

SPECIFIC HEAT

The specific heat of a substance is among the most important properties of matter. It determines the rise in temperature if a body is heated.

GOALS	Learn a proven and tested method of measuring thermal quantities. Experience the pros and cons of a computer-based experiment over a “traditional” setup.
DEVICES	<ul style="list-style-type: none">▶ copper calorimeter with stirrer▶ notebook computer with LabPro interface and temperature probe▶ pan with cork and alcohol thermometer in heat bath▶ rivets (aluminium, iron or copper)▶ ice
EXPERIMENT	<p>A Check the precision of the temperature probe on ice water.</p> <p>B Determine the mass of the empty calorimeter (with stirrer). Fill it up to about two thirds with cold water (no ice pieces) and determine the mass of the water. Finally, weigh the rivets.</p> <p>C Put the rivets into the pan and heat them in the heat bath until they have reached a temperature of at least 90°C.</p> <p>D Start the temperature measurement in Logger Pro. Fetch the pan from the heat bath.</p> <p>E Read the temperature of the rivets and immediately (!) pour them into the calorimeter. Stir the water steadily during the entire measurement.</p> <p>F Discuss how you could improve the precision of your measurement. Redo the experiment with another set of rivets (different material).</p>
ANALYSIS	<ol style="list-style-type: none">1. Find an algebraic expression for the rivets’ specific heat as a function of the experimentally determined quantities and the specific heats of water and copper. The latter may be used only for aluminium or iron rivets, of course.2. Determine values for the initial and mixing temperature with the procedure presented by the teacher. Using these values, calculate the specific heat for both materials you investigated.3. Estimate the error of every measured quantity. Calculate the error bounds for the specific heats taking into account the most important errors only. Compare your results to the accepted values.

REQUIREMENTS	<p>If you write a short report on this experiment, work at least on steps 1 and 2 for one of the metals. The complete interpretation is required for a full report.</p> <p>Hand in your report and the lab journal by Tuesday, 31 May 2011.</p>
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