SEMICONDUCTOR PHYSICS **ECE 1336**

Problem Set #6: Lattice Vibrations and Thermal Properties

1.

(a) Briefly explain the concept of zero-point energy.

(b) State (if applicable) the zero-point energy for: (i) a single three-dimensional classical harmonic oscillator, (ii) a single three-dimensional quantum harmonic oscillator.

2. Using the Debye theory of heat capacity, estimate the zero point energy per atom for solid argon given that the Debye temperature, Θ, for solid argon is 92K.

3.

(a) Explain the difference between specific heat and thermal conductivity.

(b) Explain why water is an effective cooling agent.

(c) Explain why high purity crystalline diamond has such a high thermal conductivity.