Clark-Pohlod
Earth Science

Name ______________________________
Date ______________ Period _________

Unit 8 Notes: Climate Change

Learning Target Clarifications:

E2.1A - I can explain why the Earth is essentially a closed system in terms of matter.

The abundance of elements that make up greenhouse gases are essentially constant in the Earth system, but move between the four major systems.

E2.1B - I can analyze the interactions between the major systems (geosphere, atmosphere, hydrosphere, biosphere) that make up the Earth

The systems interact through exchanges and transformation of matter and energy such as the storage and release of carbon in different environments.

E2.1C - I can explain, using specific examples, how a change in one system affects other Earth systems

There are countless examples of how a change in one system impacts others, including the specifics of how changes in the biosphere effect the amount of carbon dioxide available to operate as a greenhouse gas.

E2.2f - I can explain how elements exist in different compounds and states as they move from one reservoir to another

Reservoirs are the setting where the elements exist, such as the components of the carbon or nitrogen cycle.

Real World Context:

The Intergovernmental Panel on Climate Change (IPCC) assesses scientific, technical and socio-economic information related to climate change and produces comprehensive reports on the potential impacts and options for adaptation and mitigation.

The endeavor to predict the consequences of global warming depends greatly on the Earth system science perspective. Researcher interpret observations in light of the connections of systems and subsystems.

Burning of fossil fuels releases carbon once stored in ancient biomass. This carbon can exist in several main forms and reside in different reservoirs of the Earth system. Releases of carbon dioxide into the atmosphere promotes greater plant growth, moving carbon from the atmosphere into plants. More carbon dioxide in the atmosphere also results in more of it dissolving in water of the oceans, lakes, and rain.

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The burning of biomass both releases more carbon dioxide into the air and reduces the biosphere's capacity to remove carbon dioxide through photosynthesis.

The current warming trend is resulting in the melting of glacial ice. Other possible effects include the melting of permafrost (releasing methane) and also warming oceans which melts methane hydrates of the ocean floor.

Melting of glacial ice effects Earth systems in many ways. The effects of sea level rise are most profound when ice is land based. Increasing water density drives the thermohaline current (initiating the North Atlantic Deep Water) and plays a major role distributing Earth's heat. Increased fresh water in the North Atlantic Ocean due to melting ice decreases sea water salinity and therefore water density. Resulting changes in global heat distribution would impact climate on land regionally, a hypothesis supported by studies of ancient climates. The melting of ice reduces Earth's average albedo (the reflectivity of Earth surface materials) and therefore increases the amount of energy absorbed by the Earth.

Volcanic eruptions can release more greenhouse gases (carbon dioxide and water vapor) into the air. It also releases sulfur dioxide which combines with rain to form acid rain, which increases the weathering of limestone and puts more carbon dioxide from the limestone into the air.

Aerosols in the upper atmosphere that form by the interaction of the sulfur dioxide and water act to cause a temporary cooling of global temperatures when there is a major eruption.

The ratio of oxygen 16 to oxygen 18 in the calcium carbonate of fossils varies in accordance with water temperature and is therefore used to research past clilmates.

Multiple lines of evidence (including fossils, dust deposits in ocean sediments, pollen deposits, tree ring measurements, and ice core testing) all lead to very similar conclusions about the historical patterns of temperature changes in the Earth system. Data derived from ice cores strongly suggests a relationship between atmospheric carbon dioxide levels and temperature.