Melting ice: temperature against time

Student activity • investigation and reasoning

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The question

What happens to temperature while ice and water coexist?

Record a small ice–water sample in a room-temperature water bath. Look for a near-constant melting interval without assuming perfect measurements.

Equipment

- Small plastic sample cup, larger beaker, spill tray and crushed ice
- Digital temperature probe, smooth stirrer and timer

Use room-temperature bath water only: no kettle, flame or hot plate. Staff prepare crushed ice; no pupil crushing. Use plastic cups, keep probes secure and wipe spills promptly. Do not taste samples or hold ice against skin.

Course coverage: Physics only: 5.8P–5.11P. Changes of state and temperature–time graphs.

Plan, model or apparatus sketch

Draw the relevant wavefront, particle or energy-transfer model and label its assumptions.

Method and reasoning

Read the whole sequence before starting

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1. Staff place approximately 20 g of finely crushed ice in a 50 mL transparent plastic sample cup. Position a digital temperature probe in the middle without touching the cup walls or base, then add approximately 5 mL cold water for thermal contact.

2. Stand the cup securely in a larger beaker containing approximately 200 mL room-temperature water on a spill tray. Keep bath water below the sample-cup rim and ensure the sample is not floating or tipping.

3. Start a timer and record sample temperature every 30 s for up to ten minutes. At each reading note whether ice is visibly present. Use a separate ruled continuation table after the six rows shown.

4. Gently stir the sample with a smooth plastic stirrer while keeping the probe fixed. Do not force the probe into solid ice or use it as a stirrer.

5. Mark the observation time when the last visible ice disappears. If it has not melted within ten minutes, record that result rather than adding hot water or inventing later readings.

6. Plot temperature against time and distinguish the mixed-phase interval from subsequent warming. Explain heat transfer from the warmer bath and why sensor lag, gradients or impurities can prevent a perfectly flat trace.

Cleanup

- Pour meltwater into the sink, dry trays and probes according to their instructions and leave benches dry.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Pure ice and water at ordinary atmospheric pressure coexist near 0 °C. This setup begins with a melting mixture, so it does not measure warming from a deeply subzero solid. A plateau is an approximate experimental feature, not a set of values to copy. No boiling stage is included.

Time / s	Temperature / °C	Ice present?
0		
30		
60		
90		
120		
150		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Where does energy enter from?

2. Why keep the probe away from the cup wall?

3. What visual observation identifies the melting interval?

4. Does a flat graph mean no energy transfer?

5. Why might readings differ slightly from 0 °C?

6. What should you report if ice remains after ten minutes?