Course: Biology **Unit #1: Evolution of Earth**	**Year of Implementation: 2019-2020**
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Stage One - Desired Results	
Link(s) to New Jersey Student Learning Standards for this course: **https://www.state.nj.us/education/cccs/2016/science/HS-LS1.pdf** **https://www.state.nj.us/education/cccs/2016/science/HS-LS2.pdf** **https://www.state.nj.us/education/cccs/2016/science/HS-LS3.pdf** **https://www.state.nj.us/education/cccs/2016/science/HS-LS4.pdf** **https://www.state.nj.us/education/cccs/2016/science/HS-ESS1.pdf**	
Unit Standards: **New Jersey Student Learning Standards:** **HS-LS1-2.** **Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [*Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.*]	

HS-LS2-4.	**Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.** [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [*Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.*]
HS-LS1-6.	**Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.** [Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.] [*Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules.*]
HS-ESS1-5	**Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.**[Classification Statement: Emphasis is on the ability of plate xplain the ages of crustal rocks. Examples include evidence of the ages oceanic crust increasing with distance an ridges (a result of plate spreading) and the ages of North American continental crust decreasing with distance entral ancient core of the continental plate (a result of past plate interactions).]
CRP5	**Consider the environmental, social & economic impacts of decisions.**Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP6.	**Demonstrate creativity and innovation.** Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their

ideas and understand how to bring innovation to an organization.

CRP7. **Employ valid and reliable research strategies.** Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

CRP8. **Utilize critical thinking to make sense of problems and persevere in solving them.** Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

21st Century Life and Career Standards

9.2 Career Awareness, Exploration and Preparation
This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

9.3 Career and Technology Education
This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.
Life and Career Skills:

Transfer Goal(s): Students will be able to independently use their learning to evaluate and apply scientific reasoning and evidence to explain Earth's early origins and the beginning of life.

Enduring Understandings Students will understand that. . .	Essential Questions
EU1 the planet's physical and chemical environment along with living things affect each other to shape the history of life on Earth.	EU1 ● Why does Earth look so different than it used to? ● How has the Earth's environment evolved and changed over time? ● What might have been the sequence of events that led to cellular life?

EU2 essential nutrients are cycled through biogeochemical processes. EU3 there is a hierarchical organization within all living organisms.	● How does the endosymbiont theory contribute to the present hierarchical organization of living things? EU2 ● How does matter move through the biosphere? ● How do the building blocks of living organisms rely on cycling of matter through an ecosystem? ● Why do living organisms rely on nutrient cycling? ● What is the relevance of the main nutrient cycles? ● How does nutrient availability relate to the primary productivity of an ecosystem? EU3 ● Why are living things organized the way they are? ● How does the organization of eukaryotic cells lend itself to the creation of multicellular organisms unlike that of prokaryotic organisms? ● How does the organization within a cell compare to the organization within a multicellular organism? ● Why is the division of labor within a living system important?
<u>Knowledge</u> Students will know. . . EU1 ● the history of planet Earth: Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old. ● plate Tectonics and Large-Scale System Interactions: Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. ● evidence indicates that a sequence of chemical events preceded the origin of life on Earth and that life has	<u>Skills</u> Students will be able to. . . EU1 ● evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. HS-ESS1-5 ● apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. HS-ESS1-6 ● construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth. HS-ESS2-7

evolved continuously since that time. EU2 ● as matter cycles and energy flows through different levels of organization within living systems (cells, organs, organisms, communities), and between living systems and the physical environment, chemical elements are recombined into different products. ● each recombination of matter and energy results in storage and dissipation of energy into the environment as heat. ● continual input of energy from sunlight keeps matter and energy flowing through ecosystems. EU3 ● multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) For example, cells are made of complex molecules that have their own building blocks and specific functions. ● there is a relationship between the organization of cells into tissues and the organization of tissues into organs. The structures and functions of organs determine their relationships within body systems of an organism.	EU2 ● cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting. HS-LS1-7 ● use mathematical formulas to justify the claim of an efficient diet. HS-LS2-4 ● predict what would happen to an ecosystem if an energy source was removed. HS-LS1-6; HS-LS2-3 EU3 ● discuss factors that can lead to speciation and/or extinction. HS-LS4-2 ● represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models. HS-LS1-2. ● represent and explain the relationship between cells, tissues, organs, and organ systems.
Stage Two - Assessment	

Other Evidence:

- Tests,
- Quizzes,
- Prompts,
- Self-assessment,
- Observations, Dialogues, etc.

Stage Three - Instruction

Learning Plan: **Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.**

- Phenomenon- Show students a picture of a recent volcanic eruption. Students will analyze the picture and explain how life evolved? (M) (EU1)
    - Teacher-directed discussion on the question. "How did the Earth Form and evolved over time to its present form? Protoplanet Hypothesis (A)
    - Watch and analyze: NOVA – Origins: 14 Billion Years of Cosmic Evolution (A)
    - Primordial Soup: Study of Evolution Lab Activity (Ward's Science Item # 470213-292) (T)
    - Students hypothesis how the hydrosphere began. (M)
    - Make a Venn diagram showing the primordial atmosphere vs the present atmosphere. (M/T)

- Phenomenon - Continental Drift theory –Show students a picture of Mt. Everest with shells on the peaks or picture of the Grand Canyon and have students discuss how they became the way they are. Discuss the idea of continental Drift and Alfred Wegener contribution to the world's view of how the earth changes.(A)
    - Pangaea Lab (T) (Using a idea of jigsaw puzzle that parts together into one landmass to best represent What Pangaea might have looked like. Research and compile information on Pangaea & Alfred Wegener)
    - I'm all cut up - Putting the pieces together activity (T)(To piece of evidence that supports Alfred Wegner's idea of Plate Tectonics and Continental Drift.)
    - Plate tectonic theory: Explain the past and current movement of the rocks of Earth surface and provide a framework for understanding its geologic history (A)
    - Student Inquiry – Geological Timeline of Earth's Historical Events (Events provided to students and students will

match according to when they occurred) ("Dig Field School Lesson #3- **Lesson 3 – Age of the Earth** (http://digfieldschool.org/digboxresources/) (M)
    - Have students discuss the sequence of events that led to evolution of life. Students should predict how life on earth formed.(M)
    - Teacher-directed discussion on the question. "How does the endosymbiont theory contribute to the present hierarchical organization of living things"? Lynn Margulis: Theory of Endosymbiosis(A)
- Phenomenon- Observe Biosphere 2 and discuss all the different things that must be produced to have a living organism survived. (EU-2)
    - Biosphere 1 video and worksheet(M)
    - Student activity: Jigsaw of 4 cycles (find common themes and present)(M/T)
    - Student activity: Nitrogen Cycle Game – Center for Science Education (M)
    - Student Inquiries in Science: Exploring the Nitrogen Cycle Kit Item #251010 (Carolina Biological) (T)
    - Student Inquiry: Contributors to Carbon Dioxide Cycle # 187100 (Carolina Biological)(T)
- Phenomenon- Using the microscope look at cells that are from onion roots, and white fish then have students compare and contrast the similarities and differences they see between onion root (plant) and whitefish (animal) cells. (EU-3)
    - Student activity: Draw a Venn diagram comparing the organelles of plant cells with that of an animal's' cells.(M)
    - Student activity: How is cell structure adapted to their functions? Have student develop a visual analogy- The Cell as a Living Factory.(M)