Curriculum Map – Earth and Space Science

Topic Time Frame	Anchoring Phenomena, Essential Questions and Units of Study	NGSS Standards	Assessments	Vocabulary	Primary Resource
The Universe 4 weeks	In the first few minutes after the Big Bang, the first atoms formed. These were mostly hydrogen and helium, with a very small amount of lithium and beryllium. The Sun, however, contains calcium, titanium, and heavier elements. Earth is made up of elements even heavier, such as uranium. Where did these elements come from? How did we get from an initial universe of mostly hydrogen, to a planet rich in metal? By the end of this topic/unit students will be able to answer: What is the Big Bang, and how did it create matter? How do stars fuse matter, and why is this important to Earth's existence? Why is the Sun critical to life on Earth? How do Kepler's laws help us to understand Earth's movements through the solar system? Units within the topic include: The Sun The Big Bang Theory	HS-ESS1-1 Develop a model based on evidence to illustrate the life span of the Sun and the role of nuclear fusion in the Sun's core to release energy that eventually reaches Earth in the form of radiation. 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. HS – ESS1-3 Communicate scientific ideas about the way stars, over their life cycle, produce elements. HS – ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.	CER - Solar energy Modeling and calculating redshift CER - Human elements Proposal - Inner-Outer slingshot gravity Project - Big history timeline	universe core chromosphere photosphere fission fusion galaxy big bang theory redshift spectrum elements orbit Newton's Law Kepler's Law	STEMscopes Bundle 1: The Universe

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	Stars and Elements Kepler's Law				
Earth's History 4 weeks	Due to the erosion and weathering processes on Earth, it is difficult to form a complete story of the history of Earth's surface. However, making comparisons across the solar system can aid in this process. Up until 2014, it was believed that Earth was the only object in the solar system to have plate-tectonic processes, making it difficult to have any comparison of features for this process. Can exploration of Europa give us a better understanding of our own planet's history? By the end of this topic/unit students will be able to answer: What is the theory of plate tectonics? What do we know about the age of crustal rock? What do we not know? What evidence from across the solar system has helped us shape an idea of Earth's formation? What are constructive and destructive forces, and how do they work? What is thermal convection?	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. 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. HS-ESS2-1 Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. HS-ESS2-3 Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.	Lab - Edible plate boundaries Research – Putting the pieces together CER - Plate systems Lab - Cycling of matter Project - Plate tectonics on other planets	lithosphere asthenosphere plate tectonics continental oceanic convergent divergent transform accretion radioactive decay rock record asteroid weathering erosion seismic mantle convection thermal convection	STEMscopes Bundle 2: Earth's History

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	How could another object in the solar system expand our knowledge of Earth's plate tectonics? Units within the topic include: Plate Tectonics Earth's Early History Earth's Formations Energy and Earth Systems				
The Changing Climate 3 weeks	Since the Industrial Revolution, human activities have had a major impact on the climate conditions of the planet, including global warming. Scientists have connected major weather events, such as hurricanes, sea ice decline, and sea level rise, to changes in Earth's global climate. Although blame is placed at the global scale, the regional community response must happen quickly. By the end of the topic/unit students will be able to answer: What are the cause-and-effect events and the feedback responses associated with them? Explain the ways in which Earth's climate is impacted by natural events.	HS – ESS2-2 Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. HS - ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. HS – ESS3-5 Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.	Public Service Announcement CER – Effect of Modern Technology Scenario – Commenting earth's systems CER - CO_2 Research – My climate forecast Project – How climate change has impacted your life	feedback electromagnetic radiation constructive forces orbit reflection convection greenhouse effect climate change global warming carbon footprint carbon sink geological record atmosphere biosphere climate erosion causal relationship correlational relationship human impact	STEMscopes Bundle 3: The Changing Climate

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	How can data be presented in different ways and used to make predictions? Units within the topic include: Earth's feedback systems Energy and climate Impact of climate change				
Water, Carbon, and Organisms 3 weeks	There is debate among scientists as to when we will enter the next ice age. Some believe it is coming soon, and some believe we have postponed it, due to higher levels of carbon dioxide in the atmosphere. This is a tough place to be in! As humans, it would be helpful to know if an ice age is on the way. Will all our knowledge of the properties of water, the carbon cycle, and the coevolution of organisms be applicable? Will certain things change that we need to be aware of? By the end of the topic/unit students will be able to answer: How does water affect Earth, both mechanically and chemically? How does carbon cycle through the hydrosphere, atmosphere, geosphere, and biosphere?	HS – ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. HS – ESS2-6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. HS – ESS2-7 Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.	CER - Effects of water Lab – Growing carbon Investigation – Reefs and erosion	physical processes chemical processes polarity surface tension viscosity weathering cryosphere geosphere hydrosphere carbon cycle oxygen cycle biogeochemical cycles biogeography oxidation succession coevolution	STEMscopes Bundle 4: Water, Carbon and Organisms

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	Why is carbon so important to life on Earth? What initial conditions on Earth allowed for life to evolve? How has the evolution of life on Earth impacted Earth itself? Units within the topic include: Water's role on Earth Carbon and Earth's processes Interactions of organisms and Earth's systems				
Earth's Resources 2 weeks	According to the United States Geological Survey in 2010, 90% of the United States' total daily water usage was consumed by the public supply (12%), irrigation (33%), and thermoelectric power (45%). That year, 355 billion gallons of water were used each day. This is a reduction of 5%, compared to usage in 2005. The reduction is largely due to improved water-use efficiency of technology, and management practices used in irrigation and thermoelectric power. Could introducing a new technology or management practice to your state improve the extraction, management, or use of one of its important natural resources?	HS – ESS3-1 Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. HS – ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. HS – ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.	Research - Human settlements and their connection to water CER - Mining natural resources and cost benefit analysis Project – design and eco- friendly building	natural resources depletion human migration natural hazards scarcity sustainable geopolitical mitigating nonrenewable energy resource extraction social regulations cost-benefit ratio	STEMs copes Bundle 5: Earth's Resources

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	By the end of this topic/unit students will be able to answer: How has this natural resource influenced human activity in the past and today? How is this resource currently extracted, managed, or used? Is this sustainable? What are its impacts on biodiversity? Which technology or management practice do you recommend the government invest in, to minimize the human impacts caused by using this resource? What are the potential costs and risks? What are the potential benefits? How can the proposed technology or practice minimize the impacts of humans on biodiversity, and improve sustainability? Units within the topic include: Human dependence on Earth Resources, sustainability, and biodiversity				
Mitigating Human Impact 2 weeks	According to the Global Footprint Network, if every person on Earth lived like an American, we would require three additional Earths to provide enough food, metal, plastics, and fuel for everyone. Clearly, we only have one	HS - ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. HS – ESS3-6 Use a computational representation to illustrate the relationships	Investigation – The quest for clean water Simulation – Modeling the spheres Presentation – Public Awareness	ecosystem degradation environmental degradation pollution	STEMscopes Bundle 6: Mitigating Human Impact

	Earth. Humanity has an impact on its environment. Sometimes it is positive, but most often it is negative. Can the public be made aware of ways to reduce human impact? By the end of the topic/unit students will be able to answer: What are some ways human consumption affects the environment? What are some ways human waste affects the environment? How could reduction affect human impact? How could recycling affect human impact? Units within the topic include: Environmental solutions Human impacts on Earth's systems	among Earth systems and how those relationships are being modified due to human activity.			