A system offers noninteracting spinless bosons energy levels \( E_n = n \varepsilon \) for orbital wavefunctions \( \phi_n(r) \), \( n = 0,1,2,\ldots \).

(a) Two identical spinless bosons are introduced into the system. Write down explicit two-particle wavefunctions \( \Psi(r_1,r_2) \) and the corresponding energies for the two lowest lying two-particle states. Pay particular attention to symmetry and the indistinguishability of the particles.

(b) Now particles are added until the system contains 100 identical bosons. How many independent 100-particle states are there with energy \( 4\varepsilon \)? Identify the orbitals \( \phi_n \) contained in these different states, but you are not asked to write the explicit wavefunctions.

(c) The system is placed in contact with a reservoir at temperature \( T \) and a source of bosons that maintains a chemical potential \( \mu \). \( T \) and \( \mu \) are adjusted until the system in equilibrium maintain an average of 99 particles in the orbital with \( E_0 = 0 \), one particle in the orbital \( E_1 = \varepsilon \), and a negligible occupancy of higher levels. Use the Bose-Einstein distribution to calculate the values of \( \mu \) and \( T \) in terms of \( \varepsilon \).