NGSS Grade 7: Unit 3 Sequencing

Natural processes and human activities have shaped Earth's resources and ecosystems.

Sequence Developed by TUSD Teachers, April 2016

PEs Assessed: MS-LS2-1, MS-LS2-2, MS-LS2-3, MS-ESS2-3, MS-ESS3-1, MS-PS1-2, MS-PS1-5

DCIs

ESS2.B Plate tectonics and Large-Scale System Interactions
Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)

PS1.A Structure and Properties of Matter
- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms.(MS-PS1-1)
-Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.(MS-PS1-2),(MS-PS1-3)
-Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4)

PS1.A Structure and Properties of Matter
-In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.(MS-PS1-4)
-Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)
-The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)

PS1.B Chemical Reactions
Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.(MS-PS1-2),(MS-PS1-5)
- The total number of each type of atom is conserved, and thus the mass does not change.(MS-PS1-5)
-Some chemical reactions release energy, others store energy. (MS-PS1-6)

PS1.C Definitions of Energy
-The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects.
(secondary to MSPS1-4)

LS2.B Cycle of Matter and Energy Transfer in Ecosystems
-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. (MS-LS2-3)

LS2.A Interdependent Relationships in Ecosystems
-Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)
-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. (MS-LS2-2)

LS2.A Interdependent Relationships in Ecosystems
-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. (MS-LS2- 1)
-Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)

ESS3.A Natural Resources
-Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)

ESS2.B Plate tectonics and Large-Scale System Interactions
Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)

Introduce and Continue in Unit 4

LS2.C Ecosystem Dynamics, Functioning, and Resilience
-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 its populations. (MS-LS2-4)
-Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.(MS-LS2-5)

Additional Concepts

-Alfred Wegener's evidence
-continental drift
-distribution of rocks, fossils, minerals
-plate tectonics
-plate boundaries

-review and connect to natural resources like minerals, phosphorus, ect. http://www.conserve-energy-future.com/list-10-natural-resources.php
-locations around the world
-connect to new molecules that will frontload to go deeper into chemical reactions

-review and connect to natural resources (natural gas) and new molecules
-to frontload to go deeper into chemical reactions

-physical and chemical reactions
-molecular structures
-balancing equations
-conservation of mass
-chemical reactions
-review: endothermic and exothermic to transition to ecosystems

-Stored chemical potential energy that organisms can use in biological processes
-connect to living systems
-transition into ecosystems through the concept of energy

-Transfer of energy from organisms, mostly thermal; "waste heat", energy pyramid
-Modeling transfer of matter and energy through the eating of food
-Transfer of matter through non biomass; water, carbon dioxide and mineral decomposers release to the soil
-Ecosystems are not closed systems
-energy needs of organisms
-connect to Bio bottle in Unit 2

-predatory prey relationships
-symbiotic relationships
-population growth and ecosystem capacity
-requirements for life

-Effects of resource availability on organisms and populations in ecosystem
-Competitions
-survival
-limited resources
-population control
-rates of growth and reproduction

--Groundwater needed for life & physical properties of rocks to store
-Groundwater supplies correlate with regional latitude and geographic conditions that determine precipitation
-Transfer of matter through non biomass; water, carbon dioxide and mineral decomposers release to the soil

-revisit how plate tectonics affect natural resources available in ecosystems
-how geologic processes, regional latitude and geographic conditions affect natural resources available in ecosystems
-connect to water distribution around the world

-ecosystem stability
-define biodiversity
-dynamics of local ecosystems

SEPs

Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. - Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3)

Scientific Knowledge is Open to Revision in Light of New Evidence
Science findings are frequently revised and/or reinterpreted based on new evidence. (MS-ESS2-3)

Developing and Using Models
Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.
-Develop a model to describe unobservable mechanisms. (MS-PS1-5)

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
Laws are regularities or mathematical descriptions of natural phenomena. (MS-PS1-5)

Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
-Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2)

Scientific Knowledge is Based on Empirical Evidence
Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)

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 a model to describe phenomena. (MS-LS2-3)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.
-Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2)

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CCCs

Patterns
Patterns in rates of change and other numerical relationships can provide information about natural systems. (MS-ESS2-3)

Patterns
Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)

Energy and Matter
Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)

Energy and Matter
The transfer of energy can be tracked as energy flows through a natural system. (MS- LS2-3)

Scientific Knowledge Assumes an Order and Consistency in Natural Systems
Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)

Patterns
Patterns can be used to identify cause and effect relationships. (MS-LS2-2)

Cause and Effect
Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

Cause and Effect
Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3- 1),(MS-ESS3-4)

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-ESS3-1),(MS-ESS3-4)

PEs (boundaries of PE)

Continental Drift Presentation

MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] [Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.]

Activity Brainstorm
- **Station #1 Predicting Earth's Past:** Give them beginning , middle and end positions of continents over time.. Each group gets an envelope of maps , put them in sequence using key maps that are labeled.
- **Station #2 Evidence of Earth's Past:** Continental Drift Activity https://drive.google.com/file/d/0Bw_IhQ3QXKMoOU1TMlJ2Skh5Rkk/view?usp=sharing
- **Station #3 Earth's Past Processes Still Happening Today**
- Students are provided with maps with locations of ocean structures (Ridges, fracture zones, and trenches) ,Map with location of volcanoes, map of plate boundaries. Students make observations and inferences when comparing maps about the movement of Earth's plates.
- **Assessment:** Students create a presentation (google slides, educreations, explain everything, iMovie) supported with evidence to show how continents have moved over time- each station must be represented in the presentation with pictures and annotations.

Chemical Reaction Experiments

MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]

Activity Brainstorm:
- https://docs.google.com/a/mytusd.org/document/d/1JlQg6bLSUo1pJ1CTb2mgMX0YtQ8GFO7PtjlKN3bc_58/edit?usp=sharing
- Series of chemical reaction experiments
- Students write up each lab answering questions and writing conclusion paragraphs
- **Assessment:** Data table is created on all chemical reactions providing evidence of physical changes and chemical changes

Modeling Chemical Reactions Part 2

MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms that represent atoms.] [Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.]

Activity Brainstorm
- Students model chemical reactions using a method similar to photosynthesis and cellular respiration model in unit 2
- **Assessment:** Students model 2 or more of the chemical reaction experiments to prove understanding that the total number of atoms does not change and conservation of mass.

Bio Bottle Part 2

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, and on defining the boundaries of the system.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]

Activity Brainstorm
- Students revisit Bio bottle data they have been collecting
- Students use images to create a pic collage with annotations to show cycling of matter and flow of energy among living and nonliving parts of an ecosystem
- Students use an image from a Google search to also show cycling of matter and flow of energy among living and nonliving parts of an ecosystem
- **Assessment:** Both models are added to a Google Doc and a comparison is made between the two.

Ecosystem Dynamics Performance Task

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on 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.]

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]

Activity Brainstorm:
- Groups of students are provided articles, graphs and images that provide evidence of competition among populations of organisms in an ecosystem in a particular area
- Groups of students are also provided articles, graphs, and images that provide evidence of limited resources in that particular area
- **Assessment:** Students create a flow chart, pictograph, or other representation that shows the cause and effect relationships between individual organisms, growth of populations, and health of an ecosystem
- **Assessment:** Students conclude (written or digital narration of their product) how the relationships described can predict patterns of interactions in a different ecosystem and present their findings to the class.

Distribution of Natural Resources Research Project

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]

Activity Brainstorm:
- Groups of students are given different natural resources to research (focus on energy)
- Students find the distribution patterns of this natural resource in a given area or around the globe
- **Assessment:** Students collaboratively create a Google Slide show (alternative: collaborative research paper) to present their ideas that connect how past and current geoscience processes have helped distribute the natural resources- ie- topography, plate tectonics, movement of water, ect.