

2016 MA STE MS-HS Earth & Space Science

Please direct comments, suggested edits, or additions to: ste@doe.mass.gov
The standards and strand maps are current as of 2016.
(*) denotes integration of technology

Grade 6

Grade 7

5-ESS1-1

6.MS-ESS1-5(MA). Use graphical displays to illustrate that the Earth and its solar system are one of many in the Milky Way galaxy, which is one of billions in the universe. Clarification Statement: Graphical displays can include maps, charts, graphs, or data tables.

Earth and Space Science Strand Map (April 2016)

Comments, and questions to: mathsciencetech@doe.mass.edu.
Materials are available at: www.doe.mass.edu/stem/review.html
Technology/engineering through a practice or core idea.

Grade 8

Earth and Space Science (Gr. 9-10)

8.MS-PS1-1

Math: 8-F.1

Math: F.LE.A.1c

HS-ESS1-1. Use informational text to explain that the life span of the Sun over approximately 10 billion years is a function of nuclear fusion in its core. Communicate that stars through nuclear fusion over their life cycle, produce elements from helium to iron and release energy that eventually reaches the Earth in the form of radiation. State Assessment Boundary: Specific stages of the life of a star, details of many different nucleosynthesis pathways for stars of differing masses, or calculations of energy released are not expected in state assessment.

HS-PS4-1

HS-PS1-8

HS-ESS1-2. Describe the astronomical evidence for the Big Bang theory, including the red shift of light from the motion of distant galaxies as an indication that the universe is currently expanding, the cosmic microwave background as the remnant radiation from the Big Bang, and the observed composition of ordinary matter of the universe, primarily found in stars and interstellar gases, which

1.
Earth's
Place
in the
Universe

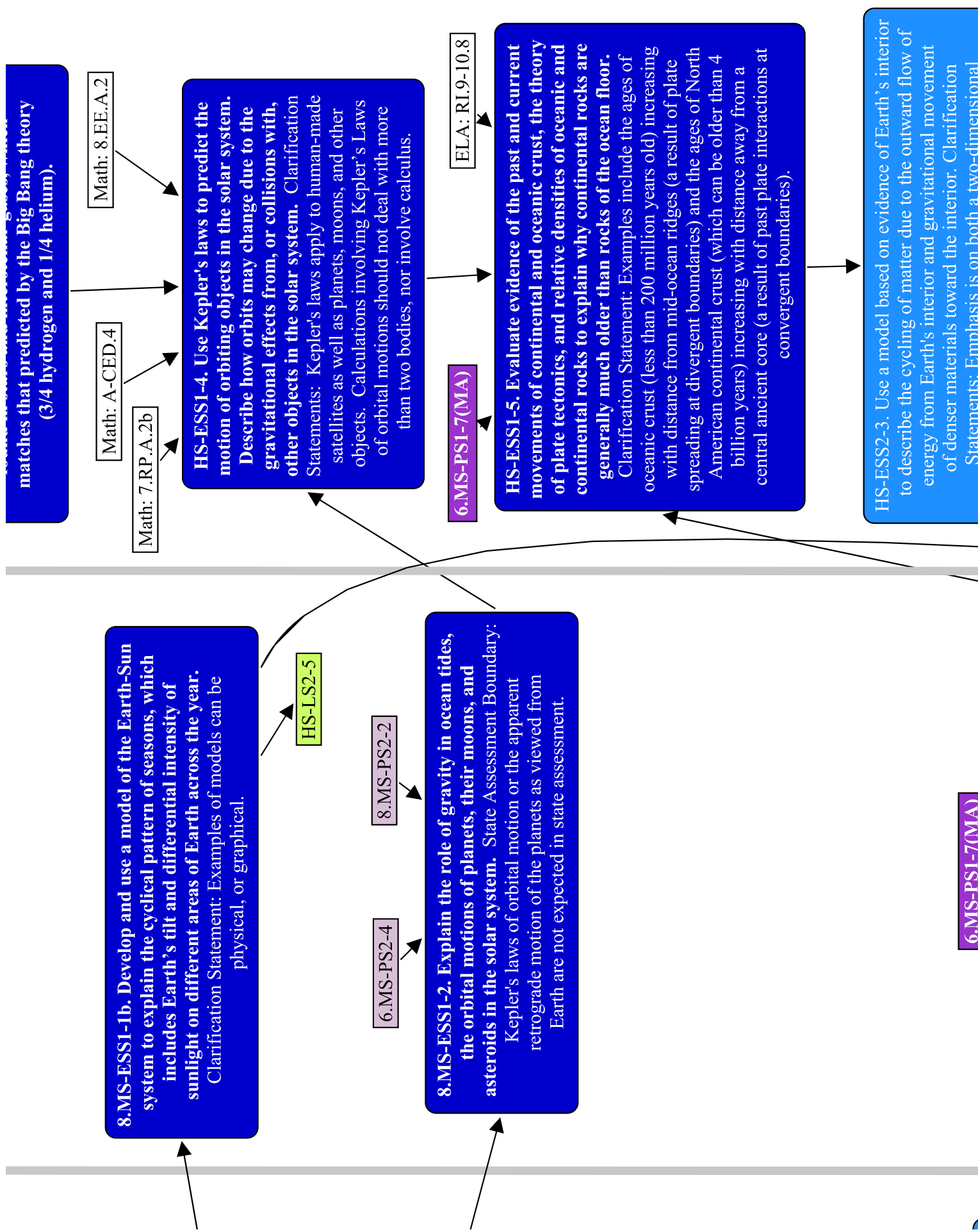
5-ESS1-2

6.MS-ESS1-1a. Develop and use a model of the Earth-Sun-Moon system to explain the causes of lunar phases and eclipses of the Sun and Moon. Clarification Statement: Examples of models can be physical, graphical, or conceptual and should emphasize relative positions and distances.

6.MS-ESS1-4. Analyze and interpret rock layers and index fossils to determine the relative ages of rock formations that result from processes occurring over long periods of time. Clarification Statements: Analysis includes laws of superposition and crosscutting relationships limited to minor displacement faults that offset layers. Processes that occur over long periods of time include changes in rock types through weathering, erosion, heat, and pressure. State Assessment Boundary: Strata sequences that have been reordered or overturned, names of specific periods or epochs and events within them, or the identification and naming of minerals or rock types are not expected in state assessment.

4-ESS2-1

ELA: W.7.9



2. Earth's Systems

4-ESS1-1

4-ESS2-2

6.MS-ESS2-3. Analyze and interpret maps showing the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence that Earth's plates have moved great distances, collided, and spread apart.
Clarification Statement: Maps may show similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches), similar to Wegener's visuals. State Assessment Boundary: Mechanisms for plate motion or paleomagnetic anomalies in oceanic and continental crust are not expected in state assessment.

7.MS-ESS2-2. Construct an explanation based on evidence for how Earth's surface has changed over scales that range from local to global in size. Clarification Statement: Examples of processes occurring over large spatial scales include plate motion, formation of mountains and ocean basins, and ice ages. Examples of changes occurring over small, local spatial scales include earthquakes and seasonal weathering and erosion.

5-ESS2-1

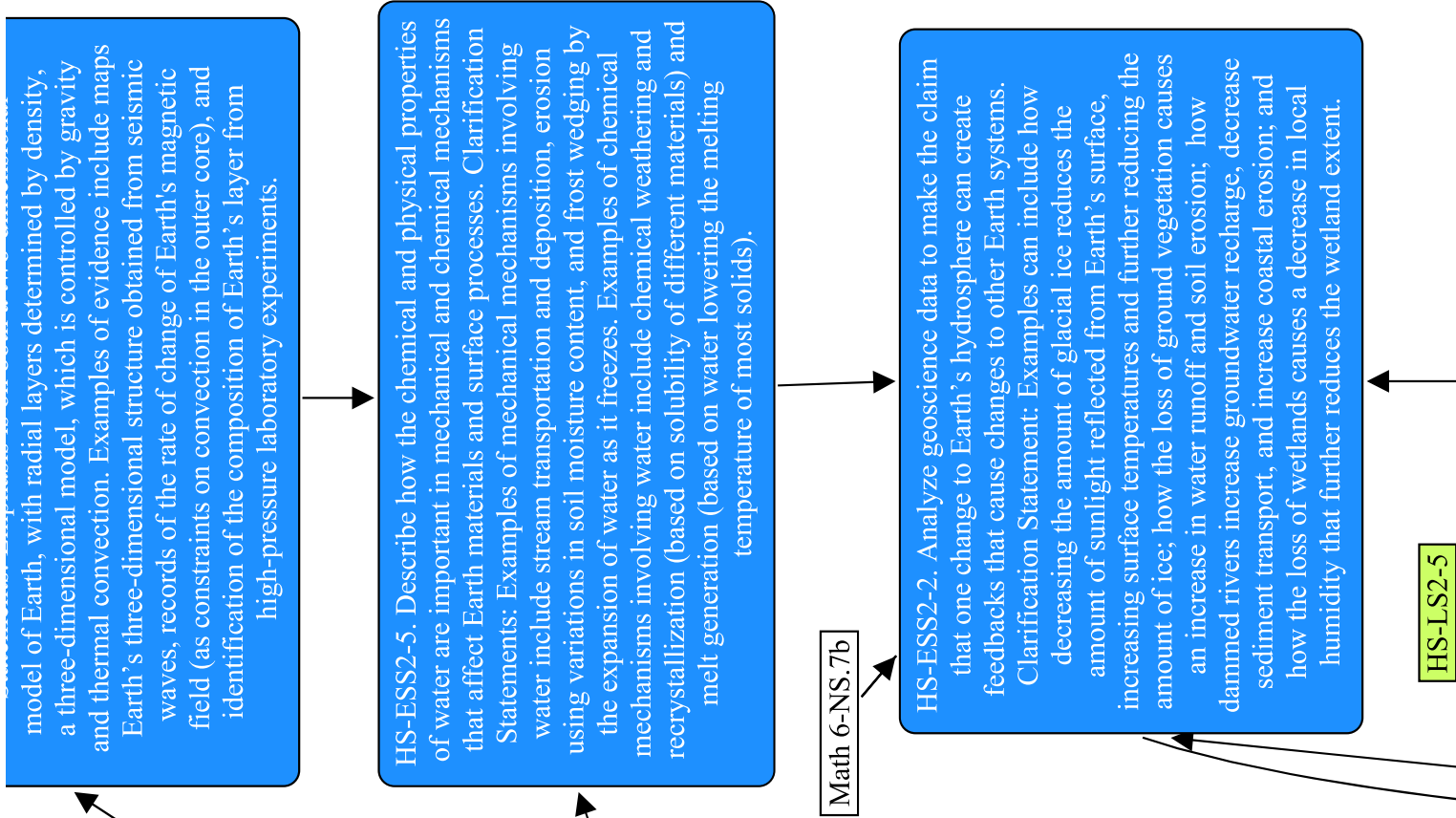
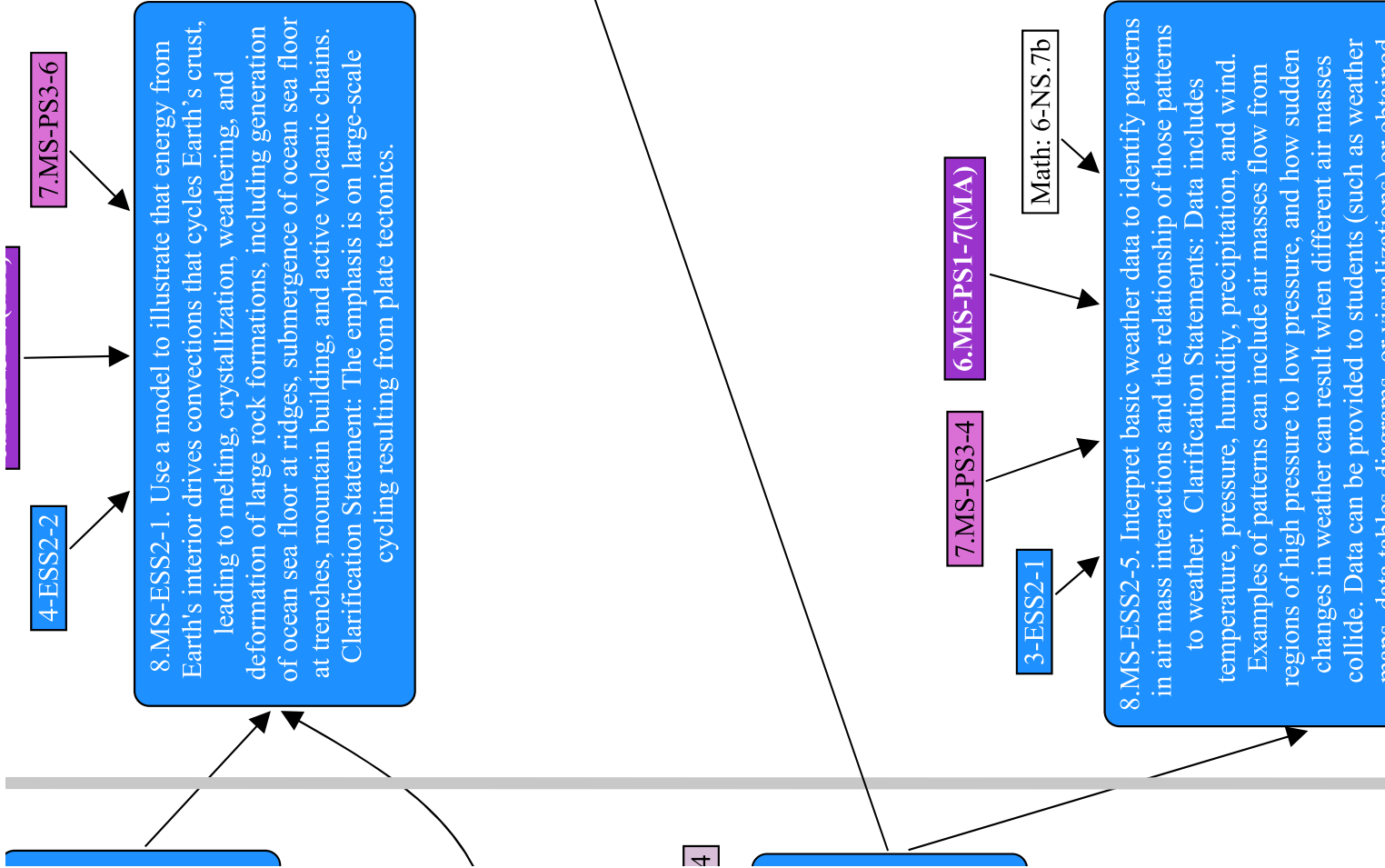
5-PS1-1

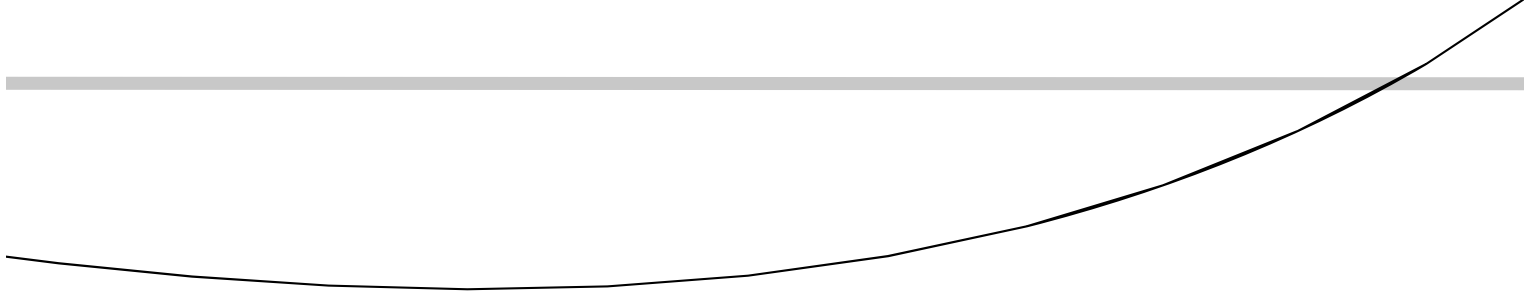
4-PS3-3

5-PS2-1

6.MS-PS2-4

7.MS-ESS2-4. Develop a model to explain how the energy of the Sun and Earth's gravity drive the cycling of water, including changes of state, as it moves through multiple pathways in Earth's hydrosphere. Clarification Statement: Examples of models can be conceptual or physical. State Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not expected in state assessment.





4-ESS3-2

Math: 7-EE.MA.4c

7.MS-ESS3-2. Obtain and communicate information on how data from past geologic events are analyzed for patterns and used to forecast the location and likelihood of future catastrophic events. Clarification Statements: Geologic events include earthquakes, volcanic eruptions, floods, and landslides. Examples of data typically analyzed can include the locations, magnitudes, and frequencies of the natural hazards. State Assessment Boundary: Active analysis of data or forecasting is not expected in state assessment.

maps, data tables, diagrams, or visualizations) of obtained through field observations or laboratory experiments. State Assessment Boundary: Specific names of cloud types, weather symbols used on weather maps are not expected in state assessment.

3-ESS2-2

8.MS-ESS2-6. Describe how interactions involving the ocean affect weather and climate on a regional scale, including the influence of the ocean temperature as mediated by energy input from the Sun and energy loss due to evaporation or redistribution via ocean currents. Clarification Statement: A regional scale includes a state or multi-state perspective. State Assessment Boundary: Koppen Climate Classification names are not expected in state assessment.

4-ESS3-1

Math: 8.F.B.5

8.MS-ESS3-5. Examine and interpret data to describe the role that human activities have played in causing the rise in global temperatures over the past century. Clarification Statements: Examples of human activities include fossil fuel combustion, deforestation, and agricultural activity. Examples of evidence can include tables, graphs, and maps of global and regional temperatures; atmospheric levels of gases such as carbon dioxide and methane; and the rates of human activities.

HS-LS2-7

HS-ESS2-6. Use a model to describe cycling of carbon through the ocean, atmosphere, soil, and biosphere and how increases in carbon dioxide concentrations due to human activity have resulted in gradual atmospheric and climate changes.

Math: 8.F.B.5

HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems over different time scales result in changes in climate. Analyze and interpret data to explain that long-term changes in Earth's tilt and orbit result in cycles of climate change such as Ice Ages. Clarification Statement: Examples of the causes of climate change differ by timescale: large volcanic eruption and ocean circulation over 1-10 years; changes in human activity, ocean circulation and solar output over tens to hundreds of years; changes to Earth's orbit and the orientation of its axis over tens to hundreds of thousands of years; and long-term changes in atmospheric composition over tens to hundreds of millions of years. State Assessment Boundary: Changes in climate will be limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution in state assessment.

Math: 8.F.B.5

HS-ESS3-3. Illustrate relationships among management of natural resources, the sustainability of human populations, and biodiversity. Clarification Statements: Examples of factors related to 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 related to human sustainability include agricultural efficiency, levels of conservation, and urban planning. Examples of factors related to biodiversity include habitat use and fragmentation, and land and resource conservation.

Math: 8.F.B.5

Math: S-IC.2

3. Earth & Human Activity

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5-ESS3-1

4-ESS3-1

7.MS-LS2-5

ELA: WHST.6-8.1

7.MS-ESS3-4. Construct an argument supported by evidence that human activities and technologies can be engineered to mitigate the negative impact of increases in human population and per-capita consumption of natural resources on the environment. Clarification Statements: Arguments should be based on examining historical data such as population graphs, natural resource distribution maps, and water quality studies over time. Examples of negative impacts can include changes to the amount and quality of natural resources such as water, mineral, and energy supplies.

