

PHY 292S

Problem Set #2

Winter 2008

Due on Thursday, March 20th before the lecture.

1. Problem 2.36 on p. 79 of Schroeder
2. Problem 2.42 on p. 83 of Schroeder
3. Problem 3.25 on p. 108 of Schroeder: (a)-(e) only.
4. Consider an Einstein solid having $N=20$ atoms.
 - (a) What is the solid's temperature when it has an energy of 10ε , assuming that $\varepsilon=hf=0.02$ eV? Calculate this directly from the definition of temperature by finding S at 10ε and 11ε , computing $\frac{dS}{dU} \approx \frac{S(11\varepsilon) - S(10\varepsilon)}{\varepsilon}$, and then applying the definition of temperature. Compare this with the temperature obtained by using the method in the textbook (Eqs. 3.7 and 3.8). That is, by considering S at 9ε and 11ε . (You will not need to show all the multiplicities, but you should explicitly calculate necessary multiplicities.)
 - (b) How does this compare with the result from the formula $U=NkT$ (Eq. 3.11 in the textbook, which is only accurate if N is large and $U/\varepsilon \gg N$)?
 - (c) Now repeat the above calculation for $N=200$ and $U=100\varepsilon$. How does this result compare with the result from (a) and (b)?