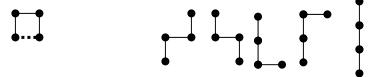
20.110/2.772/5.601 Fall 2005 Recitation # 11 10/20/2005

1. In class, we considered the example of a "polymer" comprising 4 monomer units that can exist in a "compact" state or an "open" state. The compact state arises from an attractive bond between the monomers at the ends of the chain (see fig. 10.1 in Dill). This bond is characterized by an energy - ϵ . If this bond has energy of 588x10⁻²³J, what is the (Helmholtz) free energy of the system at 310K? at 710K? Will there be more open or compact chains at 310K? The value of k is 1.38x10⁻²³J/K

Bound or compact: Unbound or open:



2. Consider a particle that has two states: bonded to a surface, or non-bonded (released). The non bonded state is higher in energy by an amount of ε_0 .

- a) Explain how the ability of the particle to bond to the surface contributes to the heat capacity, and why the heat capacity depends on temperature
- b) Compute the heat capacity C_v in units of Nk if T=300K and ε_o =1.2 kcal/mol (which is about the strength of a weak hydrogen bond in water).

Recall: R=1.987 calxmol⁻¹xK⁻¹,
$$C_v = \frac{\partial U}{\partial T}$$
,
 $C_v = \frac{N\varepsilon_o^{2\Box}}{1\pi^{2\Box}} \frac{e^{\frac{-\varepsilon_o}{kT}}}{e^{\frac{-\varepsilon_o}{kT}}}$ for a two state system

$$\frac{b}{kT^{2\square}} \frac{1}{(1+e^{\frac{-\varepsilon_o}{kT}})^2}$$
 for a two