KPBSD - Earth Science Unit 1
Maps, Rocks/Minerals & Earth History

Big Ideas (ML):

1. Life is pervasive throughout the Earth system--in the atmosphere, the hydrosphere, and the lithosphere. (Earth's spheres)
2. Life appeared early in Earth's history and has been intimately involved in the nature of the Earth--i.e. composition of the atmosphere, weathering, carbon cycle, and rock cycle. (Geological History, Pangaea)
3. Earth's materials (rocks and minerals) are formed and may undergo change by certain conditions, such as erosion or metamorphism, and can occur over various amounts of time.
4. Earth scientists use representations and models, such as contour maps and satellite images to help them understand the Earth. (Topographical maps, World map types).
5. The biosphere both shapes and is shaped by the physical environment.
6. Human beings have a unique, large, and growing impact on Earth systems. (Natural Resources, Human Impact on Earth Systems).
7. Scientists use quantitative, qualitative, experimental and non-experimental methods of scientific inquiry to understand the Earth.

Essential Questions:

- How can maps and models be used to understand interactions on earth? Or what are maps and how are they constructed and used?
- What are the basic materials that make up the Earth and how have they changed over time?
- In what ways has Earth changed throughout its history?
- How do questions about our natural world guide our scientific inquiry to help us learn more?
- How can prior knowledge or misconceptions affect the creation of a hypothesis?
- What evidence can be used to show the universe has changed over time?
- What evidence can be used to show the earth has changed over time?
- What are fossils, how are they formed and what are they used for in Geology?
- What are the basic materials that make up the Earth and how have they changed over time?
- How does the sun create and affect the water cycle, climate and weather patterns on Earth?
- What are the biological, internal and external natural forces that shape and change the Earth?
- How do scientists define and use the concept of "theory"?

Vocabulary: Mineral, Hypothesis, Theory, System, Latitude, Longitude, Topographic map, Contour line/interval, Biosphere, Hydrosphere Lithosphere, Geosphere, Atmosphere, Core/mantle/crust, Element, Chemical bonds, Mineral, Streak, Luster, Hardness, crystal, cleavage, Moh's hardness scale, Specific gravity, Mineral Groups, Igneous/Sedimentary/Metamorphic, Intrusive/Extrusive, Lava/Magma, Felsic/Mafic, Sediment, Index Fossil & Fossil, Erosion/Deposition/Compaction/Cementation, Clastic

Students who demonstrate an understanding can:

NGSS Standards:

HS-ESS1-5 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.[Clarification Statement: Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion).] [Assessment Boundary: Assessment does not include memorization of the details of the formation of specific geographic features of Earth's surface.]

HS-ESS1-6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.[Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.]

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.[Clarification Statement: Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion).] [Assessment Boundary: Assessment does not include memorization of the details of the formation of specific geographic features of Earth's surface.]

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. [Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.] [Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.]

HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.[Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids

HS-ESS2-7 Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.[Clarification Statement: Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems, whereby geoscience factors control the evolution of life, which in turn continuously alters Earth's surface. Examples of include how photosynthetic life altered the atmosphere through the production of oxygen, which in turn increased weathering rates and allowed for the evolution of animal life; how

microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants; or how the evolution of corals created reefs that altered patterns of erosion and deposition along coastlines and provided habitats for the evolution of new life forms.] [Assessment Boundary: Assessment does not include a comprehensive understanding of the mechanisms of how the biosphere interacts with all of Earth's other systems.]

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.[Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]

HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.* [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]

HS-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.[Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]

HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*[Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]

ELA Standards:
ELA/Literacy -
RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. ((HS-ESS1-5),(HS-ESS1-6) (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-4)

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS1-5),(HS-ESS1-6) (HS-ESS3-2),(HS-ESS3-4)

WHST.9-12.1 Write arguments focused on discipline-specific content. (HS-ESS1-6) (HS-ESS1-7)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS1-5) (HS-ESS3-1)

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-ESS2-1),(HS-ESS2-4)

***Math Standards**:*
MP.2 Reason abstractly and quantitatively. (HS-ESS1-5),(HS-ESS1-6)(HS-ESS2-1)(HS-ESS2-4)(HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-3),(HS-ESS3-4)

MP.4 Model with mathematics. (HS-ESS2-1), (HS-ESS2-4) (HS-ESS3-3)

HSN-Q.A.1 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. (HS-ESS1-5),(HS-ESS1-6) (HS-ESS2-1),(HS-ESS2-4)(HS-ESS3-1),(HS-ESS3-4)

HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS1-5),(HS-ESS1-6) (HS-ESS3-1),(HS-ESS3-4)

HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS1-5),(HS-ESS1-6) (HS-ESS2-1),(HS-ESS2-4)(HS-ESS2-5)(HS-ESS3-1),(HS-ESS3-4)

HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.

HSA-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (HS-ESS2-1),(HS-ESS2-4)

HSA-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

HSF-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. (HS-ESS1-6)

HSS-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how those variables are related. (HS-ESS1-6)

Learning Targets:
Questioning & Hypothesizing
Researching & Designing Investigations

- What evidence is necessary to answer a question?
- In what ways can we design an investigation to test the question?

Conducting Investigations

- How can the process of an investigation affect the outcome of the results?
- Analyzing, Communicating & Applying
- How does data guide your analysis of an investigation?