

## 1. Connect the relationship between cause and effect to how it impacts the balance of physical processes.

| Student can...                                                                                                                                        | 4                                                                                                                                                            | 3                                                                                                                                                      | 2                                                                                                                            | 1                                                                                                                          |
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| 1.1: Construct an evidence-based argument that relates the effect of changes in the environment to features of human societies.                       | I can evaluate how technological advancements have mitigated the cause and effect relationship between the development of human society and the environment. | I can construct an evidence-based argument that relates the effect of changes in the environment to features of human societies.                       | I can analyze how the changes in the environment have impacted human activity.                                               | I can identify specific cause and effect relationships between environmental factors and features of human societies       |
| 1.2: Construct an evidence-based forecast to predict how the rate and impacts of climate change affect the physical or chemical composition of Earth. | I can evaluate how variation and uncertainty of climate data affects interpretations and predictions.                                                        | I can construct an evidence-based forecast to predict how the rate and impacts of climate change affect the physical or chemical composition of Earth. | I can identify trends and changes over time for global and regional climate data.                                            | I can use global climate models and observations to relate the effect of climate change on Earth's surface and atmosphere. |
| 1.3: Connect how human activity could affect the relationships between the Earth's systems.                                                           | I can predict how changes, caused by humans, in the components of one of Earth systems can drive changes in another, interacting Earth system.               | I can connect how human activity could affect the relationships between the Earth's systems.                                                           | I can interpret relationships that determine interactions between Earth's systems and support those relationships with data. | I can describe the relevant components and conditions of Earth's systems.                                                  |

## 2. Analyze and apply how energy transfers and transforms within and across physical processes.

| Student can...                                                                                               | 4                                                                                     | 3                                                                                                             | 2                                                                                                                             | 1                                                             |
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| 2.1 Apply the concept of conservation of energy in a closed system.                                          | I can predict what will happen when energy is added to molecules in a closed systems. | I can apply the concept of conservation of energy in a closed system.                                         | I can describe how energy at the observable scale is related to motions and positions of particles at the unobservable scale. | I can identify forms of energy within a closed system.        |
| 2.2 Analyze how variations in the flow of energy into and out of Earth result in changes to Earth's systems. | I can evaluate relationships within Earth's systems as causal or correlational.       | I can analyze how variations in the flow of energy into and out of Earth result in changes to Earth's systems | I can describe factors that affect the input, output, or storage and redistribution of energy.                                | I can identify relevant energy components of an Earth system. |

### 3. Analyze relationships between structure and function of matter as it applies to physical and environmental systems.

| Student can...                                                                                                                                                                      | 4                                                                                                                                           | 3                                                                                                                                                                                | 2                                                                                                                                 | 1                                                                                                                                                    |
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| 3.1: Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. | I can propose counter arguments or alternative theories for Earth's formation and early history.                                            | I can construct an evidence-based argument of Earth's formation and early history..                                                                                              | I can cite evidence about the age, composition, size, and distribution of Earth's oldest rocks, lunar rocks, and meteorites.      | I can describe a theory about the formation of the Earth.                                                                                            |
| 3.2: Construct an evidence-based argument to support the relationship between Earth's internal and surface processes and the formation of continental and ocean floor features.     | I can predict that a change in the internal Earth process could result in changes in the formation of continental and ocean floor features. | I can construct an evidence-based argument to support the relationship between Earth's internal and surface processes and the formation of continental and ocean floor features. | I can relate how constructive forces or destructive mechanisms interact in the formation of continental and ocean-floor features. | I can identify patterns between the location and relative geographic scale of continental and ocean-floor features to the theory of plate tectonics. |
| 3.3: Analyze the cycling of matter among the hydrosphere, atmosphere, geosphere, and biosphere.                                                                                     | I can predict changes in one of the spheres can affect the cycling of matter.                                                               | I can analyze the cycling of matter among the hydrosphere, atmosphere, geosphere, and biosphere.                                                                                 | I can describe the biogeochemical cycles that occur as matter flows from one sphere to another.                                   | I can identify the forms of matter present in the hydrosphere, atmosphere, geosphere and biosphere.                                                  |

### 4. Critique patterns to predict behavior and relationships within physical and environmental systems.

| Student can...                                                                                                                                                        | 4                                                                                                                   | 3                                                                                                                                                                      | 2                                                                                                          | 1                                                                                                               |
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| 4.1: Apply Newton's laws to describe and predict the effect of forces on an object.                                                                                   | I can predict what would happen to objects based on interactions between forces.                                    | I can apply Newton's laws to describe and predict the effect of forces on an object.                                                                                   | I can analyze patterns to identify the relationships between force, mass, and acceleration.                | I can describe the effect of forces on an object using mass and acceleration.                                   |
| 4.2: Defend the claim that the total momentum of a system of objects is conserved when there is no net force on the system by analyzing mathematical representations. | I can predict what would happen if momentum were not conserved within a system.                                     | I can defend the claim that the total momentum of a system of objects is conserved when there is no net force on the system by analyzing mathematical representations. | I can model the physical interaction of two objects in terms of the change in the momentum of each object. | I can describe the momentum of each object in a system using mathematical representations of mass and velocity. |
| 4.3: Predict the motion of orbiting objects in the solar system using mathematical representations.                                                                   | I can qualitatively argue how Newton's law of gravitation plus his third law of motion relate to observed orbits by | I can predict the motion of orbiting objects in the solar system by applying Kepler's law of planetary motion.                                                         | I can mathematically relate planetary motion to distance, orbital period, and orbital velocity.            | I can describe the orbit of an object using distance, orbital period, and orbital velocity.                     |

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|                                                                                                                                                                   | predicting how the acceleration of a planet towards the sun varies with its distance from the sun.                                                                    |                                                                                                                                                                    |                                                                                                    |                                                                                   |
| 4.4: Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. | I can evaluate the reliability, strengths, and weaknesses of evidence to support logical and reasonable arguments and predictions about the motion of crustal plates. | I can evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. | I can describe how patterns from evidence support the explanation about the ages of crustal rocks. | I can identify evidence of Earth's age that can be attributed to plate tectonics. |

| 5. Design and conduct controlled physical and environmental investigations.                                   |                                                                                                                                 |                                                                                                            |                                                                                     |                                                                                             |
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| Student can...                                                                                                | 4                                                                                                                               | 3                                                                                                          | 2                                                                                   | 1                                                                                           |
| 5.1: I can ask and refine questions to explain natural phenomena.                                             | I can revise my questions based on new information.                                                                             | I can ask questions to explain phenomena.                                                                  | I can determine variables involved with phenomena.                                  | I can make observations based off a phenomena.                                              |
| 5.2: I can explain phenomena utilizing relevant information.                                                  | I can support my claims with background research.                                                                               | I can explain phenomena utilizing relevant information.                                                    | I can communicate information from various resources.                               | I can summarize the central idea of a source.                                               |
| 5.3: I can conduct an investigation using a clear, concise procedure.                                         | I can create and conduct an investigation to answer a scientific question.                                                      | I can conduct an investigation using a clear, concise procedure.                                           | I can determine the type of data that should be collected during an investigation.. | I can identify independent variable, dependent variable, and constants in an investigation. |
| 5.4: I can create an appropriate visual representation of data.                                               | I can manipulate data or make inferences about the data.                                                                        | I can create an appropriate visual representation of data.                                                 | I can make a visual representation of data.                                         | I can collect data.                                                                         |
| 5.5: I can construct an explanation based on evidence                                                         | I can connect my explanation to the real-world.                                                                                 | I can construct an explanation based on evidence.                                                          | I can summarize supporting evidence                                                 | I can state a claim to answer a scientific question                                         |
| 5.6: I can evaluate the reliability and validity of data sets.                                                | I can identify the causes of error in the investigation..                                                                       | I can evaluate the reliability and validity of data sets.                                                  | I can assess the validity of data sets/                                             | I can identify sources of error within the investigation.                                   |
| 5.7: I can develop models to support explanations, predict phenomena, analyze systems, and/or solve problems. | I can evaluate the merits and limitations of different models in order to select or revise a model that best fits the evidence. | I can develop models that support explanations, predict phenomena, analyze systems, and/or solve problems. | I can use a model to explain phenomena.                                             | I can select an appropriate model to represent a phenomenon                                 |
| 5.8: I can design a solution to a real-world problem.                                                         | I can evaluate a solution to a real-world problem based on prioritized criteria and trade-offs.                                 | I can design a solution to a real-world problem.                                                           | I can explain why the real-world problem needs to be solved.                        | I can identify a problem that can be solved.                                                |