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

Grade Level &/or HS Subject: Environmental Science   **Unit Name: Human Sustainability**

	Stage 1 Desired Results	
Overarching NGSS & PA Standards: **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-ESS3-6** Use a computational representation to illustrate the relationships among Earth systems and how those relationships	*Transfer*	
	Students will be able to independently use their learning to… Ask questions and/or define problems Develop and/or use models Plan and/or carry out investigations Analyze and interpret data using computational thinking Obtain, evaluate, and communicate information (supported by evidence) Construct explanations and design solutions	
	Meaning-Making	
	Students will understand that… Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition). Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthesis biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.	ESSENTIAL QUESTIONS *Students will keep considering...* How do humans change the planet? How do people model and predict the effects of human activities on Earth's climate?
	Knowledge and Skills Acquisition	
	UNDERSTANDINGS *Students will know…* ESS3.D: Global Climate Change -Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. -Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities.	*Students will be skilled at…* • Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps

are being modified due to human activity. **Which branch(es) of science apply:** **LS PS** ==**E&SS**==	ESS2.D: Weather and Climate -Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. The Living World: Ecosystems -Ecosystems are the result of biotic and abiotic interactions -Energy can be converted from one form to another. The Living World: Biodiversity -Ecosystems have structure and diversity that change over time.	or inconsistencies in the account. • Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. • Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. • Reason abstractly or quantitatively. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. • Define appropriate quantities for the purpose of descriptive modeling.

<div align="center">KEY VOCABULARY</div>

ecosystems and biodiversity
gross primary productivity, net primary productivity, trophic pyramid, biogeochemical cycles, disturbance, resilience, exotic species, invasive species

climate science
global climate change, greenhouse effect, positive feedback loop, negative feedback loop, Kyoto Protocol, carbon sequestering,

		• Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. • Model with mathematics.

Stage 2 – Evidence		
Evaluative Criteria	*Assessment Evidence*	

Project Rubrics
Labs
Quizzes
Tests
	PERFORMANCE TASK(S):
	
	HS-ESS3-5
	• Students organize data (e.g., with graphs) from global climate models (e.g., computational simulations) and climate observations over time that relate to the effect of climate change on the physical parameters or chemical composition of the atmosphere, geosphere, hydrosphere, or cryosphere.
	• Students describe* what each data set represents.
	• Students analyze the data and identify and describe* relationships within the datasets, including:
	    o Changes over time on multiple scales; and
	    o Relationships between quantities in the given data.
	• Students use their analysis of the data to describe* a selected aspect of present or past climate and the associated physical parameters (e.g., temperature, precipitation, sea level) or chemical composition (e.g., ocean pH) of the atmosphere, geosphere, hydrosphere or cryosphere.
	• Students use their analysis of the data to predict the future effect of a selected aspect of climate change on the physical parameters (e.g., temperature, precipitation, sea level) or chemical composition (e.g., ocean pH) of the atmosphere, geosphere, hydrosphere or cryosphere.
	• Students describe* whether the predicted effect on the system is reversible or irreversible.
	• Students identify one source of uncertainty in the prediction of the effect in the future of a selected aspect of climate change.
	• In their interpretation of the data, students:
	    o Make a statement regarding how variation or uncertainty in the data (e.g., limitations, accuracy, any bias in the data resulting from choice of sample, scale, instrumentation, etc.) may affect the interpretation of the data; and
		Differentiation Considerations:

	- Identify the limitations of the models that provided the simulation data and ranges for their predictions. HS-ESS3-6 - Students identify and describe the relevant components of each of the Earth systems modeled in the given computational representation, including system boundaries, initial conditions, inputs and outputs, and relationships that determine the interaction (e.g., the relationship between atmospheric CO_2 and production of photosynthetic biomass and ocean acidification). - Students use the given computational representation of Earth systems to illustrate and describe relationships among at least two of Earth's systems, including how the relevant components in each individual Earth system can drive changes in another, interacting Earth system. - Students use evidence from the computational representation to describe how human activity could affect the relationships between the Earth's systems under consideration. - June	
Question Accuracy Project Rubrics	OTHER EVIDENCE: Optional - Project - Labs - Greenhouse Effect and Surface Temperature Lab - Clues to the Climate Past Lab - Coral Reefs Abiotic Factors Lab - Humans and Global Climate Change Lab - Unit Test - Global Climate Change Test	Differentiation Considerations: