as needed. While watching the videos, students will complete the GPGP Cornell Notes for each video. (This should take about 30 minutes to complete.) The Pacific Garbage Patch Great Pacific Garbage Patch The Nurdles' Quest for Ocean Domination After watching the videos and completing their notes, place students in groups of 4 and use a Numbered Heads Together strategy to answer the following questions: ● How was the GPGP caused? ● Why is the GPGP so problematic? ● How could this have been avoided? ● What are "nurdles" and how do they affect the GPGP? ● What can we do to solve this problem? ● What is the most important thing you took from the videos today? (This should take about 10 minutes to complete.)	**R/R Quadrant 21 Century** C critical thinking collaboration communication creativity

	4- Analyze and Interpret data	**Day 2** Show students the following two videos and ask them if these ideas presented would actually work. Beyond Recycling https://www.youtube.com/watch?v=b5eX-J23_oE How the Oceans Can Clean Themselves https://www.youtube.com/watch?v=ROW9F-c0kIQ Give students additional time (20 minutes) to research these ideas and ask students to consider whether or not the ideas presented in the video would actually work. The following links are good starting points. What Will It Take to Get Plastics Out of the Ocean? Ocean Cleanup Array vs. 5 Gyres: A Healthy Debate to Remove Plastic From Oceans Is There Hope For Cleaning Up The Pacific Garbage Patch? Have students complete the Pros and Cons Graphic Organizer as they are researching. **Day 3** Have students review their Pro and Cons Graphic Organizer and ask, "What solutions (educate and reuse or engineering technological solutions) are better? Or do you think there is another solution for the Great Pacific Garbage Patch problem?" Have students develop an argument for their particular "best" solution using the Argument Organizer. When the organizer is complete, have students create a presentation (either on Adobe Spark or Google Slides) on their solution argument. Have students present their argument to each other in small groups. **Teacher will assess:** ● Students will be able to analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. ● Students will be able to evaluate competing design solutions using a systematic	

		process to determine how well they meet the criteria and constraints of the problem. ● Students will be able to construct an argument supported by evidence that change to physical or biological components of an ecosystem. **Performance:** **Mastery:** Students will show mastery of disciplinary core idea with 80% (17/21) **Scoring Guide:** The Great Pacific Garbage Patch Scoring Guide	

Unit 4: Sample Activities

SAMPLE LEARNING PLAN				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy Category:**	**R/R Quadrant: 21C:**
#1 Patterns **#2 Cause and Effect** #5 Energy and Matter **#7 Stability and Change**	LS2.A **1- Ask questions and define problems** **3-Plan and carry out investigation**	**1.Lesson**: Gizmo - Food Chain **Objective**: Classify organisms as producers or consumers. Observe a food chain in equilibrium. Determine how one organism affects others in a food chain. Observe how disturbing the equilibrium of an ecosystem can result in long-term population fluctuations. . **Activity:** In this ecosystem consisting of hawks, snakes, rabbits and grass, the population of each species can be studied as part of a food chain. Disease can be introduced for any species, and the number of animals can be increased or decreased at any time, just like in the real world. **Check for understanding:** Students will score a 75% to demonstrate mastery. (www.explorelearning.com) https://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=381 Student version Teachers can find another interactive food web simulator at this website as an additional resource to this lesson.	Non-linguistic representations Identifying Similarities and Differences Generating and Testing Hypotheses	B Critical Thinking
#1 Patterns **# 2 Cause & Effect**	LS2.A **1- Ask questions and define problems**	**2.Lesson**: The Feeling is Mutual *This lesson has been adapted from the original lesson entitled, "Good Buddies", from Project Wild.* **Objective**: Students will identify and differentiate between symbiotic relationships among animals in an ecosystem, including symbiosis,	Non-linguistic representation Summarizing and Note taking	B Critical Thinking

	3- Carry out investigation	commensalism, mutualism, parasitism, competition and predatory relationships. **Activity:** Engage: (5 min) Start by not by giving any formal introduction, but rather by playing the National Geographic video Larva Removed from a Girl's Scalp. This short video clip will definitely elicit everyone's attention and curiosity. After watching the video*, give the students a minute or two to process what they just saw, and then ask the following questions to the class: You just witnessed a very natural interaction between two different organisms. Who benefited from the interaction - the maggot, the woman, or both? Provide a minute or two of think time, then ask the students to discuss their ideas with their shoulder partners. Ask for a few pairs to share their responses. It is at this time that the lesson is explained. Explore (15 min) Modeling: Creating Symbols Next, pass out the Animal Relationships worksheet. While students watch the Untamed Science Symbiosis: Mutualism, Commensalism, and Parasitism video about the relationships that organisms use with others in order to survive, they should fill in the blanks on the first page. This will help them as they continue throughout the lesson. After watching the video and filling in the blanks with the correct response, the students sketch a simple drawing that will serve as a symbol of each type of relationship. (For example, mutualism might be represented by links of a chain.) For more information on symbols and how to guide students through their creation, please read the reflection. Animal Relationships.pdf https://betterlesson.com/lesson/resource/3173806/animal-relationships Explain (45 min)	Cooperative learning	

		Next, pair students up and have them read through the many (30, to be exact) examples of symbiotic relationships on their paper. As the students work, asking them to justify their responses and to explain their thinking. Using some of the following questions: ● What does it mean by...? ● Why did you choose....? ● Tell me why you answered this way... ● Can you give me another example of...? ● How come this could not be an example of...? <u>Elaborate (20 minutes)</u> Once students have read through each of the examples and identified the type of relationship, discuss as a class. Next, explain it is time to play a game. Copy several decks of the "Good Buddy" cards from the Project Wild curriculum on cardstock prior to the lesson. Each deck should contain 31 cards (15 pairs showing symbiotic relationships and one blank good buddy card). The purpose of the game will be for student to identify animals that form the relationships. This game also serves as a great review, because it calls upon students' knowledge of ecosystems, survival needs, and animal adaptations, in order to properly identify the animal pairs and their relationships. Start by having students sort the cards, attempting to make pairs according to who they think would have some sort of symbiotic relationship. Once the groups feel they have correctly identified pairs, pass out the accompanying list that contains the descriptions of each animal relationship. The students should check their work to make sure they have adequately identified pairs, then sort each pair according to the type of relationship they have with their animal partner. When they are finished, check their work and then direct them to shuffle their cards. Next, regroup the students into groups of 4. One student in each group combines two sets of cards, shuffles them again, and deals out all of the cards equally among the four students, including him/herself. Play starts to the left of the dealer and rotates clockwise. Each player randomly takes one		

		card from the player to the left. After the player has drawn a card, that player may lay down all cards in his or her hand that form symbiotic, competitive, or predatory pairs. The "Good Buddy" card serves as a wild card and can be used whenever the person holding that card needs it. Once the first player runs out of cards, the game is over. The player with the largest number of pairs at the end of the game is the winner. **Check for understanding:** Student will demonstrate mastery by completion of the Animal Relationships worksheet. Direct them to find the blank box in the middle of the second page. In that box, the students must draw and explain an example of one of the types of symbiotic relationships using specific animals within a shared ecosystem. On the lines next to the box, each student must label the type of symbiotic relationship and explain why this pair of animals demonstrates the relationship they have selected.		
# 2 Cause and Effect **# 6 Structure and Function**	LS2.A **1- Ask questions and define problems** **7- Engaging in argument from evidence** **3- Plan and carry out investigation** **4- Analyze and Interpret data**	**3.Lesson:** Exploring Symbiosis **Objective:** Students will be able to discover the meaning and importance of symbiosis by matching hosts and symbionts based on their respective needs. Before the lesson: Make an overhead, poster, or computer slideshow of examples of mutualism, commensalism and parasitism. Make enough cards for the whole class (note cards or laminated paper), each card with an organism on it. Each card should list one or two things that this organism needs and that it can provide. For example, a mutualism card could say that coral need nutrients and that they provide a hard, protected place to live. An example card pair is shown later in the article and many cards are available at the web link below. There should be an equal number of card pairs for mutualism, commensalism, and parasitism. This lesson can either focus on just marine symbiotic relationships or on a variety of symbioses. **Activity:** Exploring Symbiosis Teacher Guide and Student Cards 1. Divide the class into three groups with even numbers of students, giving each group a name (mutualism, commensalism, parasitism). Explain to each group which type of symbiosis they are and what	Cooperative Provide Feedback Non-linguistic representation	C Critical Thinking Creativity

		that means. Tell the mutualism group that both organisms must benefit from the relationships on the cards that they will receive. Explain to the commensalism group that one organism will benefit and the other will be unaffected, and tell the parasitism group that one organism will be hurt while the other benefits in that kind of relationship. Within each group, shuffle and hand out the cards that correspond with that group (parasitism group gets parasite cards, etc.) Make sure that all paired cards are passed out within a group, so each parasite has a corresponding host. Paired cards are available at the end of this article, although there are many other examples that could be used to teach this lesson. 2. Tell the class that each student has someone in their group that has a symbiotic relationship with them. Explain that one organism is using the other as a unique habitat in order to feed, survive, and reproduce. They are going try to find their "symbiont" by talking to other group members about what each organism has and needs. 3. Once a pair of students has figured out that they share a symbiotic relationship (5-10 minutes), have them come up and check that the pairing is correct (if not, send them back to the group). 4. If students are right, have them write their two organisms together on the board with a circle around them. The whole class should write with the same color marker and there should be no organization on the board with regard to group or type of symbiosis. 5. Once all the pairs of organisms are written on the board, explain that students will be working in pairs to guess what kind of symbiotic relationship the organisms on the board have. Read off the cards for each pair of organisms, and if students guess correctly and explain their answer (mutualism, commensalism, parasitism) they will get points for their group. One pair of students from each group will answer at a time. An incorrect guess will be turned over to the rest of the class to answer, but not for points. Students should not be asked about relationships they wrote on the board themselves. 6. Explain the points system. If students correctly answer mutualism, their group receives 3 points and the other groups receive one because mutualism helps everyone. If students correctly answer commensalism, their group gets two points and the other groups get		

		none because it only helps one organism. If parasitism is the correct answer, they get one point but the other groups lose a point. Ask the groups how many points they get and why for each answer. When we did this, it helped with students' understanding of the different types of symbiosis and they were excited about the variety of scoring options. **Check for Understanding:** Have students divide a sheet of paper into three columns and head each column with a type of symbiosis (mutualism, commensalism, parasitism). They can then put all the pairs of organisms on the board into one of the categories. Discuss the impacts on both organisms for each of the different types of symbiosis. The impacts on both organisms can be denoted with +/+, +/0, and +/- for each symbiosis type.		
#2 Cause and Effect #4 Systems & System Models **#7 Stability and Change**	LS2.C ETS1.B ETS1.C	**4.Lesson:** Oil Spill Cleanup **Objective:** Students should be able to: ● Identify some causes and effects of oil spills on a water source and the organisms that use that water. ● Describe the different methods that environmental engineers use to clean up water pollution. ● Use volume to describe the amount of oil and water removed during the model cleanup. ● Organize their oil removal data and analyze using a bar graph. **Activity:** Students will create a model of an oil spill. They are going to play the role of environmental engineers and use different technologies to clean oil from water. They will use booms and skimmers (used to contain the oil and avoid spreading); absorbents (used to soak up the oil and avoid spreading); and dispersants (chemicals used to break down the oil). They will collect data on oil removal and then look the cleanup methods used from the viewpoint of both the environmental engineer and the oil company owner. Hands-On Activity: Oil Spill Cleanup	Non-linguistic representation Identifying similarities and differences Generating and Testing Hypotheses	D Critical Thinking

		Check for Understanding: completion of the Oil Spill Worksheet		

Unit 4: Resources

UNIT RESOURCES
Teacher Resources: ● Life Science, Holt, Rinehart and Winston © 2007 ● Discovery Education http://app.discoveryeducation.com/ ● Brain Pop https://www.brainpop.com ● Explore Learning (Gizmo) www.explorelearning.com ● www./betterlesson.com/lesson/ ● PBS Learning Media https://www.pbslearningmedia.org/
Student Resources: ● Life Science, Holt, Rinehart and Winston © 2007 ● Online textbook http://my.hrw.com/ ● PBS Learning Media https://www.pbslearningmedia.org/
Vocabulary: **commensalism:** a relationship between two organisms in which one organism benefits and the other is unaffected **competition:**the relationship between two species (or individuals) in which both species (or individuals) attempt to use the same limited resource such that both are negatively affected by the relationship **mutualism:** a relationship between two species in which both species benefit **parasite:** an organism that feeds on an organism of another species (the host) and that usually harms the host; the host never benefits from the presence of the parasite **parasitism:** a relationship between two species in which one species, the parasite, benefits from the other species, the host, which is harmed **population:** a group of organisms of the same species that live in a specific geographical area and interbreed **predation:** an interaction between two species in which one species, the predator, feeds on the other species, the prey **symbiosis:** a relationship in which two different organisms live in close association with each other