01 Basic Building Blocks of Life

Content Area: **Science**
Course(s): **Biology A**
Time Period: **Semester 1**
Length: **5 weeks**
Status: **Published**

Standards

SCI.HS.LS1.C	Organization for Matter and Energy Flow in Organisms
SCI.HS.PS1.C	Nuclear Processes
SCI.HS.PS4.B	Electromagnetic Radiation
SCI.HS.ESS1.A	The Universe and Its Stars
SCI.HS.ESS1.C	The History of Planet Earth
SCI.HS.ESS2.C	The Roles of Water in Earth's Surface Processes
SCI.HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.
SCI.HS-ESS1-6	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.
SCI.HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
SCI.HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
SCI.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.
	Structure and Function
	Stability and Change
	Planning and Carrying Out Investigations
	Constructing Explanations and Designing Solutions
	Energy and Matter
	Obtaining, Evaluating, and Communicating Information

Enduring Understandings

1. The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. The sun is just one of more than 200 billion stars in the Milky Way galaxy, and the Milky Way is just one of hundreds of billions of galaxies in the universe. The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth

2. Radioactive decay lifetimes and isotopic content in rocks provide a way of dating rock formations and thereby fixing the scale of geological time. Continental rocks, which can be older than 4 billion years, are much older than rocks on the ocean floor, which are less than 200 million years old. Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches. Although active geological processes, such as plate tectonics (link to ESS2.B) and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these

objects can provide information about Earth's formation and early history.

3. The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy; transmit sunlight; expand upon freezing; dissolve and transport materials; and lower the viscosities and melting points of rocks.

4. Science seeks to understand and explain the world around us. Scientific knowledge is tentative. As more knowledge is gained, theories may change.

5. Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings.

6. Defining life has proven to be a difficult task, even though many of us can look at most things and tell if they're alive or not. We can at least look at the characteristics that living things have in common to better understand life. For instance, life is made of cells, maintains homeostasis, grows and develops, has the ability to reproduce, metabolizes, responds to the environment, and, over time, evolves. However, just having some of these characteristics doesn't necessarily make something alive.

7. The most widely accepted scientific definition for life right now is this: "life is a self-sustaining chemical system capable of Darwinian evolution". However, there are still problems with this definition. For instance, viruses further blur the distinction between life and non-life since they cannot live without a living host and yet they have their own genetic material, they act as biological machines, and they evolve. As we continue to consider how life works on Earth and how we might best be able to find extraterrestrial life if it exists, we'll continue to improve our understanding of what life really is.

8. Living organisms are composed of cellular units that carry out functions required for life. Cellular units are composed of molecules, which also carry out biological functions.

9. Cells are made of complex molecules that consist mostly of a few elements. Each class of molecules has its own building blocks and specific functions. Water is required for the reactions to build, breakdown and transport the building blocks for these molecules.

10. Water is required for the chemical reactions within living things to build, breakdown and transport the building blocks for these molecules.

11. The input of energy from sunlight keeps matter and energy flowing through ecosystems.

12. Proteins are manufactured by organisms through joining amino acids in a set sequence and then folding these polypeptides into a unique 3D structure.

13. Proteins have a wide variety of functions in the human body that include defense, catalysis, transport, structure, and serving as a chemical messenger.

14. Enzymes are chemical catalysts in all living things. Without enzymes, chemical reactions could not occur fast enough for life to be maintained.

15. Temperature and pH are two factors that need to be maintained within fairly narrow ranges, because they significantly impact protein structure, which in turn can impair functionality to the point that death or cell damage occurs.

Essential Questions

1. What is the universe, and what is Earth's place in it?
2. Where did all of the elements come from?
3. What effect has the presence of water had on Earth and Earth's living things?
4. What molecules are necessary for life?
5. How do we know if something is living or nonliving?
6. How do organisms obtain and use the matter and energy they need to live and grow?
7. How do people reconstruct and date events in Earth's planetary history?
8. How do the properties and movements of water shape Earth's surface and affect its systems?
9. How do organisms regulate their internal functionality when faced with a changing environment?

Knowledge and Skills

Knowledge:

1. Students will know that sugar molecules thus formed obtain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (DCI LS1.C Organization for Matter and Energy Flow in Organisms)
2. Students will know that 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 Organization for Matter and Energy Flow in Organisms)
3. Students will know that the study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. (DCI ESS1.A The Universe and its Stars)
4. Students will know that the Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars, and non-stellar gasses, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. (DCI ESS1.A The Universe and its Stars)
5. Students will know that other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a

supernova stage and explode. (DCI ESS1.A The Universe and its Stars)

6. Students will know that atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. (DCI PS4.B Electromagnetic Radiation)

7. Students will know that the study of stars' light spectra and brightness is used to identify compositional elements of stars, their movement, and their distances from Earth. (DCI ESS1.A The Universe and its Stars)

8. Students will know that although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history. (DCI ESS1.C The History of Planet Earth)

9. Students will know that spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials. (DCI PS1.C Nuclear Processes)

10. Students will know that the abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. (DCI ESS2.C The Role of Water in Earth's Surface Processes)

Skills :

1. 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.

2. Construct an explanation of the Big Bang Theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.

3. Communicate scientific ideas about the way stars, over their life cycles, produce elements.

4. 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.

5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit?usp=sharing

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit?usp=sharing