

Name: _____ Date: _____

Answer Key: Wrangle Thermal Chaos: High-Stakes Physics for 6th Grade

Students analyze molecular collisions and predict energy outcomes in complex engineering and natural scenarios to solve entropy-driven puzzles.

1. A deep-sea hydrothermal vent releases superheated water into the frigid ocean. Why doesn't the entire ocean immediately reach a uniform temperature?

Answer: B) Thermal equilibrium takes time as energy must transfer through massive volumes of water.

Thermal equilibrium is the state where temperatures equalize; however, in a system as large as an ocean, the transfer of kinetic energy between molecules is not instantaneous.

2. In a closed system, if you add 400 J of heat and the system performs 150 J of work, the internal energy of the system increases by _____ Joules.

Answer: C) 250

According to the First Law of Thermodynamics, the change in internal energy equals heat added minus work done ($400 - 150 = 250$).

3. The Second Law of Thermodynamics suggests that in an isolated system, energy will naturally spread out and become less organized over time.

Answer: A) True

Entropy is a measure of disorder; the Second Law states that entropy in an isolated system always increases, moving toward a state of maximum disorder.

4. Engineers designing a spacecraft use ceramic tiles because they have low thermal conductivity. Which process are they primarily trying to inhibit during atmospheric reentry?

Answer: C) Conduction

Conduction is the transfer of heat through direct contact; ceramics act as insulators to prevent the extreme heat outside the ship from conducting to the interior.

5. A substance at 0 Kelvin would have its constituent particles moving at their maximum possible velocity.

Answer: B) False

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At Absolute Zero (0 K), the Third Law of Thermodynamics implies that molecular motion reaches its theoretical minimum, meaning particles are essentially personally motionless.

6. A thermos maintains the temperature of a liquid by using a vacuum seal. A vacuum prevents heat transfer via conduction and _____ because there is no matter to carry the energy.

Answer: B) Convection

Convection requires a fluid (liquid or gas) to move heat via currents. In a vacuum, there are no particles to create these currents.

7. If you place a block of room-temperature iron into a bucket of boiling water, what must happen according to the Second Law of Thermodynamics?

Answer: B) Thermal energy will flow from the water to the iron until they reach the same temperature.

Heat spontaneously flows from a higher-temperature object to a lower-temperature object until thermal equilibrium is achieved.

8. The total sum of all kinetic and potential energy of the particles inside an object is known as _____ energy.

Answer: B) Internal

Internal energy is the scientific term for the total energy stored within a system's molecular structure.

9. Energy can be destroyed if a system is 100% efficient.

Answer: B) False

The First Law of Thermodynamics states that energy is always conserved; it can change forms but never be destroyed.

10. Why does a piece of asphalt feel much hotter than a blade of grass on a sunny day, even though they receive the same solar radiation?

Answer: B) Asphalt has a different specific heat capacity and lacks the cooling biological processes of grass.

Materials respond differently to heat based on their physical properties (specific heat) and, in the case of grass, evaporative cooling (transpiration).