

Chapter 36 Problem 26 [†]

Solution

Find the highest-energy electron in an infinite square well if there are nine electrons in the well.

The energy levels of an infinite square well are

$$E_n = \frac{n^2 h^2}{8mL^2}$$

Since the ground state energy is

$$E_1 = \frac{h^2}{8mL^2}$$

The other energy states are

$$E_n = n^2 E_1$$

According to the Pauli Exclusion Principle, no two electrons can be in the same state. Since electrons can be spin up and spin down, each state can hold two electrons. Since there are nine electrons, energy levels $n = 1, 2, 3$ and 4 will be filled. The ninth electron will go into the $n = 5$ state. Therefore, the energy of this electron is

$$E_5 = 5^2 E_1 = 25E_1$$

[†]Problem from Essential University Physics, Wolfson