

Thermal Energy at School

Grade: 7 **Subject:** Science **Time:** ~45 min core + ~15 min extension **Work mode:** Independent · pencil only
Science

Start Here

This is a **paper investigation**. You will read a short passage, study a diagram and a data table, and answer questions using a pencil. You do **not** need a computer, a calculator, or any lab materials. Work by yourself and do your best thinking. Write in complete sentences where you are asked to explain. If a question is hard, skip it, keep going, and come back. Reading the passage aloud quietly to yourself is allowed and encouraged.

Start Notice & Wonder 5 min

Think about ordinary warming and cooling you feel during a normal school day.

1 You touch a metal locker handle and a wooden pencil that have been sitting in the same room all morning. The metal feels colder even though a thermometer says they are the same temperature. Write **one thing you notice** and **one thing you wonder** about this.

2 Name **two places at school** where something obviously gets warmer or cooler during the day (for example, a spot by a window). For each one, say whether it warms up or cools down.

Build Read the Science 5–10 min

How thermal energy moves

Thermal energy is the energy of the tiny moving particles inside matter. When particles move faster, the material is warmer; when they move slower, it is cooler. So **temperature is a measure of the average kinetic energy (motion energy) of the particles**. Heating something makes its particles jiggle and move faster.

Thermal energy always moves from **warmer** to **cooler** until both reach the same temperature. That balanced, no-change state is called **thermal equilibrium**. There are three ways the energy travels:

- **Conduction** — energy passes through direct contact, particle to particle. A metal spoon warming in hot soup is conduction. Metals conduct quickly; wood and plastic conduct slowly, which is why they feel warmer to the touch.
- **Convection** — energy is carried by a moving fluid (a liquid or a gas). Warm air is less dense, so it rises; cooler air sinks to take its place, making a loop called a convection current.
- **Radiation** — energy travels as invisible rays that can cross empty space, needing no particles at all. Sunlight warming a desk is radiation.

Remember: nothing "cold" ever flows *in*. Something feels cold because thermal energy is flowing *out* of your hand into it.

Word Bank

- thermal energy
 - the total energy of the moving particles in matter.
- conduction
 - transfer of thermal energy through direct contact.
- convection
 - transfer of thermal energy by a moving liquid or gas.
- radiation
 - transfer of thermal energy as rays that can cross empty space.
- thermal equilibrium
 - when two things reach the same temperature and energy stops flowing net.

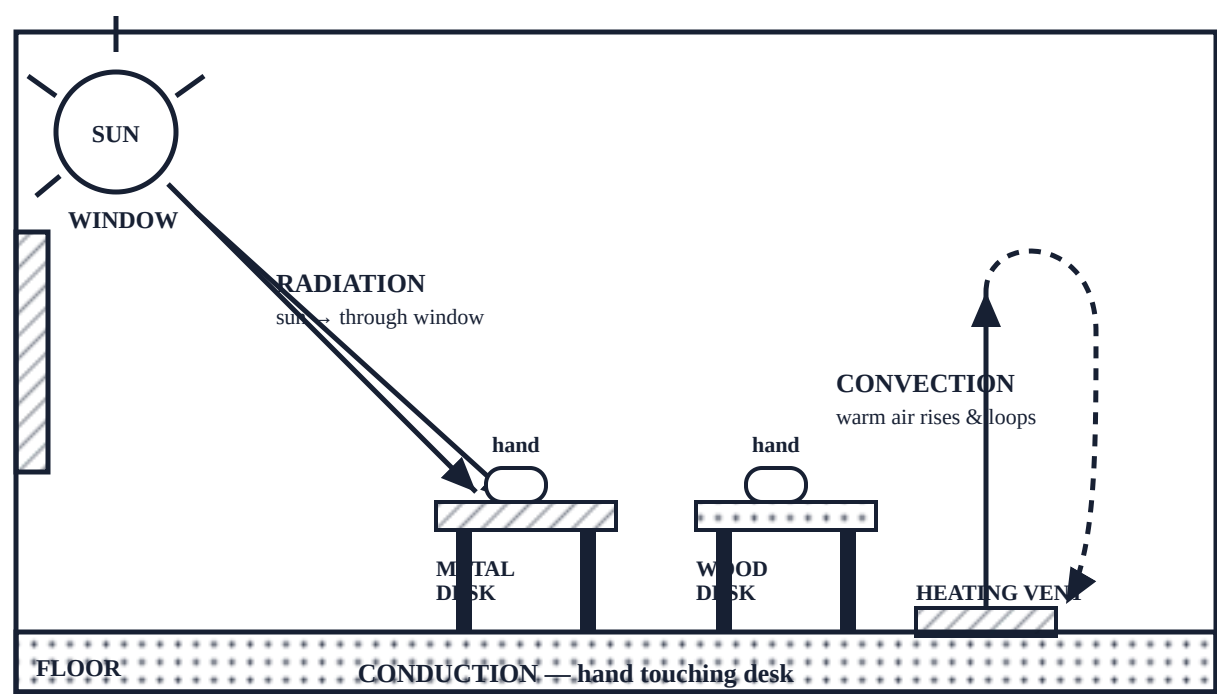


Figure 1. A sunny classroom in cross-section. Radiation from the sun passes through the window; a convection current loops up from the heating vent; conduction happens where a hand touches the metal desk and the wood desk. Fills are patterns (hatching, dots), not colors, so the figure reads clearly in grayscale.

3In the diagram, which transfer mode does **not** need any particles to travel? Name it and give the one example shown for it.

Apply Use the Data 20–25 min

A science club measured the temperature of surfaces and air around the building at the same time on a sunny afternoon. Study Table 1, then answer.

Table 1. Surface and air temperatures at 2:00 p.m. on a clear day
(original class data).

Location / material	Temperature (°C)	In sun or shade?
Metal handrail (outside stairs)	48	Sun
Sunlit concrete sidewalk	44	Sun
Shaded concrete sidewalk	29	Shade

Location / material	Temperature (°C) In sun or shade?	
Wooden bench (outside)	34	Sun
Classroom air (near window)	27	Indoors
Classroom air (far corner)	24	Indoors

4Observation vs. inference. Read each statement. Write **O** if it is an observation (something directly measured or seen) or **I** if it is an inference (a conclusion you reason out).

- ____ a) The metal handrail was 48 °C.
 ____ b) The handrail felt too hot to grip because the sun heated it by radiation.
 ____ c) The far corner of the room was 24 °C.
 ____ d) The far corner is cooler because it is farther from the sunny window.

5Look at the two concrete readings. The same material is 44 °C in the sun and 29 °C in the shade. In one sentence, explain what caused the difference using a transfer mode from the Word Bank.

6Classify the transfer. For the scenario below, choose the ONE mode that best fits.

6a. A student sets a cold soda can on the sunny metal handrail; the can warms where it touches the metal.

- Conduction
- Convection
- Radiation

6b. A ceiling fan pushes warm air near the ceiling back down across the room.

- Conduction
- Convection
- Radiation

6c. Sunlight streams through the window and warms a dark backpack on the floor.

- Conduction
- Convection
- Radiation

7Redesign reasoning (multi-step). The classroom by the window gets uncomfortably hot on sunny afternoons. Using Table 1 and the diagram, choose ONE change from the list below and explain, in 2–3 sentences, **how it reduces unwanted heat transfer** and **which mode it targets**. Options: (i) light-colored blinds on the window, (ii) a fan to keep air moving, (iii) moving desks to the far corner.

Explain Claim–Evidence–Reasoning 5–10 min

Question 8. Which design choice would **most reduce heat transfer into a hot classroom**? Write a claim and support it with **two pieces of evidence** from Table 1 or the diagram, then explain your reasoning.

Sentence stems you may use: "The best choice is... because..." · "One piece of evidence is... (from Table 1 / the diagram)." · "A second piece of evidence is..." · "This works because thermal energy moves by... and..."

Claim

Evidence (two pieces)

Reasoning

Close ACE Wrap-Up 5 min

Articulate

Explain **one** transfer mode (conduction, convection, or radiation) in your own words, as if teaching a friend.

Connect

Point to one row of Table 1 or one part of the diagram that shows that mode. Name it.

Extend

Give a **new** example of that mode from somewhere *outside* of school.

Continue Early Finisher optional • ~15 min

If you finish early (no new materials needed):

Design a "cool bench." On the back of this page, sketch an outdoor bench that stays cooler in the sun than the 34 °C wooden bench in Table 1. Label at least **two features** and, for each, name the transfer mode it fights (conduction, convection, or radiation). Then **predict** a temperature for your bench and explain why it would be lower.

Turn in: Hand in this whole packet with your name, class period, and date filled in. Make sure questions 1–8 and the ACE box are answered. The early-finisher sketch is optional but turn it in too if you did it.

G07_SCI_ThermalEnergy_01 — Thermal Energy at School Student Packet