Calibrating a Cup for Heat Measurements

Base your answers on the information provided and your knowledge of chemistry. Use the 2025 Chemistry Reference Tables as needed.

A class measures heat transfer in an insulated cup. It puts 100.0 g of water at 20.0 °C in a cup that is also at 20.0 °C. Students pour in 50.0 g of water at 50.0 °C. The stirred mixture and cup reach 29.0 °C. The model ignores energy exchange with the surroundings. Use 4.18 J/(g·°C) for the specific heat of liquid water.

1 Which statement describes the directions of energy transfer while the temperatures approach 29.0 °C?

(1) Both portions of water lose energy to the cup.

(2) The warm water loses energy and the cool water and cup gain energy.

(3) The warm water gains energy from the cooler cup.

(4) The cup transfers energy to both portions of water.

2 Calculate how much heat the 100.0 g portion of water gains. Show your setup. [1]

Answer and work

3 Calculate the heat gained by the cup. Use the loss from the warm water and the gain by the cool water. [1]

Answer and work

In a second test, a reaction warms the same cup by 4.5 °C and the water gains 2.50 kJ. Use a model in which the heat absorbed by the cup is proportional to its temperature change.

4 Estimate the total heat released by the reaction. Show how you used the temperature change and the result from the calibration. [1]

Answer and work