4th-HOMEWORK

1. Describe the following concepts(do not use equations, use words)

    Bose-Einstein Condensate

    Phonons

    Blackbody Radiation

    Para and dia magnetic susceptibilities of an electron gas

2. Find the Fermi temperature, Debye Temperature and Specific heats at room temperature of 4 different substances. (For specific heats, you should find them from some references and mention the references in your homework. The Fermi temperature and Debye temperature, either find them from some references and cite those references in your homework, or calculate them using the results that we have obtained in the class.)

3. Consider a Carnot cycle that works between two heat reservoirs at temperatures T_1 and $T_2 < T_1$ and which uses a gas whose equation of state is given by

$$PV = NT \left(1 + K \frac{N}{VT^{3/2}} \right) \tag{1}$$

    where K is some constant. By calculating explicitely the work done and the total heat absorbed by this system, show explicitely that the efficiency of the cycle is $\eta = 1 - \frac{T_2}{T_1}$ (You have to calculate the adiabatic equation for this gas also)

4. Consider a system containing two bodies, one with a heat capacitity C_1 and temperature T_1 and the other with heat capacity C_2 and temperature $T_2 < T_1$. Calculate the maximum work that can be extracted from this system until the system reaches equilibrium.

5. Calculate the Bose-Einstein condensation temperature for a boson gas that is confined to move on a flat surface of surface area A.