

Physics 418
Homework 5 - Due Feb. 27, 2009

Problem 1: Some systems are adequately described by a one-dimensional potential energy in the form of an asymmetric double well. To good accuracy each well can be assumed to be harmonic with potential energies

$$V_L(x) = (1/2)k_Lx^2, \text{ in the left well,} \quad V_R = \epsilon + (1/2)k_R(x - a)^2, \text{ in the right well.} \quad (1)$$

Here, $\epsilon = V_R(a) > 0$. N classical particles of mass m are brought into thermal equilibrium in this potential.

(a) At temperature T , what is the average number of particles in each well?

(b) What conditions need to be imposed on the parameters of the potential in order to have equal populations at temperature T^* ?

(c) Calculate the difference $u_R - u_L$ between the internal energy of two particles in the two wells. Explain why your result is not inconsistent with the way the particles are distributed between the wells for $T \geq T^*$ (when the conditions found in (b) hold.)

Problem 2: Patheria 3.31