Physics 112, Fall 2017, Holzapfel
Problem Set 9 (4 Problems). **Due Monday, November 13**, 5 PM

Problem 1: **Chemical potential versus concentration**
Kittel 7.13

Problem 2: **Two orbital boson system**
Kittel 7.14

Problem 3: **Bose Einstein Condensation with Rb 87**
Consider a collection of 10^4 atoms of Rb 87, confined inside a box of volume $10^{-15} \mathrm{m}^3$.

a) Calculate ε_0, the energy of the ground state.

b) Calculate the Einstein temperature and compare it with ε_0.

c) Suppose that $T = 0.9 T_E$. How many atoms are in the ground state? How close is the chemical potential to the ground state energy? How many atoms are in each of the (threefold-degenerate) first excited states?

d) Repeat parts (b) and (c) for the cases of 10^6 atoms, confined to the same volume. Discuss the conditions under which the number of atoms in the ground state will be much greater than the number in the first excited states.

Problem 4: **Boson Gas in One Dimension**
a) Kittel 7.9

b) What property must the density of states have for there to be an abrupt Bose-Einstein transition?