

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

## 5th Grade Thermal Energy Lab Challenge

Particle motion, thermal equilibrium, and insulation effectiveness — using high-level synthesis to predict how energy migrates through diverse physical systems.

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**1. An engineer is designing a new winter coat using specialized synthetic fibers that trap tiny pockets of air. Why does trapping air help keep a person warm?**

- A. Air is a poor conductor that slows down the transfer of body heat to the outside.
- B. The air pockets generate new thermal energy through friction.
- C. Air pockets increase the speed of molecules moving away from the body.
- D. The trapped air transforms cold energy into warm energy.

**2. When a hot ceramic mug is placed on a cold marble countertop, the molecules in the marble begin to vibrate faster. This specific process of heat transfer is called \_\_\_\_.**

- A. Convection
- B. Radiation
- C. Conduction
- D. Insulation

**3. If two objects reach thermal equilibrium, it means that heat is no longer flowing between them because they have reached the same temperature.**

- A. True
- B. False

**4. During a sea breeze, cool air over the ocean sinks and moves toward the land to replace rising warm air. Which thermodynamic principle best explains this circular movement?**

- A. The Third Law: Absolute Zero
- B. Convection currents
- C. Molecular friction
- D. Radiant absorption

**5. In a closed system, such as a thermos, the total amount of energy remains constant even if it changes form. This demonstrates the \_\_\_\_.**

- A. Law of Entropy
- B. Second Law of Thermodynamics
- C. First Law of Thermodynamics
- D. Law of Radiant Cooling

**6. A chef uses a wooden spoon instead of a copper spoon to stir boiling sugar. What is the most likely scientific reason for this choice?**

- A. Copper has a lower density than wood.

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- B. Wood is a thermal insulator with low conductivity.
- C. The copper spoon would cool the sugar too quickly via radiation.
- D. The wooden spoon absorbs cold from the air.

**7. The Law of Entropy suggests that in an isolated system, the degree of disorder or randomness tends to increase over time.**

- A. True
- B. False

**8. Dark-colored asphalt feels much hotter on a sunny day than light-colored concrete because the asphalt is more efficient at absorbing \_\_\_\_.**

- A. Magnetic waves
- B. Conduction currents
- C. Kinetic Potential
- D. Thermal radiation

**9. If you could view the molecules of a block of ice as it starts to melt into liquid water, what change would you observe in their behavior?**

- A. The molecules would stop moving entirely.
- B. The molecules would gain kinetic energy and slide past each other.
- C. The molecules would become more organized and structured.
- D. The molecules would lose energy as they change state.

**10. Why is it impossible for a machine to be 100% efficient, according to the Second Law of Thermodynamics?**

- A. Some energy is always lost as waste heat to the environment.
- B. Machines destroy a small amount of energy as they work.
- C. Gravity prevents energy from transferring perfectly.
- D. Friction creates more energy than the machine can handle.