**Alignment of *Climate Science Investigations’* Modules**

**to the *Next Generation Science Standards* and the Concepts Underlying the Scientific Arguments**

|  |  |  |
| --- | --- | --- |
| **CSI Module Topics** | **Principal Skeptics’ Claims**  **(Alternative Explanations)** | **Concepts Underlying the Scientific Argument** |
| **Nature of Science** | **There is no scientific consensus about causes of climate change.** | **Nature of Scientific Inquiry, Experimental Design, Evidence-Based Argumentation, Role of Skepticism in Science, Scientific Consensus and Certainty** |
| *(Appendix H – Understanding the Nature of Science in the Next Generation Science Standards)* | | |
| **Weather and Climate** | **Extreme weather events are not increasing, but just part of a normal cycle.** | **Difference Between Weather and Climate, Types of Climate, Extreme Weather Events** |
| *(ESS2.D: Weather and Climate; Global Climate Change)* | | |
| **Energy – The Driver of Climate** | **The explanation of the greenhouse effect contradicts the second law of thermodynamics.** | **Composition and Structure of the Atmosphere, Electromagnetic Radiation, Temperature and Radiation, Heat Transfer, Earth’s Energy Balance, Greenhouse Effect, Difference Between Natural and Amplified Greenhouse Effect** |
| *(PS1.A: Structure and Properties of Matter; PS.1.B. Chemical Reactions; PS.1.C. Nuclear Processes; PS3.A: Definitions of Energy: PS3.B: Conservation of Energy and Energy Transfer; PS3.D: Energy in Chemical Processes and Everyday Life; PS4.A: Wave Properties; PS4.B: Electromagnetic Radiation; ESS1.A: The Universe and Its Stars; ESS2.C: The Roles of Water in Earth’s Surface Processes)* | | |
| **Temperature Change Over**  **Time** | **Earth’s climate (global average temperature) has changed in the past and recent changes are NOT unusual.** | **Factors that Affect Temperature (Latitude, Angle of Solar Radiation, Seasons, Properties of Water, Ocean Currents, Elevation), Methods for Studying Temperature, Temperature Over Geologic Time, Past 2,000 Years, and Since Industrial Revolution.** |
| *(ESS.C: The History of the Planet Earth; ESS2.B: Earth and the Solar System; ESS2.A: Earth Materials and Systems; ESS2.C: The Roles of Water in Earth’s Surface Processes)* | | |
| **Causes of**  **Climate Change** | **Natural variability is causing recent changes in temperature, not human activity.** | **Radiative Forcing, Carbon Cycle, Natural Causes, (Milankovich Cycles, Volcanic Eruptions, Solar Activity, ENSO), Anthropogenic Causes (Fossil Fuel Combustion, Land-Use Changes), Climate Feedbacks, Global Climate Models** |
| (*LS1.C: Organization for Matter and Energy; LS2.B: Cycles of Matter and Energy Transfer in Ecosystems; PS3.D: Energy in Chemical Processes; ESS2.A: Earth Materials and Systems; ESS2.E: Biogeology)* | | |
| **Impacts of**  **Climate Change** | **There is not enough evidence that Earth is warming. (or) The impacts of a few degrees of global warming would NOT be that harmful to life on Earth. Warming could be good.** | **Observed/Projected Impacts for Different Emission Scenarios (Global Mean Temperature Increase, Land and Sea Ice Melt, Sea Level Rise), Changes to Hydrologic Cycle, Ocean Currents, Ocean Chemistry, Ecosystems and Species Diversity, Human Health** |
| (*LS2.A: Interdependent Relationships in Ecosystems; LS2.C: Ecosystem Dynamics, Functioning, and Resilience; LS2.D: Biodiversity and Humans; LS4.C: Adaptation; ESS2.C: The Roles of Water in Earth’s Surface Processes; SEE3.B: Natural Hazards)* | | |
| **What We Can Do––Mitigation and**  **Adaptation** | **Humans cannot reduce the effects of global warming even if happening. It is too late to stop global warming, so we should adapt.** | **Mitigation, Adaptation, Energy Consumption, Renewable Energy, Environmental Policy, Stabilization Wedges** |
| (*PS3.A: Definitions of Energy; ETS1.C: Optimizing Design Solutions; ETS1.A: Defining and Delimiting Engineering Problems; ETS1.B: Developing Possible Solutions; ESS3.A: Natural Resources; ESS3.C: Human Impacts on Earth Systems)* | | |