

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Answer Key: Catastrophic Climate Changes: Crack Carbon Challenges for 8th Grade

How do positive feedback loops accelerate permafrost thaw? Assess the complex relationship between albedo reduction, ocean acidification, and anthropogenic forcing.

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**1. Scientists are concerned about 'positive feedback loops' in the Arctic. Which scenario best exemplifies a feedback loop that accelerates global warming?**

**Answer:** B) Melting sea ice exposes dark ocean water, which absorbs more solar radiation and melts more ice.

This is a classic albedo-related feedback loop: reduced reflectivity (albedo) leads to more heat absorption, which further accelerates the warming process.

**2. True or False: The current rate of atmospheric carbon dioxide increase is significantly faster than any natural fluctuations recorded in ice core data over the last 800,000 years.**

**Answer:** A) True

While Earth's climate has changed naturally in the past, the current rate of CO<sub>2</sub> increase due to human activity is unprecedented in the geological record accessible via ice cores.

**3. As the oceans absorb more CO<sub>2</sub>, the pH level of the water drops, a process known as \_\_\_\_\_, which threatens the stability of marine food webs.**

**Answer:** B) Ocean Acidification

Ocean acidification occurs when CO<sub>2</sub> reacts with seawater to form carbonic acid, lowering the pH and making it difficult for calcifying organisms to build shells.

**4. Which of these is a significant 'carbon sink' that naturally sequesters atmospheric carbon for long-term storage?**

**Answer:** C) Peatlands and deep-ocean sediments

Peatlands and deep-ocean sediments store vast amounts of carbon over millennia, acting as critical sinks that help regulate the global carbon cycle.

**5. True or False: Anthropogenic global warming is primarily caused by an increase in the intensity of solar radiation hitting the Earth's upper atmosphere.**

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**Answer:** B) False

Current warming is driven by the enhanced greenhouse effect (trapping heat) rather than an increase in solar output, which has remained relatively stable.

**6. The melting of land-based glaciers contributes to sea-level rise through both the addition of new water and through \_\_\_\_\_, where warmer water occupies more space.**

**Answer:** C) Thermal Expansion

Thermal expansion is a major driver of sea-level rise; as ocean temperatures increase, the water molecules move more and take up more volume.

**7. In the context of climate mitigation, what is the primary goal of 'Carbon Capture and Storage' (CCS) technology?**

**Answer:** B) To remove CO<sub>2</sub> from industrial emissions and pump it underground

CCS involves capturing CO<sub>2</sub> at the source (like power plants) and storing it in geological formations to prevent it from entering the atmosphere.

**8. True or False: Methane (CH<sub>4</sub>) is a more potent greenhouse gas than Carbon Dioxide (CO<sub>2</sub>) molecule-for-molecule over a 20-year period.**

**Answer:** A) True

Methane has a much higher Global Warming Potential (GWP) than CO<sub>2</sub>, meaning it is significantly more effective at trapping heat, though it stays in the atmosphere for a shorter time.

**9. The thawing of \_\_\_\_\_, which contains vast amounts of ancient organic matter, threatens to release massive amounts of methane in a dangerous feedback loop.**

**Answer:** B) Permafrost

Permafrost is frozen ground that, when thawed, allows microbes to decompose organic matter, releasing CO<sub>2</sub> and methane into the atmosphere.

**10. Which of the following is considered an 'adaptation' strategy rather than a 'mitigation' strategy?**

**Answer:** C) Developing heat-resistant urban infrastructure and 'cool roofs'

Adaptation focuses on managing the effects of climate change that are already occurring or expected, such as preparing for extreme heat, whereas mitigation focuses on reducing the causes.

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