**Earth and Space Units Outline:**

1. **The Origin of Everything**: Students use prior knowledge and a reference data sheet to create an explanation of the origin of heavy elements like iron, carbon, or calcium. The explanation will encompass the big bang, a star’s life cycle, and stellar fusion. This explanation will then be used to generate a visual model that accurately encompasses their entire explanation.
   1. 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.
   2. 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.
   3. HS-ESS1-3: Communicate scientific ideas about the way stars, over their life cycles, produce elements.
   4. EP 2 - Developing and using models
2. **The History of Planet Earth and Biogeology**: In this PEAT Storyline, the student is talking to his or her aging grandfather, who happens to be a geologist with a bucket list of activities related to Earth’s early history. The student will construct an account of Earth’s formation and early history with an emphasis on scientific supporting evidence and will use evidence and knowledge of plate tectonics to prepare a written explanation of patterns in the ages of crustal rocks.
   1. 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.
   2. 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.
   3. HS-ESS2-7: Construct an argument based on evidence about the simultaneous coevoluton of Earth’s systems and life on Earth.
   4. EP 8 - Obtaining, evaluating, and communicating information
3. **The Flow of Energy in Geology**: ​In this scenario, the student is an entry-level drilling assistant for STEM Oil and Gas. The student will demonstrate that they can model Earth’s interior, model the formation of two actual continental and ocean floor features, and support the claim that one change to Earth’s surface can create feedbacks that cause changes to other Earth systems.
   1. 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.
   2. 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.
   3. HS-ESS2-3: Develop a model based on evidence of Earth’s interior to describe the cycling of matter by thermal convection.
   4. EP 8 - Obtaining, evaluating, and communicating information
4. **The Role of Water in Earth’s Surface Processes**: Students select three properties of water and plan an investigation to identify the relationship between the properties of water and the hydrologic cycle and the rock cycle. Students then work in pairs to conduct one of the investigation plans.
   1. HS-ESS2-5: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
   2. EP 1 - Asking questions (for science) and defining problems (for engineering)
   3. EP 2 - Developing and using models
   4. EP 7 - Engaging in argument from evidence
5. **Orbit and Planet Development**: In this PEAT Storyline scenario, the student is starting a space company whose mission requires knowledge of orbiting object motion. The student will first use a mathematical model to study and describe the motions of two defective communications satellites with very different Earth orbits. The student will then construct a model to explain the effects of changes to Earth’s motion. Lastly, the student will be asked to give a mechanistic account of the effects of these changes in Earth’s motion on Earth’s climate.
   1. HS-ESS1-4: Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
   2. 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.
   3. EP 2 - Developing and using models
   4. EP 4 - Analyzing and interpreting data
6. **Weather and Climate**: In this PEAT, the student is a climate change analyst who routinely reviews scientific reports involving the relationships between changes in climate and changes in Earth’s systems. The PEAT covers four very detailed performance expectations. In Part I, the student will use data to support the claim that one change to Earth’s surface can create feedbacks that cause changes to other Earth systems. In Part II, the student will use a model to communicate a mechanistic account of the relationship between energy flow in Earth’s systems and climate changes in a given scenario. Part III requires the student to develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. Finally, in Part IV, the student constructs an argument based on evidence about the simultaneous coevolution of Earth’s systems and life on Earth.
   1. 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.
   2. HS-ESS2-6: Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
   3. HS-ESS2-7: Construct an argument based on evidence about the simultaneous coevolution of Earth’s systems and life on Earth.
   4. EP 4 - Analyzing and interpreting data
7. **Natural Resource and Transportation Planning**: In this scenario, the student is a high school–aged resident of a small southwestern U.S. town.The student comes across a handwritten story that connects the history of his/her town to ideas about how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. Current events in the town require the student to evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
   1. 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.
   2. HS-ESS3-2: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
   3. EP 1 - Asking questions (for science) and defining problems (for engineering)
   4. EP 8 - Obtaining, evaluating, and communicating information
8. **Natural Hazards Impact**s: The scenario of moving to a new city challenges the student to think about the bigger picture of how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
   1. 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.
   2. EP 3 -Planning and carrying out investigations
   3. EP 4 - Analyzing and interpreting data
   4. EP 7 - Engaging in argument from evidence
9. **Computing Human Impact on Earth’s Systems**: In this PEAT Storyline scenario, the student inherits an island in the Pacific Ocean and realize that they could become the key force in maintaining, changing, or destroying the natural island ecosystem. The student will first create a computational model to understand the relationships among management of natural resources, the sustainability of human populations, and biodiversity on the island. The student will then analyze their computational model and evaluate a technical solution for getting fresh water to the island.
   1. HS-ESS3-3: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
   2. HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
   3. EP 1 - Asking questions (for science) and defining problems (for engineering)
   4. EP 7 - Engaging in argument from evidence
10. **Global Climate Change**: In this PEAT, the student is a member of a recently formed, regional grassroots organization supporting public awareness about climate change. The student’s role in the organization is to identify new resources and strategies to educate the regional population about climate change. The student will analyze and describe a climate simulation and use a model to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
    1. 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.
    2. 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.
    3. EP 3 -Planning and carrying out investigations
    4. EP 8 - Obtaining, evaluating, and communicating information