DRAFT ALTERNATE CONTENT EXPECTATIONS FOR EARTH AND SPACE SCIENCE - HIGH SCHOOL (GRADES 9-12)

Topic Bundle: Space Systems

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standards: HS-ESS1-1 and ESS1-3. **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-ESS1-3. Communicate scientific ideas about the way stars, over their life cycle, produce elements.**			
EE.HS-ESS1-1-3: Use a model to observe and describe that reactions inside the Sun release energy as radiation, and some of this radiation reaches Earth.	**EE.HS-ESS1-H.1-3:** Use a model to describe that reactions inside the Sun release energy as radiation, and some of this radiation reaches Earth.	**EE.HS-ESS1-M.1-3:** Use a model to trace the path of solar radiation (as heat and light) from the Sun to Earth.	**EE.HS-ESS1-L.1-3:** Use a model of the Solar System (Sun, Earth, Moon) to identify the Sun as the source of heat and/or light for Earth.

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Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: 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.			
Not applicable	Not applicable	Not applicable	Not applicable

Topic Bundle: Space Systems

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: HS-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.			
EE.HS-ESS1-4: Given scaled models of the Sun, a planet, and its moon, identify that the Sun holds the planet in orbit and the planet holds the moon in orbit due to differences in mass that affect gravitational forces.	**EE.HS-ESS1-H.4:** Given scaled models of the Sun, a planet, and its moon, identify that the Sun holds the planet in orbit and the planet holds the moon in orbit due to differences in mass that affect gravitational forces.	**EE.HS-ESS1-M.4:** Given scaled models or illustrations, identify that planets orbit the Sun because it has greater mass/exerts greater gravitational force.	**EE.HS-ESS1-L.4:** Given scaled models of Earth the moon, identify the moon as the object orbiting Earth.

Topic Bundle: History of Earth

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: HS-ESS1-5, HS-ESS2-1, and HS ESS2-2. **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-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-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.**			
EE.HS-ESS1-5_2-1-2: Use models to identify evidence of past and current tectonic plate movement and explain the relative ages of rocks in Earth's crust.	**EE.HS-ESS1-5_2-1-H.2:** Use models to identify evidence of past and current tectonic plate movement and explain the relative ages of rocks in Earth's crust.	**EE.HS-ESS1-5_2-1-M.2:** Given a simulation or demonstration, identify the effect of tectonic plates colliding (volcano eruptions, earthquake, etc.)	**EE.HS-ESS1-5_2-1-L.2:** Use models to identify, past effects of tectonic plate collisions (i.e., a volcano, earthquakes)

Topic Bundle: History of Earth

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standards: **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-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.**			
EE.HS-ESS1-6-2-3: Use models of the layers of Earth to show that the Earth formed over a long period of time.	**EE.HS-ESS1-H.6-2-3:** Use models of the layers of Earth to show that the Earth formed over a long period of time.	**EE.HS-ESS1-M.6-2-3:** Use a model to identify Earth's crust mantle outer core, and inner core.	**EE.HS-ESS1-L.6-2-3:** Use a model to identify the layer of Earth on which people live.

Topic Bundle: Earth's Systems

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.			
EE.HS-ESS2-5: Use a model simulation, or scenario to describe the effects of water on earth materials (such as soil, sand, rocks, etc.)	**EE.HS-ESS2-H.5:** Use a model, simulation or scenario to describe the effects of water on earth materials (such as soil, sand, rocks, etc.)	**EE.HS-ESS2-M.5:** Use a model or simulation to demonstrate erosion using water and earth materials such as soil or gravel.	**EE.HS-ESS2-L.5:** In a demonstration of water's effect on soil or gravel, identify which material acted on the other (i.e., water washed away the soil).

Topic Bundle: Earth's Systems

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standards: **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.**			
EE.HS-ESS2-6-7: Use a model to describe a simple carbon cycle between two or more Earth systems (hydrosphere, atmosphere, geosphere, and biosphere). *	**EE.HS-ESS2-H.6-7:** Use a model to describe a simple carbon cycle between two or more Earth systems (hydrosphere, atmosphere, geosphere, and biosphere).	**EE.HS-ESS2-M.6-7:** Use a model to describe the dependence on oxygen and/or carbon dioxide between people and plants.	**EE.HS-ESS2-L.6-7:** Use a model or illustration of the interdependency between plants and people to identify that people breathe in oxygen.

*Note that this EE standard is written similarly to LS.HS-LS2-5.

Topic Bundle: Weather and Climate

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standards: HS-ESS3-5 and HS-ESS2-4 **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.** **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.**			
EE.HS-ESS3-5_2-4: Use weather data to describe changes in local, regional, and global climate.	**EE.HS-ESS3-5_2-H.4:** Use weather data to describe changes in local, regional, and global climate.	**EE.HS-ESS3-5_2-M.4:** Use descriptions and illustrations to identify weather patterns in a given region.	**EE.HS-ESS3-5_2-4:** Given weather and non-weather data, identify the weather data.

Topic Bundle: Human Sustainability

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: 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.			
EE.HS-ESS3-1: Use evidence to describe how natural resources, natural hazards, and climate change affect human populations.	**EE.HS-ESS3-H.1:** Use evidence to describe how natural resources, natural hazards, and climate change affect human populations.	**EE.HS-ESS3-M.1:** Given evidence about natural resources or natural hazards in an area, identify one or more positive and/or negative ways that humans may be affected.	**EE.HS-ESS3-L.1:** Given a model, identify a natural resource and/or a natural hazard.

Topic Bundle: Human Sustainability

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standards: HS-ESS3-2 and HS-ESS3-4. **HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.** **HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.**			
EE.HS-ESS3-2-4: Participate in investigations to determine and/or describe a solution that best results in reducing the human impact on a natural resource.	**EE.HS-ESS3-H.2-4:** Participate in investigations to determine and/or describe a solution that best results in reducing the human impact on a natural resource.	**EE.HS-ESS3-M.2-4:** Given a natural resource, identify a human activity that demonstrates conservation or a reduced human impact on that natural resource.	**EE.HS-ESS3-L.2-4:** Match a human activity or behavior to a natural resource it is intended to conserve.

Topic Bundle: Human Sustainability

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standards: **HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.** **HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.**			
EE.HS-ESS3-3-6: As part of exploring the concept of biodiversity, use evidence to describe the effects of human populations on biodiversity and the sustainable use of natural resources (students are not expected to define biodiversity).	**EE.HS-ESS3-H.3-6:** As part of exploring the concept of biodiversity, use evidence to describe the effects of human populations on biodiversity and the sustainable use of natural resources (students are not expected to define biodiversity).	**EE.HS-ESS3-M.3-6:** Given evidence about a human population and a natural resource being used, identify whether the resource will increase, decrease, or remain the same (sustainable use).	**EE.HS-ESS3-L.3-6:** Given a picture of a human development (population), identify a natural resource that is being used.