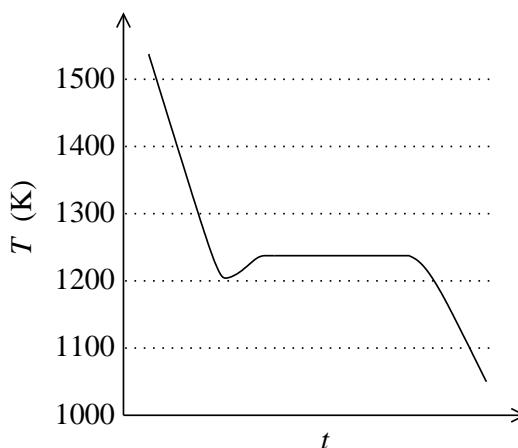


Chemistry 2720 Fall 2001 Assignment 3

Due: Tuesday, Sept. 25, 9:25 a.m.

1. Steam causes notoriously serious burns. What property of steam makes these burns so severe? Support your argument with some calculations. [5 marks]
2. The makers of a new metal alloy desire to determine its thermal properties. In particular, they would like to know the specific heat capacity of the solid and the melting temperature. They proceed as follows:
 - A 518.04 g sample is heated to 100.0°C and is then transferred to an insulated water-filled calorimeter with a heat capacity of 8403 J/K (including the water) at an initial temperature of 22.04°C. The equilibrium temperature is 24.33°C.
 - A sample heated beyond its melting point and the temperature is measured as a function of time as it cools. The results are as follows:



Determine the specific heat capacity of the solid and melting temperature. [8 marks]

3. Various devices are used to trap, cool and condense steam. One way to condense steam is to bubble it through liquid water. Suppose that 8 g of steam initially at 115°C is bubbled into 300 g of water initially at 20°C. All the steam disappears before reaching the surface of the water. Assuming that the vessel in which this occurs is well insulated, what is the final temperature of the water? [8 marks]
4. The MONJU experimental nuclear reactor¹ in Japan produces heat at a rate of 714 MW. Liquid sodium is used as a coolant. It flows into the reactor at a temperature of 397°C and flows out at a temperature of 529°C. The specific heat capacity of liquid sodium in this temperature range is $29.26 \text{ JK}^{-1} \text{ mol}^{-1}$. What flow rate of sodium through the reactor is required to carry away the heat produced by the nuclear reaction given the desired inlet and outlet temperatures? Express your answer in t/h. [8 marks]

Note: A tonne is 1000 kg, i.e. 1 Mg.

¹This reactor has a very well organized and very informative web site: <http://www.jnc.go.jp/zmonju/mjweb/welcome.htm>.