Heating and Cooling Curves

The substance cyclohexane, C_6H_{12}, has the following physical properties:

melting point = 6.0 ^oC	$S_{(solid)}$ = 1.2 J/g^oC	ΔH_{fusion} = 2.4 kJ/mol
boiling point = 81.0^oC	$S_{(liquid)}$ = 2.8 J/g^oC	ΔH_{vap} = 18.0 kJ/mol
	$S_{(gas)}$ = 0.9 J/g^oC	

Sketch a diagram that represents a 100g sample of cyclohexane cooling from 100^oC to 0^oC. Indicate what is happening in each segment of your diagram (i.e. gas cooling.....)

What is the physical state of cyclohexane at 100 ^oC? _____

At what temperature will the gaseous cyclohexane condense back to liquid? _____

Calculate the heat lost by the cyclohexane when it cools down to this temperature.

Does the temperature of a gas change when it condenses to a liquid? _____

Calculate the heat lost by the cyclohexane as the gaseous state condenses to the liquid state.

At what temperature would the liquid cyclohexane freeze? _____

Calculate the heat lost by the liquid cyclohexane as its temperature falls to the freezing point.

Calculate the heat lost by the liquid cyclohexane as it freezes.

Calculate the heat lost by the solid cyclohexane as it cools to 0 ^{o}C.

What is the total amount of heat lost by cyclohexane as it is cooling from 100^{o}C to 0^{o}C. (Watch your units!)

1. Given the following data for H_2O

normal melting point: 0^oC	Specific heat of liquid: 4.184 J/g^oC
normal boiling point: 100^oC	Specific heat of gas: 2.0 J/g^oC
Heat of fusion: 6.0 kJ/mol	Specific heat of solid: 2.1 J/g^oC
Heat of vaporization: 44 kJ/mol	

Calculate how much energy (in kilojoules) is required to convert 360 g of water initially at -20^oC to a final temperature of 120 ^oC. Assume a closed system. Start by sketching a heating diagram. (ans. 1180.14 kJ)

b) calculate how many grams of CH_4 would have to be burned to generate the heat necessary to cause this change. Assume all of the heat goes into the system (that is, the water you want to heat up).

$$CH_{4(g)} + 2\ O_{2(g)} \rightarrow CO_{2(g)} + 2\ H_2O_{(l)} + 802.3\ kJ$$

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Heat of fusion: 6.0 kJ/mol
Heat of vaporization: 44 kJ/mol

Specific heat of liquid: 4.184 J/g^oC
Specific heat of gas: 2.0 J/g^oC
Specific heat of solid: 2.1 J/g^oC

Hugo First, ace chemistry student, brings in a 254g icicle from his front yard, where the T is -12^oC and puts in on the kitchen counter, where the T is 22^oC. He returns 8 hours later to find a 254g puddle of liquid water at room temperature. How much heat did the water absorb?

Using the same data for water, if 234.56kJ of heat is added to a 500g block of ice at -15^oC, what physical state and temperature does the H_2O end at?