PHYS 328
IN CLASS DISCUSSION-- 30 AUG. 2012

Our problem poses the situation where two rooms of equal size, A and B, are connected by an open door. Room A is warmer. Which room has a greater number of molecules.

  The statement of the problem tells us explicity that V is the same for both. The information about the open door tells us that P is the same in both rooms, because if it were not, then air would move between the rooms until the pressure were equilibriated throughout. Therefore, if we write the ideal gas lawfor each room :

$$P_A \, V_A \; = \; N_A \, k \, T_A \; \text{ and } P_B \, V_B \; = \; N_B \, k \, T_B$$

Since P and V are the same in both rooms, the left hand sides of the equations are equal, meaning that :

$$N_A \, k \, T_A \; = \; N_B \, k \, T_B \; \Rightarrow \; N_A \, T_A \; = \; N_B \, T_B$$

Since you are told that the temperature in A is greater than the temperature in B, the number of molecules in B must be correspondingly greater than A to preserve the equality.