Specific heat capacity: water and a solid

Teacher / technician

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Staff preparation and answer guidance. Keep separate from student sheets. No laboratory trial is claimed. Staff must pilot the actual apparatus. Record final settling temperatures in the calculation space and retain all raw data.

Coverage and delivery

Physics only: 5.2P, 5.13P, 5.14P. Electrical investigation of water and a solid.

Allow about 60 minutes. Follow the student sequence and use the answers to check reasoning.

Requisition • class of 30 observing two staff stations

Item	Per pair / setup	Class total
Water calorimeter, immersion heater and stirrer	Staff station	1 checked set
Metal block and compatible heater	Staff station	1 checked set
Isolated supply, joulemeter and probe	1 per station	2 of each
Water	One sample	Approximately 300 mL
Balance, timer and heat-resistant trays	Shared staff setup	1 balance; 1 timer; 2 trays
Booklets and calculators	1 per learner	30 of each

Immediate safety

Staff operate both heaters and check manufacturer immersion/insertion requirements. Never energise a heater in air or remove it while powered. Keep terminals and supplies dry and guarded, use suitable insulated leads and heat-resistant trays, and stop sample heating at 45 °C. Heater surfaces can be hotter than the measured sample; leave everything in place to cool before handling. No mains immersion heater is used.

Preparation and delivery

Read alongside the student method

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1. Pilot both setups at up to 12 V and 20 W, within the actual heater ratings. Select a water vessel that provides the required immersion depth at the measured mass; use more water if required and record it.

2. Check insulation compatibility, heater fit, probe contact and temperature settling. Keep block and heater secured. Start near room temperature, prepare a safe cooled storage area and provide stored real traces if a live setup is unavailable.

Close of lesson

• Switch off and isolate supplies. Leave heaters in their rated setups until cool; staff drain and dry the water apparatus and store the block safely.

Check before teaching

Check the cards, reference data and quantities against this requisition. Keep the staff answer guide separate until the checking stage. Supplied numerical practice datasets are labelled examples; they are not class measurements.

Answers and teaching notes

Expected explanations • do not give as experimental observations

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- Nominal masses may differ and c depends on mass.
- Electrical energy supplied to the heater circuit.
- Final sample temperature minus initial sample temperature.
- 900 J kg^{-1} $°C^{-1}$.
- Some energy heats apparatus or escapes instead of raising sample temperature.
- The heater can continue transferring stored energy while no new electrical energy is supplied.

References and provenance

Pearson Physics specification

IOP: thermal physics

Prepared 22 November 2026. Original wording, tables and questions. Sources inform the concepts and technique; the lesson scope and classroom quantities are explicitly described here. No laboratory trial or final school risk approval is claimed.