ILLINOIS STATE BOARD OF EDUCATION

SCIENCE HIGH SCHOOL EARTH & SPACE SCIENCE

Theory of Action: Academic standards represent a collective commitment around what students should learn each year. The state assessment asks students to demonstrate their knowledge, skills, and understanding related to these standards using a common measure. The resulting data allows us to see patterns in performance that should guide school and district improvement, helping identify areas of strength and opportunity.

Role of Performance Level Descriptors in Defining Proficiency: Performance level descriptors bridge the state assessment to classroom instruction and the systems of formative assessments that guide local instruction and choices about individual students. *Academic proficiency represents a range of observable student performance characteristics*. There are multiple pathways to proficiency, and students rely upon their strengths differently within that range of performance.

Proficiency and Difficulty: A student's ability to demonstrate proficiency is influenced by the complexity of the texts or stimuli presented, tasks they're asked to complete, and the contexts in which they are engaged. As student performance improves, students are typically able to handle more challenging texts/stimuli, tasks, and contexts, and are able to demonstrate their skills and knowledge more accurately and consistently.

Earth and Space Science *Student performance indicates the ability to…*

HS-ESS1-1	Below Proficient	Approaching Proficient	Proficient	Above Proficient
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. **SEPs**: Developing and using models **DCI**: ESS1.A: The Universe and Its Stars **CCCs**: Energy and matter; Scale, proportion, and quantity **ACT Integrations**: Scientific Investigation, Interpretation of Data	Identify the sun as a source of energy but may not yet connect this to nuclear fusion or stellar life stages. Attempt to describe solar processes but may confuse fusion with unrelated phenomena or provide inaccurate details. May not connect scientific evidence or models to energy production in the sun. May omit or misrepresent how energy reaches Earth or why the sun's mass and structure matter. *For example, state that "the sun burns" or "gives off light" without explaining how or why energy is produced inside the sun.*	Construct basic models showing that the sun generates energy through a process involving atomic interactions. Describe the idea that the sun undergoes changes over time but provide incomplete or generalized explanations of its lifespan. Recognize that energy from the sun affects Earth but may not connect this to nuclear fusion or interior processes. Reference components of models, such as "core" or "heat," with only partial accuracy. *For instance, state that "the sun makes energy" without identifying the role of hydrogen fusion or the process through which energy is released and travels.*	Develop accurate models to show that nuclear fusion in the sun's core produces energy that is transferred outward and reaches Earth. Describe the main stages in the sun's life span, including current hydrogen fusion and future phases like red giant expansion. Use evidence from solar observations to explain how fusion maintains the sun's stability and provides energy to the solar system. Represent the movement of energy from the core to the surface using labeled diagrams or written models. *For example, explain that in the sun's current stage, hydrogen atoms fuse into helium under high pressure and temperature, releasing light and heat that affect Earth's systems.*	Develop complex models that accurately represent how nuclear fusion reactions in the sun's core release energy throughout its life cycle. Apply evidence from observations of stellar evolution to predict changes in solar energy output over billions of years. Explain, with precise detail, how the sun's mass influences the type and duration of fusion processes that occur at different stages in its lifespan. Justify the transfer of solar energy to Earth using principles of energy conservation and system modeling. *For example, describe how hydrogen nuclei fuse to form helium in the sun's core, releasing energy that radiates outward and eventually reaches Earth, influencing atmospheric and climate systems.*

HS-ESS1-2	Below Proficient	Approaching Proficient	Proficient	Above Proficient
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. **SEPs**: Constructing explanations and designing solutions **DCI: ESS1.A**: The Universe and Its Stars **CCCs**: Scale, proportion, and quantity; Patterns **ACT Integrations**: Evaluation of Models/Claims, Interpretation of Data	Identify the Big Bang as a theory for the origin of the universe but may not refer to supporting evidence. May provide claims that lack accuracy or confuse light, spectra, or galaxy motion with unrelated ideas. May not construct explanations or may misinterpret data related to cosmological evidence. *For example, state that the Big Bang “caused stars to explode” or mix up galaxy motion with gravity in the solar system.*	Describe components of the Big Bang theory but provide limited or incomplete explanations of supporting evidence. Recognize that galaxies are moving apart but struggle to explain how redshift or elemental abundance supports expansion. Attempt to interpret spectral data but misapply or misunderstand key relationships. *For instance, state that galaxies are “spreading out” without linking this to observed spectral shifts or underlying physics.*	Construct explanations of the Big Bang theory using evidence from astronomical observations, such as the redshift of distant galaxies and the distribution of elements like hydrogen and helium. Describe how light spectra provide information about the motion and composition of celestial bodies. Use reasoning to connect the Doppler effect to the idea that the universe is expanding. *For example, explain how shifts in light wavelengths indicate that distant galaxies are moving away, supporting the idea of a common origin point.*	Construct detailed explanations of the Big Bang theory by integrating evidence from redshift, cosmic microwave background radiation, and elemental abundance. Analyze data to explain how the motion of galaxies supports the expansion of the universe over time. Justify the use of the wave model of light and spectral line shifts to support claims about universal origin. Evaluate alternative cosmological models and explain why the Big Bang theory is most consistent with current observations. *For example, describe how redshift patterns show galaxies are moving away in all directions, consistent with the rapid expansion from a single point.*

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HS-ESS1-3	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Communicate scientific ideas about the way stars, over their life cycle, produce elements. **SEPs:** Obtaining, evaluating, and communicating information. **DCI:** ESS1.A: The Universe and Its Stars **CCCs:** Energy and matter; Stability and change **ACT Integrations:** Scientific Investigation, Evaluation of Models/Claims	State that stars change over time but may not identify element production or nuclear fusion. May make statements that confuse fusion with other processes like fission or chemical reactions. Communicate ideas but may lack clear structure, detail, or scientific accuracy. *For example, describe stars as "burning" and creating heat but omit mention of fusion or specific element formation.*	Describe that stars produce elements but provide only basic or partial explanations of how this happens. Identify general stages in stellar life cycles but lack detail about fusion processes or element production. May use scientific vocabulary inconsistently or inaccurately when providing explanations. *For instance, state that "stars make elements" without specifying when or how in the life cycle those processes occur.*	Communicate the idea that nuclear fusion in stars creates elements and that different stages in a star's life correspond to the formation of different elements. Describe how hydrogen fusion leads to helium and, in more massive stars, results in the creation of heavier elements. Use appropriate terminology and sequencing to describe stellar evolution. *For example, explain that elements up to iron are formed in stars through fusion, and heavier elements form during explosive events like supernovae.*	Communicate how stars of different masses undergo fusion to produce progressively heavier elements, ending in events such as supernovae or neutron star mergers. Compare stellar processes in low-mass vs. high-mass stars using precise vocabulary and well-supported claims. Explain how fusion and element production relate to energy transformations and system stability. *For example, describe how a supernova explosion disperses heavy elements like iron and uranium, enriching interstellar matter for future star formation.*

HS-ESS1-4	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. **SEPs**: Using mathematics and computational thinking **DCI: ESS1.B**: Earth and the Solar System **CCCs**: Scale, proportion, and quantity; Systems and system models **ACT Integrations**: Interpretation of Data, Scientific Investigation	Identify that planets orbit the sun but may not explain or model how. May make statements that demonstrate a misunderstanding of gravitational forces or motion relationships. May attempt to use math or representations but may provide inaccurate or unsupported predictions. *For example, suggest that heavier planets move faster or that orbiting is caused by momentum alone, without reference to gravity.*	Use simplified equations or models to describe general patterns of planetary motion. Recognize that gravity affects orbit but make errors in applying formulas or interpreting results. Describe orbital motion qualitatively without full quantitative support. *For instance, state that “planets move because of gravity” but provide an incorrect or incomplete model of how or why the motion is sustained.*	Apply mathematical models to describe and predict the motion of orbiting objects using Newton’s law of gravitation and basic orbital formulas. Calculate orbital periods or velocities for objects in circular or elliptical orbits. Represent gravitational relationships between mass, distance, and orbital motion. *For example, use the formula for gravitational force to explain how Earth's gravity keeps the Moon in orbit and predict changes if distance increased.*	Use mathematical formulas and computational simulations to accurately predict orbital paths and speeds based on mass and distance. Model gravitational interactions between planets, moons, or artificial satellites and describe how forces affect orbital stability. Explain variations in orbit shape and speed using Kepler’s laws and Newtonian mechanics. *For example, calculate the orbital period of a moon around a gas giant and predict how changes in mass or orbital radius would alter that period.*

HS-ESS2-1	Below Proficient	Approaching Proficient	Proficient	Above Proficient
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. **SEPs**: Developing and using models **DCI: ESS2.A**: Earth Materials and Systems **CCCs**: Scale, proportion, and quantity; Stability and change **ACT Integrations**: Scientific Investigation, Interpretation of Data	Identify basic Earth features or events but may not model or explain how they are formed. May provide minimal or incorrect connections between surface processes and internal dynamics. May use static or inaccurate models that miss key spatial and temporal components. *For example, describe volcanoes forming "from inside the Earth" without connecting to subduction or mantle convection.*	Describe internal and surface processes and provide basic models of landform formation. Recognize that some processes take longer or occur on larger scales than others but may not fully show how they interact. Provide partial or simplified models with limited integration of system dynamics. *For instance, state that earthquakes make mountains without explaining plate interactions or timescale differences.*	Develop models that illustrate how Earth's surface and internal processes build and reshape landforms. Show how processes like volcanism, plate motion, and erosion operate over different timescales and spatial extents. Represent how tectonic and surface forces interact to form mountain ranges, trenches, or ocean basins. *For example, explain how continental collisions cause mountain building while erosion reshapes those features over time.*	Develop integrated models that show interactions between tectonic forces, erosion, deposition, and mantle convection. Explain how internal processes (e.g., subduction, uplift) and surface processes (e.g., weathering, sedimentation) act over varying time and spatial scales. Use evidence from geologic structures, topographic maps, and satellite imagery to support modeling. *For example, model how seafloor spreading at mid-ocean ridges interacts with continental uplift to shape coastlines over millions of years.*

HS-ESS2-2	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. **SEPs**: Analyzing and interpreting data **DCI: ESS2.A**: Earth Materials and Systems; **ESS2.C**: The Roles of Water in Earth's Surface Processes **CCCs**: Cause and effect; Systems and system models **ACT Integrations**: Data Representation, Scientific Investigation	Identify surface events but may not explain system connections or use data to support claims. Provide examples of feedback between systems that may be unrelated or inaccurate. *For example, mention floods without connecting them to changes in land use or climate systems.*	Describe examples of surface changes and suggest possible effects on other systems but may not support claims with data. Use limited cause-effect reasoning and provide incomplete or undeveloped feedback examples. *For instance, state that "cutting trees changes the land" without identifying how it affects weather, runoff, or habitats.*	Use geoscience data to support claims that changes in one Earth system can influence others. Explain interactions such as erosion leading to increased sediment in rivers, which alters aquatic ecosystems. Identify system feedbacks and use evidence to support cause-effect reasoning. *For example, describe how volcanic eruptions release gases that change atmospheric conditions and affect global climate.*	Analyze data sets from multiple Earth systems to identify feedback loops and long-term system responses. Justify claims about surface change—such as deforestation, glacial melting, or volcanic eruptions—by tracing cascading effects across hydrosphere, atmosphere, and biosphere. Evaluate both positive and negative feedback and apply evidence to support system-level claims. *For example, explain how ice melt reduces albedo, increasing surface temperature and accelerating further melting.*

HS-ESS2-3	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. **SEPs:** Developing and using models **DCI: ESS2.A**: Earth Materials and Systems **CCCs**: Energy and matter; Systems and system models **ACT Integrations**: Scientific Investigation, Interpretation of Data	Identify that Earth's interior is hot but may not explain how heat drives movement. May provide models that are inaccurate or lack essential components such as density, direction of flow, or layer boundaries. May not explain how Earth's interior contributes to surface changes. *For example, mention that "volcanoes come from inside Earth" without modeling or connecting to mantle convection.*	Describe convection within Earth's interior in general terms and may provide partial or simplified models. Recognize that heat causes movement of materials but may not fully link this to rock cycling or plate motion. Reference mantle or core layers inconsistently or with limited accuracy. *For instance, say "hot magma moves" without distinguishing between magma and mantle convection or explaining the cyclical nature.*	Create models that illustrate how thermal energy from Earth's interior causes mantle material to rise and sink in convection currents. Describe how convection results in the cycling of solid and molten rock within the mantle. Represent energy flow and material movement between Earth's inner layers and the lithosphere. *For example, use arrows in a cross-section diagram to show how hot rock rises and cooler rock descends, forming a convection cell.*	Develop a model showing how differences in temperature and density within Earth's interior cause cycling of mantle material through convection. Use evidence from seismology, volcanism, and plate movement to support representations of matter and energy flow. Explain how these convective cycles contribute to tectonic activity, including subduction and seafloor spreading. *For example, model how heated mantle rock rises at mid-ocean ridges, cools and sinks at subduction zones, and drives plate motion.*

HS-ESS2-4	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Use a model to describe how variations in the flow of energy into and out of Earth's systems result in climate changes. **SEPs**: Developing and using models **DCI: ESS2.D**: Weather and Climate **CCCs**: Energy and matter; Stability and change; Systems and system models **ACT Integrations**: Scientific Investigation, Interpretation of Data	Identify that Earth's temperature changes but may not link this to energy flow or climate systems. Provide models that may be incorrect or incomplete and may omit system boundaries or relevant variables. *For example, suggest that the "ozone layer causes warming" or that weather events are long-term climate changes.*	Describe that Earth's climate changes with energy flow but may model or explain relationships in a limited way. Mention greenhouse gases or the sun's energy but may not connect inputs and outputs in a full system. *For instance, state that "more sun makes Earth hotter" without including atmospheric interactions or long-term patterns.*	Use models to show that changes in the amount of energy entering or leaving Earth's atmosphere affect global climate. Explain how factors such as greenhouse gases and cloud cover influence the energy budget and contribute to warming or cooling trends. Describe system interactions and apply cause-effect reasoning within the model. *For example, explain that more greenhouse gases trap heat, leading to an increase in average global temperatures.*	Use models to analyze how changes in solar radiation, greenhouse gas concentration, and Earth's reflectivity affect global energy balance. Illustrate long-term climate trends and feedback loops such as polar ice-albedo effects or increased water vapor. Integrate human and natural variables into climate models and explain implications for system stability. *For example, simulate how increased CO_2 traps more outgoing infrared radiation, raising global temperatures and intensifying feedback loops.*

HS-ESS2-5	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. **SEPs**: Planning and carrying out investigations **DCI: ESS2.C**: The Roles of Water in Earth's Surface Processes **CCCs**: Cause and effect; Energy and matter; Stability and change **ACT Integrations**: Scientific Investigation, Interpretation of Data	Attempt an investigation but may not show clear understanding of water's role or properties. May make claims that are vague or that are not supported with evidence or correct reasoning. *For example, state that "water made the rock disappear" without describing the process or measuring effects.*	Conduct investigations that observe the effects of water on Earth materials but provide limited explanations of underlying properties. Describe observations (e.g., "water made the sand move") without connecting to properties like viscosity or energy transfer. *For instance, show that soil erodes but may not explain how water's velocity or content changes the process.*	Plan and carry out investigations to demonstrate how water contributes to surface processes like erosion or chemical weathering. Identify and explain relevant properties such as cohesion, temperature change, and solubility. Analyze data to explain how water interacts with different Earth materials over time. *For example, observe how running water carries and deposits sediments, shaping stream channels or beaches.*	Design and conduct investigations that examine multiple properties of water—such as heat capacity, density, and solvent ability—and their role in erosion, weathering, or sediment transport. Collect quantitative data and analyze results to explain how water's unique behavior affects landform development. Demonstrate understanding of system interactions, feedbacks, and energy transfer. *For example, test how freeze-thaw cycles break down rock and explain how water's expansion during freezing contributes to mechanical weathering.*

HS-ESS2-6	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. **SEPs**: Using mathematics and computational thinking; Developing and using models **DCI: ESS2.D**: Weather and Climate; ESS3.D: Global Climate Change **CCCs**: Energy and matter; Systems and system models **ACT Integrations**: Data Representation, Scientific Investigation	Identify carbon as part of nature but may not represent how it moves or is cycled. Provide vague descriptions such as "carbon is created by plants." May provide explanations that omit mathematical or systems thinking. *For example, list carbon sources without modeling how carbon is exchanged or stored.*	Describe parts of the carbon cycle and attempt to model movement between systems with limited accuracy or quantification. Mention carbon processes but leave out rates, feedbacks, or major system interactions. *For instance, say "plants use carbon" without explaining how this connects to other reservoirs or climate systems.*	Create models that show how carbon is stored and transferred between Earth's major systems. Represent key processes such as photosynthesis, respiration, decomposition, combustion, and sedimentation. Explain how carbon moves through living and nonliving systems over time. *For example, describe how plants absorb atmospheric carbon during photosynthesis and return it during respiration or decomposition.*	Develop quantitative models that track carbon movement through reservoirs like oceans, atmosphere, soil, and living organisms using accurate flow rates. Integrate anthropogenic and natural factors, including fossil fuel combustion, deforestation, and volcanic activity, into the carbon cycle model. Use system feedback reasoning to explain how disruptions in one part of the cycle affect the others. *For example, model how increased carbon emissions reduce ocean pH through higher absorption rates, which then affects marine life and sediment storage.*

HS-ESS3-1	Below Proficient	Approaching Proficient	Proficient	Above Proficient
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. **SEPs**: Constructing explanations and designing solutions **DCI: ESS3.A**: Natural Resources; ESS3.B: Natural Hazards **CCCs**: Cause and effect; Systems and system models **ACT Integrations**: Scientific Investigation, Interpretation of Data	Mention resources or hazards but may not to connect them to human behavior. May provide explanations that are vague or that do not include scientific evidence or causal reasoning. *For example, may make general statements such as "volcanoes are dangerous, so people stay inside" without providing any scientific evidence or support.*	Identify general relationships between climate, hazards, or resources and human actions, but may provide incomplete or unsupported explanations. Mention events or patterns without analyzing their influence on human systems. *For instance, state that "floods cause people to move" without identifying long-term effects or data support.*	Explain how natural resources and hazards influence where and how people live and work. Use examples such as resource-rich areas encouraging industrial growth or high-risk zones deterring development. Support claims with scientific reasoning and evidence. *For example, describe how coal deposits historically influenced settlement patterns in Appalachia.*	Construct well-supported explanations of how climate shifts, resource distributions, and natural disasters have shaped historical and contemporary human systems. Use case studies and datasets to show how hazard frequency, water availability, or soil fertility influence land use, migration, or policy. Include spatial and temporal data to connect systems thinking across scales. *For example, explain how long-term drought patterns led to agricultural relocation or urban planning adaptations in the southwestern U.S.*

HS-ESS3-2	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. **SEPs**: Engaging in argument from evidence; Constructing explanations and designing solutions **DCI: ESS3.A**: Natural Resources **CCCs**: Cause and effect; Systems and system models; Stability and change **ACT Integrations**: Evaluation of Models/Claims, Scientific Reasoning	Mention energy or resource strategies but may not evaluate them based on evidence. Provide opinions but may not provide any evidence to support those opinions, or may include vague or inaccurate statements as evidence. *For example, state that "mining is bad" without context or comparison.*	Identify benefits or drawbacks of resource strategies but provide limited analysis or evidence. Make general claims without quantitative support or detailed comparisons. *For instance, say "solar is better for the environment" without explaining trade-offs like land use or production costs.*	Evaluate at least two potential solutions for energy or mineral use based on cost, efficiency, and environmental trade-offs. Identify pros and cons and use evidence to support claims about which solution is more sustainable or effective. Apply systems reasoning to understand unintended consequences or feedbacks. *For example, explain why wind energy may be more sustainable than coal based on cost over time and emission reductions.*	Evaluate multiple solutions for resource management using environmental impact data, cost-benefit analyses, and life cycle assessments. Consider short- and long-term consequences of resource extraction and use, including sustainability, economic viability, and ecosystem health. Argue for optimal solutions using evidence from real-world case studies and apply trade-off reasoning. *For example, compare fracking and solar panel installation by assessing economic returns, water use, carbon emissions, and public health impacts.*

HS-ESS3-3	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. **SEPs**: Using mathematics and computational thinking **DCI: ESS3.A**: Natural Resources; ESS3.C: Human Impacts on Earth Systems **CCCs**: Systems and system models; Stability and change; Cause and effect **ACT Integrations**: Data Representation, Scientific Investigation	Mention resource use or population growth but may not use simulations to connect these to biodiversity. May misinterpret cause-effect relationships or offer inaccurate reasoning. *For example, state that "cutting trees helps animals by making space for farms" without modeling or supporting logic.*	Construct simple simulations or describe how changes in one variable (e.g., population) affect others (e.g., resources). Provide limited interpretation of results or fail to explain long-term implications. *For instance, show that more people need more water but not connect this to habitat degradation or species loss.*	Create or interpret simulations that demonstrate how human resource use affects population support and biodiversity levels. Represent key variables such as population size, consumption rate, and habitat area. Use simulation results to draw conclusions about long-term impacts and trade-offs. *For example, model how increased land use for agriculture can support human populations short-term but decrease native species diversity.*	Create simulations that show interactions between population growth, resource consumption, and biodiversity outcomes under multiple scenarios. Use feedback mechanisms, such as habitat loss or pollution accumulation, to predict tipping points and sustainability thresholds. Adjust variables and justify conclusions using quantitative outputs and ecological reasoning. *For example, simulate how overfishing reduces marine biodiversity and impacts future food security under varying regulation levels.*

HS-ESS3-4	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. **SEPs**: Constructing explanations and designing solutions **DCI: ESS3.C**: Human Impacts on Earth Systems **CCCs**: Cause and effect; Systems and system models **ACT Integrations**: Evaluation of Models/Claims, Scientific Reasoning	Mention technologies like solar panels or recycling but may not explain their effectiveness or propose design improvements. Make generalized claims without connection to systems reasoning. *For example, state that "technology can fix the environment" without explaining how or offering evidence.*	Describe technological efforts to reduce environmental harm but provide vague or unsupported evaluations. Offer design changes without explaining how they affect system function or reduce impacts. *For instance, suggest "planting more trees" without considering site limitations or growth factors.*	Evaluate technological solutions (e.g., carbon capture, solar panels, green infrastructure) based on their effectiveness in reducing human impacts. Identify limitations and propose refinements based on system needs or environmental performance. Use cause-effect reasoning to support design recommendations. *For example, assess how permeable pavement reduces stormwater runoff and suggest improvements to extend its durability.*	Evaluate the effectiveness of environmental technologies using performance data, efficiency metrics, and ecological impact reports. Refine a proposed or existing design by modifying variables to optimize sustainability and minimize unintended consequences. Justify refinements using system modeling and trade-off analysis. *For example, revise a green roof design to increase runoff absorption and reduce heat island effect while minimizing cost and maintenance.*

HS-ESS3-5	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of climate change and associated future impacts to Earth systems. **SEPs**: Analyzing and interpreting data **DCI: ESS3.D**: Global Climate Change **CCCs**: Stability and change; Cause and effect; Systems and system models **ACT Integrations**: Data Representation, Interpretation of Data	State that climate is changing but may not support with data or explain implications. May provide examples that are inaccurate or unrelated (e.g., confusing daily weather with long-term trends). *For example, suggest that a cold winter disproves global warming.*	Refer to climate data or models but may not clearly interpret trends or forecast impacts. Mention general climate effects (e.g., warming) but provide limited reasoning or evidence. *For instance, state that "the Earth is getting hotter" without referencing supporting data or specific impacts.*	Use evidence from climate data and model results to explain current climate trends and potential impacts on Earth systems. Interpret outputs to identify changes such as temperature rise, glacial melt, or shifting ecosystems. Support forecasts with logical cause-effect reasoning and scientific context. *For example, explain how rising sea surface temperatures may intensify hurricane strength in coming decades.*	Analyze geoscience data trends and global climate model outputs to forecast climate-related changes in atmospheric, hydro spheric, and bio spheric systems. Justify conclusions using multi-decade datasets, IPCC scenarios, and model projections. Predict likely outcomes such as sea-level rise, drought frequency, or species migration based on specific model assumptions. *For example, forecast agricultural shifts in a region using temperature, precipitation, and carbon concentration projections.*

HS-ESS3-6	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. **SEPs**: Using mathematics and computational thinking **DCI: ESS3.C**: Human Impacts on Earth Systems **CCCs**: Systems and system models; Stability and change **ACT Integrations**: Scientific Investigation, Interpretation of Data	Attempt to show Earth systems but may not model relationships accurately. May not connect human activities to system-level changes or use computational reasoning. *For example, draw unrelated parts of the environment without showing how they interact or change.*	Create basic representations of Earth systems but may not show detailed relationships or model human modifications. Identify some effects of human activity but may omit important system interactions or variables. *For instance, state that "pollution affects the ocean" without connecting this to temperature, oxygen levels, or food webs.*	Create computational representations of how changes in one Earth system (e.g., atmosphere) influence others (e.g., hydrosphere, biosphere) due to human activity. Describe the role of feedback and apply cause-effect reasoning to predict outcomes. *For example, simulate how deforestation affects carbon storage, climate, and water availability in ecosystems.*	Use advanced computational models to show how human activities alter Earth system interactions such as carbon cycling, energy flow, and water distribution. Represent feedback loops and non-linear changes, like thresholds or tipping points. Predict long-term effects using scenarios with varied human inputs and policy outcomes. Justify conclusions using data trends and system behavior. *For example, simulate how deforestation affects atmospheric* CO_2*, which alters temperature, which further affects ecosystems and land use.*