

Solution

The Pauli exclusion principle applies to all fermions in all situations (not just to electrons in atoms). Consider electrons in a 2-dimensional infinite square well potential.

1. How many electrons can be in the first excited energy level?
a. 1 b. 2 c. 3 **d. 4** e. 5

The first excited energy level has $(n_x, n_y) = (1, 2)$ or $(2, 1)$.

That is, it is degenerate.

Each of these can hold two electrons (spin up and down).

2. If there are 4 electrons in the well, what is the energy of the most energetic one (ignoring e-e interactions, and assuming the total energy is as low as possible)?

- a. $(h^2/8mL^2) \times 2$
b. $(h^2/8mL^2) \times 5$
c. $(h^2/8mL^2) \times 10$

Two electrons are in the $(1, 1)$ state, and two are in the $(2, 1)$ or $(1, 2)$ state. So, $E_{\max} = (1^2 + 2^2) \times (h^2/8mL^2)$.