Conduction: comparing temperature changes

Student activity • observation and reasoning

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The question

How does a temperature change spread along different materials?

Observe matched conductivity bars heated at one end in a warm-water bath. Describe the evidence without treating arrival times as direct conductivity measurements.

Equipment

- Commercial matched conductivity bars with temperature-indicator strips and reservoir
- Thermometer, timer, tray and labelled observation sheet

Staff handle the warm-water reservoir on a stable tray. Keep hands away from heated bars and water. Do not use flames, sharp pins or molten wax. Report spills and allow the apparatus to cool before moving it.

Course coverage: Shared Physics / Double Award: 4.6, 4.9. Thermal conduction.

Plan, model or apparatus sketch

Draw a labelled setup or force diagram; include the measured quantities.

Method and reasoning

Read the whole sequence before starting

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1. Observe the staff-mounted commercial conductivity bars with temperature-indicator strips. Identify the materials and mark the same distance from the heated end on each.

2. Record the room temperature and initial indicator readings. Keep the bars supported; do not hold them during heating.

3. Staff add water at no more than 60 °C to the apparatus reservoir, following its instructions. Start the clock when the ends contact the water.

4. Record each bar's indicator reading at the marked position every minute for five minutes. Write the indicator interval when an exact temperature cannot be read.

5. Compare the changes and sketch how energy transfers from the hot end towards cooler regions. Explain the role of vibrating particles and mobile electrons in metals.

6. Identify differences in dimensions, heat capacity and heat loss that restrict the comparison. Do not calculate a thermal conductivity from this activity.

Cleanup

- Staff allow the apparatus to cool, drain it and dry the tray.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Record actual observations. Indicator strips have a limited range and resolution; a colour outside the scale is not an exact temperature. No expected times or fabricated results are supplied.

Time / min	Bar A / °C	Bar B / °C	Bar C / °C
0			
1			
2			
3			
4			
5			

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Which direction is the net thermal transfer?

2. Must the whole bar move for conduction?

3. Why do metals generally conduct well?

4. Why use the same reading position?

5. Does the quickest temperature rise uniquely measure conductivity?

6. How could the evidence be made more repeatable?