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Latent Heat of Fusion

Introduction: Most homogeneous solids, including ice, have a very specific melting temperature. You know that pure ice melts at $0^{o}c$ at atmospheric pressure. When a sample of ice is melting to form water, the entire ice/water mixture remains at $0^{o}c$ until all of the ice is melted. This is evident when you are drinking a glass of ice water. The water really doesn't heat up until all of the ice is gone.

The Latent heat of fusion of a solid is the amount of energy that must be transferred to one gram of the solid, at its melting point temperature, in order to melt it. It is called latent heat because there is no temperature change associated with this energy transfer, there is only a change in phase.

In this experiment you will determine the latent heat of fusion of ice by melting a known mass of ice in some warm water. An energy balance on the system will reveal the heat of fusion.

You will need: Calorimeter, warm water, thermometer, ice, balance

What to do:

1. Prepare a calorimeter with a known mass of warm water. Record this mass and temperature.
2. Place 2 or three pieces of ice into the calorimeter and stir with the thermometer until the ice melts.
3. Record the final temperature of the water and the final mass of all water in the calorimeter.
4. Calculate the mass of water added by the ice.

To analyze your data:

The amount of energy lost by the warm water is easily calculated with the formula:

Energy change = $mass*(T_{final}-T_{initial})*(1cal/g^{o}c)$

Remember that this energy change is negative because the water loses energy.

After the ice melts it is liquid water with a temperature of $0^{o}c$ and a specific heat of $1cal/g^{o}c$. This water gains energy until it reaches the equilibrium temperature. Thus, the amount of energy gained by the ice (water after it melts) is slightly more complicated to calculate.

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Energy change = mass*(T_{final}-$T_{initial}$)*(1cal/g^{o}c) + mass*L_f

where L_f is the heat of fusion of ice. This energy change is positive because the ice/water gains energy.

Using these two equations, solve for h_f and compare your answer to the known value. Show all of your calculations very neatly and explain all of your steps. Remember that an analysis is more than numbers and equations. You must interpret your data with words in order to get credit for your work; any monkey can solve for a variable and punch numbers on a calculator.

The conclusion:

In your conclusion explain the concept of latent heat of fusion. Does the process that you performed in lab work the same way in reverse? Give examples of solids with latent heats, give examples of solids which do not have well defined latent heats. What are the units of L_f?