Heating and Cooling teacher pack

Track heat, electricity and moisture rather than relying on temperature alone.

For learners around age 14 and curious adults. Three 40-minute sessions. Use with the current AHA Heating and Cooling manuscript. References use chapter titles so they work in both print and ebook.

Learning goals

Track heat, electricity and moisture rather than relying on temperature alone.

Use the terms temperature; heat; conduction; convection; radiation; COP. Show the reasoning behind an answer and identify where the example stops applying.

Reading route

1. A thermometer is not an energy meter

2. Three out for one in

3. Relative to what?

Teaching plan

Session 1: Ask the opening question before reading (5 minutes). Read the first selected chapter together (15). Draw the mechanism or compare two possible explanations (15). End with a one-sentence explanation (5).

Session 2: Read the remaining selected material (10 minutes). Complete the worksheet individually, then compare reasoning in pairs (20). Discuss the common wrong turn (10).

Session 3: Revisit one uncertain answer (10 minutes). Try the extension (15). Give a two-minute explanation without the book (10). Use the exit question (5).

Materials and access

Paper, pencil, the book and an optional calculator. Read diagrams aloud, allow spoken or drawn responses, and give extra time for vocabulary. No real accounts or specialist equipment are needed.

Heating and Cooling learner worksheet

Opening question

Why can a floor feel colder than a rug in the same room?

Investigation

A fictional heat pump uses 1 kWh of electricity and moves 2 kWh of heat from outdoors to indoors. A separate heater rated 2 kW runs for 90 minutes. Draw the energy arrows and label amount versus rate.

1. How much heat reaches indoors through the heat pump?

Show your reasoning, label units or evidence, and state any assumptions.

2. What is its heating COP?

Show your reasoning, label units or evidence, and state any assumptions.

3. How much electricity does the separate heater use?

Show your reasoning, label units or evidence, and state any assumptions.

Transfer question

Discuss the floor and rug using different rates of heat transfer from a foot. Do not assume their temperatures differ solely because they feel different.

Exit question

What would you now check before accepting a claim about this topic? Name one specific check and explain why.

Heating and Cooling answers and teaching notes

Answer 1

1 + 2 = 3 kWh.

Answer 2

COP = 3/1 = 3 under the stated conditions.

Answer 3

2 kW × 1.5 h = 3 kWh.

Common wrong turn

Temperature is not total thermal energy. COP depends on conditions and is not a claim that energy is created.

Extension discussion

Discuss the floor and rug using different rates of heat transfer from a foot. Do not assume their temperatures differ solely because they feel different.

Assess the explanation

Give one point each for a correct conclusion, visible reasoning, correct units or evidence, and a relevant limitation. A correct number with no explanation is not a complete answer. Accept equivalent wording and well-supported alternative interpretations where the question allows them.

If the learner gets stuck

Return to the diagram or the smallest example. Ask what is being counted, compared or transferred. Let the learner revise the answer after explaining the mistake; do not reward speed over understanding.

Family connection

Observe a closed window or a cold drink for condensation and discuss water vapor. Do not open refrigerant systems, heaters or electrical equipment.