

## LATENT HEAT

The specific and the latent heat of a substance are among the basic properties of matter. They determine the amount of heat required to increase a body's temperature and to melt or evaporate it.

GOALS	You are able to set up and solve the energy equation for a mixing problem including a phase change. You measure reasonably precise values for the heat of transformation.
DEVICES	<ul style="list-style-type: none"><li>▶ copper calorimeter with stirrer</li><li>▶ notebook computer with LabPro interface and temperature probe</li><li>▶ crushed ice</li><li>▶ gas torch, kettle with attached tube</li></ul>
EXPERIMENT	<p>A Using the barometer and the tables in the lab room determine the boiling temperature of water under the current conditions.</p> <p>B Measure the empty calorimeter's mass (with stirrer). Fill the cup to about two thirds with water and measure the water's mass.</p> <p>C <i>Heat of fusion</i>: Prepare some 60 g of crushed ice on a tissue.</p> <p><i>Heat of vaporisation</i>: Heat the water in the kettle over the gas torch until it starts boiling. Wait until vapour leaves the tube at a constant rate.</p> <p>D Start the measurement („Collect“).</p> <p>E <i>Heat of fusion</i>: Make sure that the ice does not contain any melted water by dabbing off the liquid with a tissue. Pour the ice into the calorimeter and start stirring immediately. Continue until all the ice is melted.</p> <p><i>Heat of vaporisation</i>: Conduct the vapour into the water in the calorimeter. Wait until the temperature has increased by about 40 °C.</p> <p>F Continue measuring for some more minutes.</p> <p>G Measure the calorimeter's final mass (with its content) to determine the mass of the added ice or vapour.</p>
ANALYSIS	<ol style="list-style-type: none"><li>1. Use the diagram in Logger Pro to determine the initial and mixing temperature with the method presented by the teacher.</li><li>2. Derive a formal expression for the heat of fusion/vaporisation, which includes only measured values and specific heats.</li><li>3. Calculate the numerical values for both the heat of fusion and vaporisation.</li><li>4. Estimate the errors of all measured quantities. Decide which errors are most significant and calculate the error of the respective latent heat.</li><li>5. Compare your results to the accepted values.</li></ol>

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REQUIREMENTS	<p>If you write a short report on this experiment, work at least on steps 1 to 3 for one of the measurements. The complete interpretation is required for a full report.</p> <p>Hand in your report and the lab journal by Tuesday, 21 June 2011.</p>
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