

# Solutions

There is a set of solutions; each member is represented by a combination of integers, called quantum numbers. A fourth quantum number,  $s$ , spin, is a result of relativistic quantum mechanics.

name	symbol	orbital meaning	range of values	value example
principal quantum number	$n$	shell	$1 \leq n$	$n = 1, 2, 3...$
azimuthal quantum number (angular momentum)	$\ell$	subshell (s orbital is listed as 0, p orbital as 1 etc.)	$(0 \leq \ell \leq n - 1)$	for $n = 3$ : $\ell = 0, 1, 2$ (s, p, d)
magnetic quantum number, (projection of angular momentum)	$m_\ell$	energy shift (orientation of the subshell's shape)	$-\ell \leq m_\ell \leq \ell$	for $\ell = 2$ : $m_\ell = -2, -1, 0, 1, 2$
spin projection quantum number	$m_s$	spin of the electron (-1/2 = counter-clockwise, 1/2 = clockwise)	$-\frac{1}{2}, \frac{1}{2}$	for an electron, either: $-\frac{1}{2}, \frac{1}{2}$

Example: The quantum numbers used to refer to the outermost valence electron of the Carbon (C) atom, which is located in the 2p atomic orbital, are;  $n = 2$  (group 2),  $l = 1$  or 0,  $m_l = 1$ , or 0, or  $-1$ ,  $m_s = -1/2$  or  $1/2$ .