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## Answer Key: Glaciers to Gas Guzzlers: The Climate Change Survival Challenge for 8th Grade

Calculate carbon feedback loops and evaluate the thermodynamic impact of albedo loss while proposing engineering solutions for urban heat islands.

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**1. Which phenomenon describes the process where melting permafrost releases trapped methane, further accelerating global warming beyond human-driven emissions?**

**Answer:** C) Positive Feedback Loop

A positive feedback loop occurs when the product of a reaction leads to an increase in that reaction; in this case, warming causes methane release, which causes more warming.

**2. The 'Albedo Effect' refers to the ability of dark surfaces like the open ocean to reflect more solar radiation back into space than white ice sheets.**

**Answer:** B) False

False. Albedo is the measure of reflectivity. Light-colored surfaces like ice have high albedo (reflect more), while dark surfaces like the ocean have low albedo (absorb more).

**3. As world oceans absorb higher concentrations of CO<sub>2</sub>, the chemical reaction produces \_\_\_\_\_ acid, which lowers the pH of the water and dissolves the shells of mollusks.**

**Answer:** D) Carbonic

Carbon dioxide reacts with seawater to form carbonic acid (H<sub>2</sub>CO<sub>3</sub>), a process known as ocean acidification that threatens marine calcifiers.

**4. Scientists use 'proxy data' to understand climates from thousands of years ago. Which of the following is an example of a climate proxy used to measure ancient atmospheric composition?**

**Answer:** B) Air bubbles trapped in ice cores

Ice cores contain trapped air bubbles that act as 'time capsules,' allowing scientists to directly measure CO<sub>2</sub> and methane levels from hundreds of thousands of years ago.

**5. The process of 'Carbon \_\_\_\_\_' involves capturing CO<sub>2</sub> from industrial sources and pumping it deep underground into geological formations for permanent storage.**

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**Answer:** A) Sequestration

Carbon sequestration is a key mitigation strategy that seeks to remove CO<sub>2</sub> from the cycle by storing it where it cannot affect the atmosphere.

**6. Global warming and 'Climate Change' are scientifically identical terms that describe only the increase in the Earth's average surface temperature.**

**Answer:** B) False

False. Global warming refers specifically to rising temperatures, whereas climate change is a broader term encompassing shifts in precipitation, wind patterns, and extreme weather.

**7. Which sector is globally responsible for the highest percentage of greenhouse gas emissions due to its heavy reliance on coal, natural gas, and oil?**

**Answer:** B) Electricity and Heat Production

The burning of fossil fuels for electricity and heat remains the largest single source of global GHG emissions, followed by industry and transportation.

**8. The \_\_\_\_\_ protocol was an international treaty designed to reduce emissions, though it was later succeeded by the Paris Agreement which aimed to limit warming to below 2 degrees Celsius.**

**Answer:** B) Kyoto

The Kyoto Protocol (1997) was the first major international agreement to mandate specific emission reductions for industrialized nations.

**9. Climate adaptation involves changing our behavior and infrastructure to live with the impacts of climate change, such as building floating houses in flood-prone areas.**

**Answer:** A) True

True. Adaptation focuses on resilience and survival under new climate conditions, whereas mitigation focuses on stopping the causes of change.

**10. If the Thermohaline Circulation (the 'Great Ocean Conveyor Belt') were to slow down due to fresh water melting from Greenland, what would be the likely result for Northern Europe?**

**Answer:** B) A cooling effect due to lack of warm water transport

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The conveyor belt brings warm water from the tropics to the North Atlantic; if it slows, Europe would lose that 'heat' and experience much colder temperatures.