Physics 831 - 2002

Statistical Physics

Problem Set 13

1. Show that Bose-Einstein condensation does not occur in an ideal 2D Bose gas of nonrelativistic particles (6 pt)

2. Consider a system of two coupled oscillators, with coordinates q_1, q_2 amd momenta p_1, p_2m and the Hamiltonian
$$H = \frac{p_1^2}{2m} + \frac{p_2^2}{2m} + \frac{1}{2}\sum_{i,j=1,2} K_{ij} q_i q_j$$
where K_{ij} is a positive definite 2×2 matrix. Show that this system can be reduced to two independent oscillators and find their eigenfrequencies. Suppose that the system is weakly coupled to a thermal bath. Find $\langle q_1^2 \rangle$. (8pt)

Problems with numbers are from Kerson Huang, *Statistical Mechanics*, 2nd edition, (Wiley, NY 1987).