Name: _____ **Date:** _____

Why Does Hot Air Rise? 8th Grade Thermodynamics Challenge

Calculate thermal equilibrium and analyze entropy increases across 10 rigorous scenarios involving specific heat and the laws of energy conservation.

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1. A 50g block of copper at 90°C is dropped into 50g of water at 20°C. Given that water has a much higher specific heat capacity than copper, which is the most likely equilibrium temperature?

A. 25°C
B. 55°C
C. 85°C
D. 110°C

2. According to the Second Law of Thermodynamics, it is possible to build a machine that converts 100% of input heat directly into useful mechanical work.

A. True
B. False

3. In a closed system, if 400 J of work is done ON a gas while it is simultaneously cooled, losing 150 J of heat, the change in internal energy (ΔU) is _____.

A. +550 J
B. +250 J
C. -250 J
D. -550 J

4. Why does a pressurized aerosol can feel cold to the touch after the gas is released rapidly?

A. Heat is created by the friction of the nozzle
B. The gas undergoes adiabatic expansion, using its own internal energy to do work
C. The liquid inside the can has reached absolute zero
D. Convective currents pull heat from the user's hand into the atmosphere

5. Thermal equilibrium is reached when two objects in contact have the same amount of total internal energy, regardless of their mass.

A. True
B. False

6. When water transitions from a liquid at 100°C to steam at 100°C, the added energy is known as _____.

A. Specific Heat
B. Latent Heat of Vaporization
C. Thermal Conductivity
D. Absolute Entropy

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7. In the vacuum of deep space, how does a satellite primarily dissipate the heat generated by its internal electronics?

A. Conduction through the air surrounding it
B. Convection currents in the solar wind
C. Thermal radiation via infrared light
D. Ablative cooling through melting heat shields

8. Entropy can decrease locally within a system, such as when water freezes into highly ordered ice crystals, as long as the entropy of the surroundings increases even more.

A. True
B. False

9. An ideal gas is kept in a rigid, fixed-volume container. If heat is added to the system, the work (W) done by the gas is _____.

A. Positive
B. Negative
C. Zero
D. Infinite

10. Two blocks (Lead and Aluminum) of equal mass are heated to 100°C and placed on a large block of ice. If Aluminum has a higher specific heat than Lead, what happens?

A. The Lead block melts more ice because it is denser
B. Both blocks melt the exact same amount of ice
C. The Aluminum block melts more ice because it stored more thermal energy
D. The ice melts faster under the lead block due to radiation