

CH 221 Guide to Quantum Numbers

<u>Quantum Number</u>	<u>Quantum Name</u>	<u>Values</u>
n	shell	1, 2, 3, 4, ... ∞
l	subshell	0, 1, 2, ... (n - 1)
m_l	orbital	-l ... 0 ... +l
m_s	electron spin	+¹/₂ or -¹/₂

Each electron in an atom can have its own unique "address" or *set of quantum numbers*.

Example: Consider a **Beryllium** atom with four electrons. Beryllium is in the second period, so possible n values are 1 and 2. Electrons are filled using the lowest value of n (or n + l), so the electrons will be placed into the n=1 shell before they enter the n=2 shell.

When n = 1, the only allowed value of l is 0; likewise, the only allowed value of m_l = 0. We will place the first two electrons in a 1s orbital. Each electron can have either a "spin up" (m_s = +¹/₂) or "spin down" (m_s = -¹/₂) configuration.

The first electron's set of quantum numbers (or address) will be: **n = 1, l = 0, m_l = 0, m_s = +¹/₂**

The second electron's set of quantum numbers (or address) will be: **n = 1, l = 0, m_l = 0, m_s = -¹/₂**

When n = 2, allowed values of l are 0 and 1. Lowest (n + l) values are filled first; hence, a (n + l) value of (2 + 0) = 2 will be filled before a (n + l) value of (2 + 1) = 3. When l = 0, the only allowed value of m_l = 0. We will place the next two electrons in a 2s orbital. Each electron can have either a "spin up" (m_s = +¹/₂) or "spin down" (m_s = -¹/₂) configuration.

The third electron's set of quantum numbers (or address) will be: **n = 2, l = 0, m_l = 0, m_s = +¹/₂**

The fourth electron's set of quantum numbers (or address) will be: **n = 2, l = 0, m_l = 0, m_s = -¹/₂**