Heat on the Move

Trace thermal energy through a shop and its surroundings.

PHS.8.3 "Relate thermal energy transfer to real world applications of conduction (e.g., quenching metals), convection (e.g., movement of air masses/weather/plate tectonics), and radiation (e.g., electromagnetic)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline where thermal energy moves from a warmer place to a cooler one. Circle each example of conduction, convection, or radiation, then number the examples to match the order in which you find them.

A Hot Day at the Tool Shop

1. At a coastal tool shop, a worker removes a steel punch from a furnace and lowers its hot tip into a tank of cooler water. Thermal energy moves from the steel surface into water touching it because their temperatures differ. Energy also travels through the steel from its hotter center toward its cooling surface. These transfers through direct contact are conduction. Water near the tip warms, becomes less dense, and rises while cooler water moves in to replace it. That circulating water carries energy away by convection. Rapid cooling can change a metal's hardness, though the result depends on the alloy and process.

2. Outside the shop, sunlight warms the land more quickly than the nearby ocean during the day. The warm ground transfers energy to the air touching it. As this air warms, it becomes less dense and rises; cooler air from over the water moves toward land to take its place. This circulation helps produce a sea breeze. The moving air carries thermal energy by convection, even though sunlight reached the ground by radiation. Deep inside Earth, heated rock in the solid mantle also moves very slowly. Its motion is one influence on the movement of tectonic plates.

3. After sunset, the worker stands near a still-hot furnace and feels warmth without touching its door. The furnace emits infrared radiation, an electromagnetic wave that can transfer energy across the air gap. Unlike conduction, radiation does not require objects to touch. Unlike convection, it does not require flowing material and can even cross empty space. The Sun's energy reaches Earth this way. In the shop, a metal handle attached to the furnace door can also get hot by conduction, while warm air rising above the door carries energy by convection. One hot object can transfer energy in several ways at once.

2 ANSWER WITH EVIDENCE

Use the passage

1. After the punch first touches the water, why does energy keep moving from its center toward its surface? Name the transfer process.

2. How does water carry energy away from the punch tip, and what starts the water moving?

3. Trace how sunlight helps produce a daytime sea breeze. Which transfer process carries energy with the moving air?

4. The worker feels warmth across the gap from the furnace, but its metal handle also gets hot. How do the transfer processes differ?

3 YOUR TURN

Your own words

Design a food-delivery box that keeps a hot meal warm on a cold day. In four sentences, describe one feature that slows each of conduction, convection, and radiation, and explain where the meal's energy would otherwise go.

ANSWER KEY

Heat on the Move

HIGH SCHOOL · PHS.8.3

PART 1 · READ AND MARK

Underline where thermal energy moves from a warmer place to a cooler one. Circle each example of conduction, convection, or radiation, then number the examples to match the order in which you find them. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	After the punch first touches the water, why does energy keep moving from its center toward its surface? Name the transfer process.	**The center remains hotter than the cooling surface, so energy moves toward the surface by conduction.**
2	How does water carry energy away from the punch tip, and what starts the water moving?	**Water warmed near the tip becomes less dense and rises. Cooler water replaces it, creating a convection current that carries energy away.**
3	Trace how sunlight helps produce a daytime sea breeze. Which transfer process carries energy with the moving air?	**Sunlight warms the land, which warms the air touching it. That air rises, and cooler air from over the water moves inland. The moving air carries energy by convection.**
4	The worker feels warmth across the gap from the furnace, but its metal handle also gets hot. How do the transfer processes differ?	**Infrared radiation transfers energy across the gap without contact. Conduction transfers energy through the metal handle.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

A thick foam wall slows conduction of energy from the hot meal toward the cold outside air. A tight lid keeps warm air from escaping and slows convection. A reflective lining reduces the infrared radiation that would carry energy outward from the meal. Together, these features slow the meal's energy loss to its cooler surroundings.

Accept equivalent descriptions that identify the transfer process and correctly trace energy from warmer to cooler regions. For the open task, each proposed feature must address its named process.