Name: _____ **Date:** _____

Frozen Volcanos and Boiling Glaciers: Advanced Heat Quiz for Grade 7

Challenge your class to troubleshoot thermal systems and predict energy behaviors using the foundational laws of thermodynamics as a rigorous bell-ringer.

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1. An oceanographer notices that deep seafloor vents release superheated water, yet the surrounding deep-sea water remains near freezing. Which thermodynamic principle primarily explains why the entire ocean doesn't reach a uniform temperature instantly?

A. Specific heat capacity of water slows energy distribution.
B. The Second Law dictates that entropy must decrease in cold systems.
C. The Third Law prevents heat from moving at high pressures.
D. Convective currents are impossible in high-density salt water.

2. If an experimental Stirling engine takes in 800 J of thermal energy and produces 250 J of mechanical work, the remaining 550 J of energy must be _____ according to the First Law of Thermodynamics.

A. destroyed by the system
B. converted into new matter
C. exhausted as waste heat
D. stored as potential gravity

3. The Second Law of Thermodynamics implies that a perfectly efficient 'perpetual motion machine' is impossible because some energy will always dissipate as unusable heat, increasing total entropy.

A. True
B. False

4. A scientist cools a sample of crystalline silicon to 0.001 Kelvin. According to the Third Law of Thermodynamics, what is happening to the silicon's molecular state?

A. The molecules are moving faster to generate friction.
B. The entropy is trending toward a specific minimum value.
C. The thermal energy is being created from the vacuum.
D. The crystal lattice is expanding to release internal work.

5. A thermal imaging camera detects a 'cold spot' on a building's exterior wall. This likely indicates where _____ is failing to occur from the warm interior to the exterior surface.

A. Radiation
B. Conduction
C. Sublimation
D. Absolute Zero

6. Why does a pressurized aerosol can feel cold to the touch after you spray it for several seconds?

A. The gas inside undergoes an endothermic chemical reaction.

B. The can is absorbing radiation from the user's hand.
C. Internal energy decreases as the gas does work to expand.
D. The metal of the can has reached absolute zero.

7. Heat can spontaneously flow from a cold object to a hot object as long as the total energy remains constant.

A. True
B. False

8. In the design of a specialized 'vacuum flask' for space travel, engineers eliminate gas molecules between two walls to prevent heat loss via conduction and _____.

A. Convection
B. Radiation
C. Entropy
D. Compression

9. Compare two systems: An oven baking bread and a star forming in a nebula. Both follow the First Law of Thermodynamics because:

A. The total energy in each system's surroundings is always decreasing.
B. Energy is being created from gravitational pressure alone.
C. The sum of heat added and work done equals the change in internal energy.
D. Both occupy a state of zero entropy at their start.

10. According to the Second Law, as a teenager tidies their messy room, the total entropy of the entire universe actually increases.

A. True
B. False