Phoenixville Area School District Understanding by Design (UbD) Science Template

Grade Level 5 **Unit Name: Earth & Sun Systems** **Authors: K. Parsons, B. Douglas**

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="4">Overarching PA Core or National Standards:

3.2.5.A
Develop a model to describe that matter is made of particles too small to be seen.

3.2.5.D
Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.

3.3.5.A
Support an</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

1. Develop and/or use models
2. Analyze and interpret data using computational thinking
3. Obtain, evaluate, and communicate information (supported by evidence)</td></tr>
<tr><td colspan="2">Meaning-Making</td></tr>
<tr><td>UNDERSTANDINGS
Students will understand that…
• Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means.
• The gravitational force of Earth acting on an object near Earth’s surface pulls that object toward the planet’s center.
• The sun is a star that appears larger and brighter than other stars because it is closer.
• Stars range greatly in their distance from Earth.
• The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns.
o These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.
• Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans).
• The Earth’s systems interact in multiple ways to affect Earth’s surface materials and processes.
• The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate.
• Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.
• Nearly all of Earth’s available water is in the ocean.</td><td>ESSENTIAL QUESTIONS
Students will keep considering...

• How can we predict events based on patterns? For example, what do shadows tell us about daily patterns involving the Earth/Sun system?
• What objects do we observe in our solar system and how do they move in relation to each other?
• What happens outside of our system?
• What is Earth’s atmosphere and what does it have to do with weather?
• How does Earth’s atmosphere heat up?
• How is water distributed over Earth’s surface and atmosphere, how does it</td></tr>
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argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth.	• Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. • Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. • Individuals and communities are doing things to help protect Earth's resources and environments.	move, and what is the effect on Earth?
	Knowledge and Skills Acquisition	

3.3.5.B Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. **3.3.5.C** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. **3.3.5.D** Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution	*Students will know…* • Shadows are the dark areas that result when light is blocked. • Shadows change during the day because the position of the Sun changes in the sky. • The length and direction of a shadow depends on the Sun's position in the sky. • Day is the half of Earth's surface being illuminated by sunlight; night is the half of Earth's surface in its own shadow. • The cyclical change between day and night is the result of Earth's rotating around the stationary Sun, Earth's star. • The solar system includes the Sun, a star, and the objects that orbit it, including Earth, the Moon, seven other planets, their satellites, and smaller objects. • The Moon is much smaller than Earth and orbits at a distance equal to about 30 Earth diameters. • The Sun is 12,000 Earth diameters away from Earth and is more than 100 times larger than Earth. • Gravity is a pulling force between two masses; it is the force that pulls things toward the center of Earth. The pulling force of gravity keeps the planets and other objects in orbit by continuously changing their direction of travel. • A great deal of light travels through space to Earth from the Sun and from distant stars. • Stars are at different distances from Earth. The Sun is the closest star to Earth, so it appears brighter and larger. • The side of Earth facing the Sun is always in daylight; the side facing away from the Sun is always in darkness. Because of the brightness of the Sun, we can only see stars outside our solar system when we are on the dark half of Earth (at night). • Air is a mixture of gases held by gravity near Earth's surface. Air is made of particles too small to see. • Air has mass, takes up space, and is compressible. • Most of Earth's air resides in the troposphere, the layer of the atmosphere closest to Earth's surface. • Weather happens in the troposphere. • Weather is the condition of Earth's atmosphere at a given time in a given place. • Meteorology is the science of weather, and meteorologists are the scientists who study Earth's weather. • Weather is described in terms of several variables. • The Sun is the major source of energy that heats Earth.	*Students will be skilled at… (SEPS)* • Develop a model using an example to describe a scientific principle • Describe and graph quantities such as area and volume to address scientific questions. • Represent data in graphical displays to reveal patterns that indicate relationships. • Support an argument with evidence, data, or a model.

of water on Earth. **3.3.5.E** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. **What branches of science apply:** **PS & ESS**	• The different energy-transferring properties of earth materials (soil and water) can lead to uneven heating of Earth's surface. • The atmosphere is heated by conduction between Earth's surfaces and air particles as a result of contact, and by absorption of energy radiated directly from the Sun and reradiated from Earth's surfaces. • Convection is the circulation of fluid (liquid or gas) that results in energy transfer. • Convection currents are driven by uneven heating of Earth's surface. • A solar water heater is a system that uses solar energy to heat water. • People can protect Earth's resources and environments by using alternative energy sources. • Evaporation and condensation contribute to the movement of water through the water cycle, redistributing water over Earth's surface. • As temperature increases, the rate of evaporation increases. • Most of Earth's water (97%) is salt water in the ocean; Earth's fresh water is found in the atmosphere, lakes and rivers, soil, ground ice, ground water, and glaciers. • The Sun's energy drives weather. • Climate is the average or typical weather that can be expected to occur in a region of Earth's surface. • Earth's climate is changing. <u>KEY VOCABULARY:</u> Planet Orbit Solar System Moon Characteristic Atmosphere Cycle Geosphere Hydrosphere Biosphere Soil Sediment Luminous Stars Axis Constellations Rotate Seasonal Shadow	

Stage 2 – Evidence		
Evaluative Criteria	**Assessment Evidence**	
What criteria will be used in each assessment to evaluate attainment of the desired results? Rubrics related to each will be developed. Criterion 2: Three-Dimensional performance assessments require students to make sense of phenomena and solve problems by using the three dimensions together. Assessment tasks elicit sense-making and problem solving by focusing strongly on reasoning using scientific and engineering evidence, models, and principles.	PERFORMANCE TASK(S): Investigations: I. **Task(s):** Students observe the phenomenon of outdoor shadows. They trace their shadows in the morning and afternoon. They use this information to monitor the position of the Sun as it moves across the sky. After using a compass to orient a Sun tracker, students make hourly records of the position of the shadow cast by a golf tee. Back in the classroom, students use flashlights to reproduce the shadow movements to model how the Sun's position in the sky changes during the day. Students imagine an observer on Earth (their head) and position themselves around a lamp to observe day and night. They discover that rotation of Earth produces day and night. Students put the observed daily movement of the Sun phenomenon together with the phenomenon of day and night and use another model to resolve explanations for both phenomena. **Assessment**: Investigation 1 I-Check II. **Task(s):** Students investigate the phenomena of objects giving off light and others reflecting light in the sky. They take a field trip to the schoolyard to look for the Moon. The class starts a Moon calendar, on which they record the Moon's appearance every day for a month and analyze their observations to discover the sequence of changes. Students grapple with the size and distance relationships among the Moon, Earth, and the Sun, and build a model of the Earth/Moon/Sun system. Based on previous knowledge, information on solar system cards, and information provided by the teacher, students organize a model of the solar system. Gravity is introduced as the force that pulls on planets, changing their direction of travel to produce circular orbits. Students are introduced to constellations as patterns of stars. They simulate Earth's rotation to observe the appearance of stars rising in the east and setting in the west. Students observe a demonstration of why different stars are visible in different seasons. **Assessment**: Investigation 2 I-Check	Differentiation Considerations: For labs, some students may wish to: • Explain verbally instead of in a written format • Draw their responses • Write in their first language If challenges arise with the complexity of the task(s), some students may need: • Additional incremental steps • An alternative activity Other considerations: • When grouping students' various skills sets and strengths will be considered • When asking students to describe a model, opportunities to draw or write it, as well. • Teacher can scribe written responses for students

	III. **Task(s):** Students investigate the phenomenon that air surrounds us—Earth's atmosphere. They explore air by working with syringes and tubes to discover that air takes up space and is compressible. They are introduced to the atmosphere as a mixture of gases with properties that change with altitude above Earth's surface. They review local weather reports and determine the variables that combine to produce the weather. They use a weather station to monitor the weather and look for patterns. **Assessment**: Investigation 3 I-Check IV. **Task(s):** Students investigate the phenomenon of energy transfer on Earth. They investigate uneven heating by recording and graphing temperature changes when two earth materials absorb solar energy. They observe examples of energy transfer by radiation and conduction and discuss mechanisms of energy transfer to and from the air. Students observe convection currents in water as a model of what happens in air. They test different designs for solar water heaters. Students consider how the atmosphere, hydrosphere, and geosphere interact. **Assessment**: Investigation 4 I-Check V. **Task(s):** Students turn to the phenomenon of water on Earth. They consider why Earth is called the water planet. They investigate systems to observe condensation on cold surfaces and determine the components of the water cycle. Students explore the conditions that promote evaporation. They simulate the travels of a drop of water through the water cycle to explore the complexities of the process. Students are introduced to world climate regions and global climate change. This brings students back to the driving question for the module—how do Earth's hydrosphere, geosphere, atmosphere, and biosphere interact to create a sustainable environment for all life? **Assessment**: Investigation 5 I-Check Unit Projects/Activities: 1. Your task is to build/simulate or act out the Earth-Moon-Sun System o Project Rubric	For the project, consider that some students may wish to:

	2. Your task is to write a letter urging an adult you know to conserve water, provide at least 3 reasons why this is important! o Writing/Presentation Rubric OR 3. Consider hosting a "town hall" where students will be assigned a "side" either for water conservation or against it... (teacher facilitates) o Participation Rubric	• explain this verbally or use gestures or other objects to depict this • draw it • create a computer model • Build a 3D model For the letter, consider that some students may wish to: • make a commercial and present it "in person" or on film For the town hall, consider that some students may wish to: • play an alternate role, i.e., timer, fact checker, moderator
What criteria will be used in each assessment to evaluate attainment of the desired results? Rubrics related to each will be developed.	OTHER EVIDENCE: • Checklists of collaborative behaviors in labs and activities • Checklists of collaborative behaviors in class discussions • Daily journal entries • Self-Assessment Rubrics for all performance tasks • Science Notebook o Planet characteristics • TO CONSIDER FOR LATER: UNIT TEST(S)	Differentiation Considerations: For journal entries, consider that some students may wish to: • draw instead of write entries • write in their first language • record verbally instead of in a written format • annotated notes/slide