The Warming Spoon

Trace thermal energy as temperatures move toward equilibrium.

7.8.B "investigate how thermal energy moves in a predictable pattern from warmer to cooler until all substances within the system reach thermal equilibrium; and"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each phrase that tells which material is warmer or cooler, and circle the sentence that explains what happens at thermal equilibrium.

Lunchroom Energy Transfer

1. At lunch, Maya leaves a metal spoon in a bowl of hot oatmeal. The oatmeal is warmer than the spoon, so thermal energy moves from the oatmeal into the spoon where they touch. The spoon's handle soon feels warmer. Energy also moves from the warm oatmeal and spoon to the cooler air. These changes do not mean that "cold" flows into anything. Thermal energy transfers from warmer materials to cooler materials during every contact in this system.

2. As thermal energy leaves the oatmeal, its temperature decreases. As the spoon gains thermal energy, its temperature increases. The rate of transfer is usually fastest when the temperature difference is largest. Later, the oatmeal and spoon have temperatures closer together, so energy still transfers, but the net transfer is slower. If the bowl, spoon, oatmeal, and nearby air are treated as one system, energy moves among its parts because their temperatures are different at first.

3. Eventually, the materials in this closed system can reach thermal equilibrium. At equilibrium, the oatmeal, spoon, bowl, and air have the same temperature. Thermal energy still moves between particles in both directions, but equal amounts move each way. There is no net transfer of thermal energy from one part to another, so the temperatures no longer change. Equilibrium does not mean the materials contain the same total thermal energy. It means their temperatures are equal and their net thermal energy transfer is zero.

2 ANSWER WITH EVIDENCE

Use the passage

1. At the start, which material transfers thermal energy to the spoon? Explain how you know.

2. How does the temperature of the oatmeal change, and how does the temperature of the spoon change?

3. Why is the net thermal energy transfer slower later in the process?

4. What must be true at thermal equilibrium, and what happens to net thermal energy transfer?

3 YOUR TURN

Your own words

Create a new situation with two materials at different temperatures. Write exactly four sentences that explain the direction of thermal energy transfer from first contact until thermal equilibrium. Use the words *warmer*, *cooler*, and *thermal equilibrium*.

ANSWER KEY

The Warming Spoon

GRADE 7 · TEKS 7.8.B

PART 1 · READ AND MARK

Underline each phrase that tells which material is warmer or cooler, and circle the sentence that explains what happens at thermal equilibrium. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	At the start, which material transfers thermal energy to the spoon? Explain how you know.	**The hot oatmeal transfers thermal energy to the spoon because the oatmeal is warmer than the spoon.**
2	How does the temperature of the oatmeal change, and how does the temperature of the spoon change?	**The oatmeal's temperature decreases as it loses thermal energy. The spoon's temperature increases as it gains thermal energy.**
3	Why is the net thermal energy transfer slower later in the process?	**Later, the oatmeal and spoon have temperatures closer together, so the temperature difference is smaller.**
4	What must be true at thermal equilibrium, and what happens to net thermal energy transfer?	**All materials in the system have the same temperature. There is no net thermal energy transfer because equal amounts move in both directions.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

A warm steel bolt is placed in cooler water. Thermal energy moves from the warmer bolt to the cooler water. The bolt cools and the water warms, so their temperature difference gets smaller. When the bolt and water have the same temperature, they have reached thermal equilibrium, and there is no net thermal energy transfer between them.

Accept equivalent statements that thermal energy moves from warmer to cooler materials and that temperature differences decrease. For the open task, check for a new scenario, a correct transfer direction, temperature changes, and equilibrium described as equal temperatures with no net transfer.