Lab-Aids Correlations for

UTAH SCIENCE WITH ENGINEERING EDUCATION (SEEd) STANDARDS (2019)

EARTH AND SPACE SCIENCE

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This document is intended to show how the EDC Earth Science materials align with the 2019 Earth and Space Science Utah Science with Engineering Education (SEEd) Standards[1].

ABOUT OUR PROGRAMS
Lab-Aids has maintained its home offices and operations in Ronkonkoma, NY, since 1963. We publish over 200 kits and core curriculum programs to support science teaching and learning, grades 6-12. All core curricula support an inquiry-driven pedagogy, with support for literacy skill development and with assessment programs that clearly show what students know and are able to do as a result of program use. All programs have extensive support for technology and feature comprehensive teacher support. For more information, please visit www.lab-aids.com and navigate to the program of interest.

UTAH EARTH AND SPACE SCIENCE SEEd STANDARD	**Location in EDC Earth Science** **Unit #: Unit title** **Chapter #: Relevant Student Book pages**
Strand ESS.1: Matter and Energy in Space The Sun releases energy that eventually reaches Earth in the form of electromagnetic radiation. The Big Bang theory is supported by observations of distant galaxies receding from our own as well as other evidence. The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. 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, releasing electromagnetic energy. Heavier elements are produced when certain massive stars reach a supernova stage and explode. New technologies advance science knowledge including space exploration	
ESS.1.1 Develop a model based on evidence to illustrate the life span of the Sun and the role of nuclear fusion releasing energy in the Sun's core. Emphasize energy transfer mechanisms that allow energy from nuclear fusion to reach Earth. Examples of evidence for the model could include observations of the masses and lifetimes of other stars, or non-cyclic variations over centuries. (PS1.C, PS3.D, ESS1.A, ESS1.B)	Unit 3: Earth's Place in the Universe Chapter 8: 200-203, 212-215
ESS.1.2 Construct an explanation of the Big Bang theory based on astronomical evidence of electromagnetic radiation, motion of distant	Unit 3: Earth's Place in the Universe Chapter 8: 200-206

[1] https://www.schools.utah.gov/file/907086b7-f433-42e5-83e0-2ffd746f7fcb

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galaxies, and composition of matter in the universe. Emphasize redshift of electromagnetic radiation, cosmic microwave background radiation, and the observed composition and distribution of matter in the universe. (PS4.B, ESS1.A)	
ESS.1.3 Develop a model to illustrate the changes in matter occurring in a star's life cycle. Emphasize that the way different elements are created varies as a function of the mass of a star and the stage of its lifetime. (PS3.D, ESS1.A)	Unit 3: Earth's Place in the Universe Chapter 8: 200-201
E-ESS1-4. Design a solution to a space exploration challenge by breaking it down into smaller, more manageable problems that can be solved through the structure and function of a device. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Examples of problems could include, cosmic radiation exposure, transportation on other planets or moons, or supplying energy to space travelers. (ESS1.A, ESS1.B, ETS1.A, ETS1.B, ETS1.C)	Unit 1: Hydrosphere: Water in Earth's Systems Chapter 1: Comparing Earth to Other Worlds Not addressed specifically but chapter addresses many challenges involved with a mission to Mars.
Strand ESS.2: Patterns in Earth's History and Processes Although active geologic processes have destroyed or altered most of Earth's early rock record, evidence from within Earth and from other objects in the solar system are used to infer Earth's geologic history. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior. The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. 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 and co-evolution of life.	
ESS.2.1 Analyze and interpret data to construct an explanation for the changes in Earth's formation and 4.6 billion year history. Examples of data could include the absolute ages of ancient Earth materials, the size and composition of solar system objects like meteorites, or the impact cratering record of planetary surfaces. (ESS1.C)	Unit 3: Earth's Place in the Universe Chapter 9: 195-199, 203-206 Unit 4: Plate Tectonics Chapter 10: 256-260; 12: 342-347 Unit 5: The Rock Cycle Chapter 14: 399-401, 415-426
ESS.2.2 Develop and use a model based on evidence of Earth's interior and describe the cycling of matter by thermal convection. Emphasize the density of Earth's layers and mantle convection driven by radioactive decay and heat from Earth's	Unit 3: Earth's Place in the Universe Chapter 9: 241-244 Unit 4: Plate Tectonics Chapter 11: 317-319 Chapter 12: 342-352

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early formation. Examples of evidence could include maps of Earth's three-dimensional structure obtained from seismic waves or records of the rate of change of Earth's magnetic field. (PS1.C, ESS2.A, ESS2.B)	
ESS.2.3 Construct an explanation for how plate tectonics results in patterns on Earth's surface. Emphasize past and current plate motions. Examples could include continental and ocean floor features such as mountain ranges and mid-ocean ridges, magnetic polarity preserved in seafloor rocks, or regional hot spots. (ESS2.B)	Unit 3: Earth's Place in the Universe Chapter 9: 241-244 Unit 4: Plate Tectonics Chapter 10: 250-279; 11: 289-322 Chapter 12: 336-345, 350-352 Unit 5: The Rock Cycle Chapter 13: 363-389 Chapter 14: 415-426
ESS.2.4 Develop and use a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales. Emphasize how the appearance of land and seafloor features are a result of both constructive forces and destructive mechanisms. Examples of constructive forces could include tectonic uplift or mountain building. Examples of destructive mechanisms could include weathering or mass wasting. (ESS2.B)	Unit 3: Earth's Place in the Universe Chapter 9: 241-244 Unit 4: Plate Tectonics Chapter 10: 250-279 Chapter 11: 289-322 Chapter 12: 336-345, 350-352 Unit 5: The Rock Cycle Chapter 13: 363-389 Chapter 14: 415-426
ESS.2.5 Engage in argument from evidence for how the simultaneous co-evolution of Earth's systems and life on Earth led to periods of stability and change over geologic time. Examples could include how microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants or how the evolution of corals created reefs that altered patterns of coastal erosion and deposition providing habitats for the evolution of new life forms. (LS4.D, ESS2.D, ESS2.E)	Unit 4: Plate Tectonics Chapter 10: 250-279 Chapter 11: 289-322 Chapter 12: 336-345, 350-352 Unit 5: The Rock Cycle Chapter 14: 425-426
ESS.2.6 Evaluate design solutions that reduce the effects of natural disasters on humans. Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution. Examples of natural disasters could include earthquakes, tsunamis, hurricanes, drought, landslides, floods, or wildfires. (ESS3.B, ETS1.A, ETS1.B, ETS1.C)	Unit 4: Plate Tectonics Chapters 10 (earthquakes) and 11 (volcanoes) investigate the causes, monitoring techniques, and risk evaluation of natural hazards but do not evaluate design solutions. Unit 5: The Rock Cycle Chapter 13: 387-390 (Students consider and research some possible solutions to reduce flooding in New Orleans but do not identify criteria and constraints or necessarily determine an optimal solution.)

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Strand ESS.3: System Interactions: Atmosphere, Hydrosphere, and Geosphere The abundance of liquid water on Earth's surface and its unique properties are central to the planet's dynamics and system interactions. The foundation for Earth's global weather and climate systems is electromagnetic radiation from the Sun. 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. Changes in the atmosphere due to human activity increase carbon dioxide concentrations and thus affect climate. Current scientific models predict that future average global temperatures will continue to rise, although regional climate changes will be complex and varied.	
ESS.3.1 Plan and carry out an investigation of the properties of water and its effects on Earth materials and surface processes. Examples of properties could include water's capacity to expand upon freezing, dissolve and transport material, or absorb, store, and release energy. (ESS2.C)	Unit 1: Hydrosphere: Water in Earth's Systems Chapter 3: 64-66 Unit 2: Atmosphere and Climate Chapter 4: 99-102 Unit 5: The Rock Cycle Chapter 13: 368-370
ESS.3.2 Construct an explanation of how heat (energy) and water (matter) move throughout the oceans causing patterns in weather and climate. Emphasize the mechanisms for surface and deep ocean movement. Examples of mechanisms for surface movement could include wind, Sun's energy, or the Coriolis effect. Examples of mechanisms for deep ocean movement could include water density differences due to temperature or salinity. (ESS2.C, ESS2.D)	Unit 1: Hydrosphere: Water in Earth's Systems Chapter 3: 52-76 Unit 2: Atmosphere and Climate Chapter 4: 94-98, 102-106
ESS.3.3 Construct an explanation for how energy from the Sun drives atmospheric processes and how atmospheric currents transport matter and transfer energy. Emphasize how energy from the Sun is reflected, absorbed, or scattered; how the greenhouse effect contributes to atmospheric energy; and how uneven heating of Earth's atmosphere combined with the Coriolis effect creates an atmospheric circulation system. (PS3.A, ESS1.B, ESS2.A, ESS2.D)	Unit 2: Atmosphere and Climate Chapter 4: 94-98, 102-106 Chapter 5: 115-124
ESS.3.4 Analyze and interpret patterns in data about the factors influencing weather of a given location. Emphasize the amount of solar energy received due to latitude, elevation, the proximity to mountains and/ or large bodies of water, air mass formation and movement, and air pressure gradients. (ESS2.D)	Unit 2: Atmosphere and Climate Chapter 4: 94-98, 102-106

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ESS.3.5 Develop and use a quantitative model to describe the cycling of carbon among Earth's systems. Emphasize each of Earth's systems (hydrosphere, atmosphere, geosphere, and biosphere) and how the movement of carbon from one system to another can result in changes to the system(s). Examples could include more carbon absorbed in the oceans leading to ocean acidification or more carbon present in the atmosphere leading to a stronger greenhouse effect. (LS2.B, ESS2.D, ESS3.D)	Unit 2: Atmosphere and Climate Chapter 5: 124-135 Chapter 6: 160-163
ESS.3.6 Analyze and interpret data from global climate records to illustrate changes to Earth's systems throughout geologic time and make predictions about future variations using modern trends. Examples of data could include average sea surface temperature, average air temperature, composition of gasses in ice cores, or tree rings. (ESS2.D, ESS3.D)	Unit 2: Atmosphere and Climate Chapter 6: 142-181
ESS.3.7 Engage in argument from evidence to support the claim that one change to Earth's surface can create climate feedback loops that cause changes to other systems. Examples of climate feedbacks could include ice-albedo or warming oceans. (PS3.B, ESS2.A)	Unit 2: Atmosphere and Climate Chapter 5: 133-137
Strand ESS.4: Stability and Change in Natural Resources Humans depend on Earth's systems for many different resources, including air, water, minerals, metals, and energy. Resource availability has guided the development of human society and is constantly changing due to societal needs. Natural hazards and other geologic events have shaped the course of human history. The sustainability of human societies, and the biodiversity that supports them, requires responsible management of natural resources. Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that reduce ecosystem degradation. They also evaluate solutions to resolve complex global and localized problems that contain inherent social, cultural, and environmental impacts in an effort to improve the quality of life for all.	
ESS.4.1 Construct an explanation for how the availability of natural resources, the occurrence of natural hazards, and changes in climate affect human activity. Examples of natural resources could include access to fresh water, clean air, or regions of fertile soils. Examples of factors that affect human activity could include that rising sea levels cause humans to move farther from the coast or that humans build railroads to transport mineral	Unit 1: Hydrosphere: Water in Earth's Systems Chapter 2: 18-20, 38-40 Unit 4: Plate Tectonics Chapter 10: 250-253, 283-284 Chapter 11: 290-292, 321-322 Unit 5: The Rock Cycle Chapter 13: 358-361, 387-389 Unit 6: Earth Resources Chapter 15: 432-435, 444-456

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resources from one location to another. (ESS3.A, ESS3.B)	Chapter 16: 461-468, 479-485
ESS.4.2 Use computational thinking to explain the relationships between the sustainability of natural resources and biodiversity within Earth systems. Emphasize the importance of responsible stewardship of Earth's resources. Examples of factors related to sustainability could include costs of resource extraction, per-capita consumption, waste management, agricultural efficiency, or levels of conservation. Examples of natural resources could include minerals, water, or energy resources. (ESS3.A)	Unit 1: Hydrosphere: Water in Earth's Systems Chapter 2: 18-23 Unit 2: Atmosphere and Climate Chapter 5: 127-132 Chapter 6: 165-178 Unit 6: Earth Resources Chapter 16: 463-467
ESS.4.3 Evaluate design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios on large and small scales. Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution. Emphasize the conservation, recycling, and reuse of resources where possible and minimizing impact where it is not possible. Examples of large-scale solutions could include developing best practices for agricultural soil use or mining and production of conventional, unconventional, or renewable energy resources. Examples of small-scale solutions could include mulching lawn clippings or adding biomass to gardens. (ESS3.A, ETS1.A, ETS1.B, ETS1.C)	Unit 6: Earth Resources Chapter 15: 444-456 Chapter 16:479-484
ESS.4.4 Evaluate design solutions for a major global or local environmental problem based on one of Earth's systems. Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution. Examples of major global or local problems could include water pollution or availability, air pollution, deforestation, or energy production. (ESS3.C, ETS1.A, ETS1.B, ETS1.C)	Unit 1: Hydrosphere: Water in Earth's Systems Chapter 2: 38-40 Unit 5: The Rock Cycle Chapter 13: 387-389 Unit 6: Earth Resources Chapter 16: 479-481