Name: _____ **Date:** _____

Answer Key: Crush the Thermohaline Challenge: 10th Grade Ocean Systems Quiz

Calculate density variables and predict global climatic shifts by analyzing the complex feedback loops between salinity, heat, and deep-water formation.

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1. Deep-water formation in the North Atlantic serves as a primary engine for the 'Global Conveyor Belt.' Which mechanism initiates the sinking of this water mass near the Greenland Sea?

Answer: A) Brine rejection during sea ice formation increasing localized salinity

Brine rejection occurs when salt is excluded from freezing sea ice, making the surrounding water denser and causing it to sink, driving thermohaline circulation.

2. The zone of the ocean where density increases rapidly with depth is known as the _____, serving as a barrier to nutrient mixing.

Answer: C) Pycnocline

The pycnocline is the layer where water density changes most rapidly with depth, often influenced by both temperature (thermocline) and salinity (halocline).

3. The Coriolis effect causes surface currents in the Southern Hemisphere to deflect to the right of the wind direction.

Answer: B) False

In the Southern Hemisphere, the Coriolis effect deflects moving objects and fluids to the left; rightward deflection occurs in the Northern Hemisphere.

4. Ekman Transport describes the net movement of water at a 90-degree angle to the wind direction. How does this process contribute to coastal upwelling?

Answer: C) Winds blowing parallel to the coast move surface water offshore, drawing deep water up

When surface waters are moved offshore by Ekman Transport, deep, cold, nutrient-rich water rises to replace it, a process critical for marine productivity.

5. In the context of the global water cycle, the residence time of a water molecule in the _____ is significantly longer than in the atmosphere.

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Answer: C) Cryosphere

Water trapped in the cryosphere (glaciers and ice sheets) can remain for hundreds of thousands of years, whereas atmospheric residence time is roughly 9 days.

6. Latent heat release during the condensation of water vapor in the atmosphere provides the primary energy source for tropical cyclones.

Answer: A) True

As water vapor condenses into clouds, it releases stored latent heat energy, which warms the surrounding air and fuels the intensification of storms.

7. Which of the following scenarios would likely lead to a weakening of the Atlantic Meridional Overturning Circulation (AMOC)?

Answer: B) Rapid melting of the Greenland Ice Sheet creating a 'freshwater lens'

Freshwater is less dense than saltwater; a massive influx of meltwater prevents surface water from sinking, effectively stalling the conveyor belt movement.

8. The total mass of dissolved inorganic solids in seawater is termed _____, typically measured in practical salinity units (PSU).

Answer: B) Salinity

Salinity refers to the concentration of dissolved salts. In the open ocean, this averages around 35 PSU or 3.5%.

9. The Pacific Decadal Oscillation (PDO) is a short-term weather event that occurs strictly in the troposphere over the Indian Ocean.

Answer: B) False

The PDO is a long-term (20-30 year) ocean-atmosphere climate variability pattern centered over the North Pacific, not a localized Indian Ocean weather event.

10. How does the high specific heat capacity of the oceans affect global continental temperature ranges?

Answer: C) It acts as a thermal buffer, moderating temperature fluctuations in coastal areas

Water requires more energy to change temperature than land. Consequently, the oceans absorb and release heat slowly, keeping coastal climates more stable than inland ones.

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