Melting Ice Lab

Materials: styrofoam cup, scale, thermometer, ice and water

The setup

You will put around 200g of water in your cup, massing it with the scale as you add it. You will be given a goal for the initial temperature for the water used by your group, which will be somewhere between room temperature and boiling. Measure the temperature of the water after it has been in the cup long enough to equilibrate with the cup. Then add around 100g of 0° ice to the cup and record its mass. Cover the cup and wait for the ice to melt. While you wait, work in your groups on the following questions using your big white boards.

Recall that the heat capacity of liquid water is $C_p = 4.18$ J/g·K and is roughly constant over the temperature range we will be using, and that the enthalpy of fusion (a.k.a. latent heat) of ice is 334 J/g.

Theoretical analysis

Question 2.1 Mass of ice remaining Work out the mass of ice (if any) that will remain after the cup has reached thermal equilibrium.

Question 2.2 Final temperature of water Work out the final temperature of the water/ice mixture.

Question 2.3 Change in entropy of water Work out the change in entropy of the water that happened as it cooled down.

Question 2.4 Change in entropy of ice Work out the change in entropy of the ice as it melted and (possibly) warmed up.

Question 2.5 Net change What is the net change of entropy for this entire adiabatic process?

Experimental Results

Look inside your cup once you've done all the above work.

1. **Question 2.6 Mass of ice remaining** Is there any ice left? If so, carefully fish it out and measure the mass of the remainder to find out how much ice was left.
2. **Question 2.7 Final temperature** Measure the final temperature of the water in the cup.
3. **Question 2.8 Error Analysis** Comment on the magnitude and sources of errors in your experiment and/or prediction. What could you do to reduce or estimate these errors?

by David Roundy

©DATE David Roundy