NGSS Grade 6: Unit 1 Sequencing

A cell, a person and planet Earth are each a system made up of subsystems.

Sequence Developed by TUSD Teachers, May 2016

PEs Assessed: MS-LS1-1, MS-LS1-2, MS-LS1-3, MS-ESS2-4, MS-ESS2-6, MS-ETS1-1, MS-ETS1-2

Whole to Part

Whole to Part

DCIs

Intro to NGSS: Living vs. Nonliving

Possible Inquiry Activity to introduce:
http://teachers.egfi-k12.org/are-we-alone/

LS1.A: Structure and Function
In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS1-3)

LS1.A: Structure and Function
Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2)

LS1.A: Structure and Function
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). (MS-LS1-1)

ESS2.C: The Roles of Water in Earth's Surface Processes -Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4)
-Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)

ESS2.C: The Roles of Water in Earth's Surface Processes
The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5)

ESS2.D: Weather and Climate
The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)
-Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6)

ESS2.D: Weather and Climate
Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)

ETS1.A: Defining and Delimiting Engineering Problems
The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)

ETS1.B: Developing Possible Solutions
There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2),

Additional Concepts

-What are the characteristics of living?
-What are the characteristics of nonliving?

-organization of life
-organisms
-body systems (circulatory, digestive, respiratory, muscular, and nervous)
-tissues
-organs
-cells
-unicellular vs. multicellular
-biotic and abiotic

-microscopes
-cellular components
- nucleus, mitochondria, chloroplast
-organelles made up of smaller systems such as ATP creation, glucose creation, protein synthesis

-cell membrane, cell wall
-plant vs. animal
-interact and often dependent on one another
-introduce a variety of cells to potentially use in student investigations.

-review Earth's 4 major spheres that make up the Earth System: hydrosphere, geosphere, biosphere, atmosphere
-How these spheres interact: http://www.csun.edu/science/books/sourcebook/chapters/8-organizing/files/earth-systems-interactions.html
-intro to global hydrologic patterns
-made up of smaller non-living systems such as phase changes, forces of gravity,

-intro to global atmospheric patterns
-made up of smaller systems including such as sea breeze/land breeze, forces of winds, high and low pressure cells

-intro to global oceanic patterns
-made up of smaller systems including energy transfer, convection currents

-regional climate differences
-the smallest of the subsystems are at the local level
-longitude and latitude effects on the 4 spheres

-engineering design process
-how to identify the problem: drought

-how to evaluate solutions
-how to narrow down solutions

SEPs

Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS-LS1-3)

Developing and Using Models
developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop and use a model to describe phenomena. (MS-LS1-2)

Planning and Carrying Out Investigations
Includes investigations that use multiple variables and provide evidence to support explanations or solutions. -Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1)

Developing and Using Models
Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop and use a model to describe phenomena. (MS-ESS2-6)

Will be touched on in Part 4 of Assessment. We will come back to this in units 2 and 3. Major idea here is that Earth is a system made up of four subsystems: hydrosphere, atmosphere, geosphere, and biosphere. Each of these can be broken down into smaller systems including patterns and cycles found within each of the four spheres.

Asking Questions and Defining Problems
Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models. Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)

Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)

CCCs

Systems and System Models
Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS-LS1-3)

Science is a Human Endeavor
Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS-LS1-3)

Structure and Function
Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-2)

Scale, Proportion, and Quantity
Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1)

Interdependence of Science, Engineering, and Technology
Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS1- 1)

Systems and System Models
Models can be used to represent systems and their interactions—such as inputs, processes and outputs— and energy, matter, and information flows within systems. (MS-ESS2-6)

Influence of Science, Engineering, and Technology on Society and the Natural World
All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1) The uses of technologies and 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. (MS-ETS1-1)

PEs (boundaries of PE)

Cell Organelle Performance Task

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.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.]

MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]

Activity Brainstorm:

- Students are assigned an organelle and create videos to explain how the organelles structure, function, and contribution to the whole cell
- Media products could be created from iMovie, educreations, explain everything, or any app that allows for modeling within the video (annotations and explanations of the functions) Resources can be provided on Haiku for research
- All students upload their videos to a padlet with the background as a large cell membrane or cell
- Students watch all videos and take notes on each organelle.
- **Assessment:** Students then write a few paragraphs using evidence from the videos (and resources provided on haiku to make the videos) for the body is a system of interacting subsystems composed of groups of cells

Microscopic Cell Lab Investigations

LS1-1.
MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. [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.]

Activity Brainstorm

- A series of microscope labs including cheek cell, onion cell, elodea, ect. (some can be on non-living specimens)
- **Assessment:** Students create a 30 Hands project with one slide on each type of cell providing evidence of unicellular vs. multicellular, plant vs. animal, living vs. nonliving in their narration
- Images can be taken from google if you do not have digital microscopes
- Images can be annotated/ labeled in Pic collage

Intro to the Earth System

MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. [Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]

MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]

Activity Brainstorm

- Students are provided with graphics on each of the spheres that make up Earth systems (hydrosphere, geosphere, biosphere, and atmosphere)
- Students analyze these graphics and and identify how water flows in and out of each
- Students find patterns and identify the many cause and effect relationships within these spheres and between the spheres
- **Assessment:** Students create a model (poster on butcher paper or media product) to show how water can move within and between the spheres. All models will have a different emphasis- students can peer review to identify ideas that they did not include in their own model.

Engineering Design Process: Human Impact on Earth's Spheres

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.

Activity Brainstorm:

- Students are introduced to the engineering design process for the first time in middle school
- Students will be introduced to the ideas of how humans are damaging the processes found within the Earth system.
- Students choose one problem to research and come up with a variety of solutions to decrease the negative impact of humans on Earth Systems
- Students evaluate the solutions for feasibility, cost, or other criteria and constraints and choose one solution to develop
- **Assessment:** Students develop a presentation (slideshow, iMovie, Explain Everything, ect) to present their solution to the class. (Presentations shared via Haiku Wiki Project)
- Students vote on most creative solution, most realistic solution, and most innovative solution