Soup Energy Journey

Track how thermal energy moves through a system.

7.8 "Force, motion, and energy. The student understands the behavior of thermal energy as it flows into and out of systems. The student is expected to: investigate methods of thermal energy transfer into and out of systems..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each statement that tells which part is warmer or cooler, and circle *conduction*, *convection*, and *radiation*. These marks help you trace the direction and method of thermal energy transfer.

A Bowl of Hot Soup

1. At lunch, Maya pours hot soup into a metal bowl and sets it on a cool table. The bowl, soup, table, and nearby air form a system because thermal energy can move among them. Thermal energy flows from the warmer soup to cooler parts of the system. Where the soup touches the metal bowl, energy transfers by conduction. Faster-moving particles in the hot soup collide with particles in the bowl. The bowl's particles gain kinetic energy, so the metal becomes warmer.

2. Energy also reaches the air above the soup. Air warmed near the bowl becomes less dense and rises. Cooler, denser air moves in to take its place, creating a convection current. This moving air carries thermal energy away from the bowl. At the same time, the warm soup and bowl emit infrared radiation. Radiation transfers energy by electromagnetic waves and does not need touching particles or moving fluid. A person across the table could receive this radiation as warmth.

3. These transfers continue in a predictable direction, from warmer material to cooler material. As the soup loses energy, its particles move more slowly on average, and its temperature falls. As the bowl, table, and air gain energy, their particles move faster on average, and their temperatures rise. Eventually, all parts of the system reach the same temperature. This condition is thermal equilibrium. Particles still move and energy can still be exchanged, but there is no net flow of thermal energy from one part to another.

2 ANSWER WITH EVIDENCE

Use the passage

1. How does thermal energy transfer from the soup to the metal bowl by conduction?

2. Explain how the convection current above the bowl forms and carries energy away.

3. How is radiation from the soup and bowl different from conduction and convection?

4. What happens to a material's average particle motion and temperature when it gains thermal energy? What is true when thermal equilibrium is reached?

3 YOUR TURN

Your own words

Choose a hot baked potato on a ceramic plate in a cooler room. In three panels, sketch and label one way thermal energy leaves the potato by conduction, convection, and radiation, using arrows from warmer to cooler. Below the panels, write exactly two sentences predicting how the potato, plate, and air change until thermal equilibrium.

ANSWER KEY

Soup Energy Journey

GRADE 7 · TEKS 7.8

PART 1 · READ AND MARK

Underline each statement that tells which part is warmer or cooler, and circle *conduction*, *convection*, and *radiation*. These marks help you trace the direction and method of thermal energy transfer. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How does thermal energy transfer from the soup to the metal bowl by conduction?	**Faster-moving particles in the hot soup collide with particles in the metal bowl. The bowl's particles gain kinetic energy and the metal warms.**
2	Explain how the convection current above the bowl forms and carries energy away.	**Air near the bowl warms, becomes less dense, and rises. Cooler, denser air moves in to replace it. The moving air carries thermal energy away from the bowl.**
3	How is radiation from the soup and bowl different from conduction and convection?	**Radiation transfers thermal energy by electromagnetic waves. It does not require touching particles or moving fluid.**
4	What happens to a material's average particle motion and temperature when it gains thermal energy? What is true when thermal equilibrium is reached?	**Its particles move faster on average and its temperature rises. At thermal equilibrium, all parts have the same temperature and there is no net flow of thermal energy.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Panel 1: An arrow goes from the hot potato to the cooler ceramic plate and is labeled conduction. Panel 2: Warm air above the potato rises while cooler air moves toward it, labeled convection. Panel 3: Arrows from the potato to the cooler surroundings are labeled infrared radiation. The potato loses thermal energy, so its particles move more slowly on average and its temperature falls. The plate and air gain energy until the potato, plate, and air reach the same temperature with no net thermal energy flow.

Accept equivalent descriptions that identify energy moving from warmer to cooler and accurately distinguish the three transfer methods. In Part 3, accept different realistic labels or arrow placements if the student shows conduction through contact, convection in moving air, radiation by waves, and a correct equilibrium prediction.