

# Quantum Mechanics - Quantum Numbers

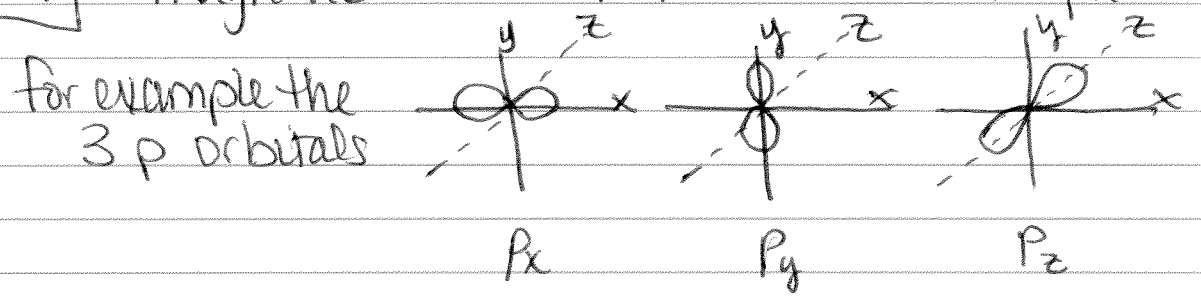
1<sup>st</sup>  $[n]$  = principle energy level = size of the  $e^-$  cloud  
 $n = 1-7$  possible energy levels (Street)

2<sup>nd</sup>  $[l]$  = azimuthal = sublevel (type of house)

- $l = s, p, d, f$
  - $s = \text{O spherical } 1 \text{ orbital } 2e^-$
  - $p = \text{OO dumbbell } 3 \text{ orbitals } 6e^-$
  - $d = 5 \text{ orbitals } 10e^-$
  - $f = 7 \text{ orbitals } 14e^-$
- } don't worry about shape

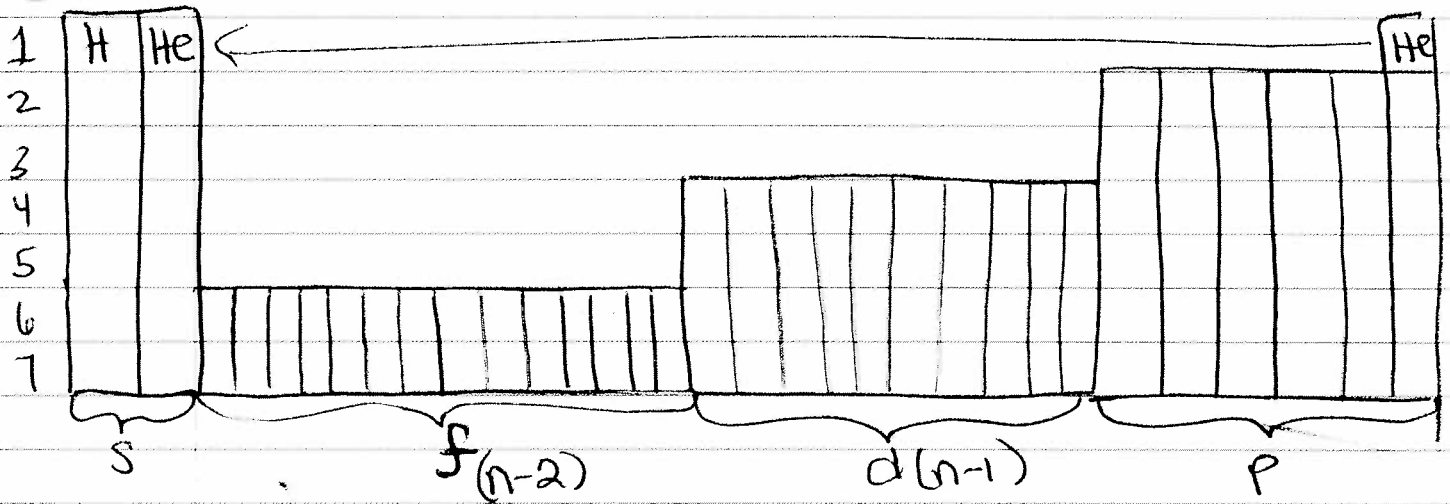
orbital = the pathway of the  $e^-$ , an orbital can only hold  $2e^-$  and the  $e^-$  must spin in opposite directions.

3<sup>rd</sup>  $[m]$  = magnetic = an orbitals direction in space



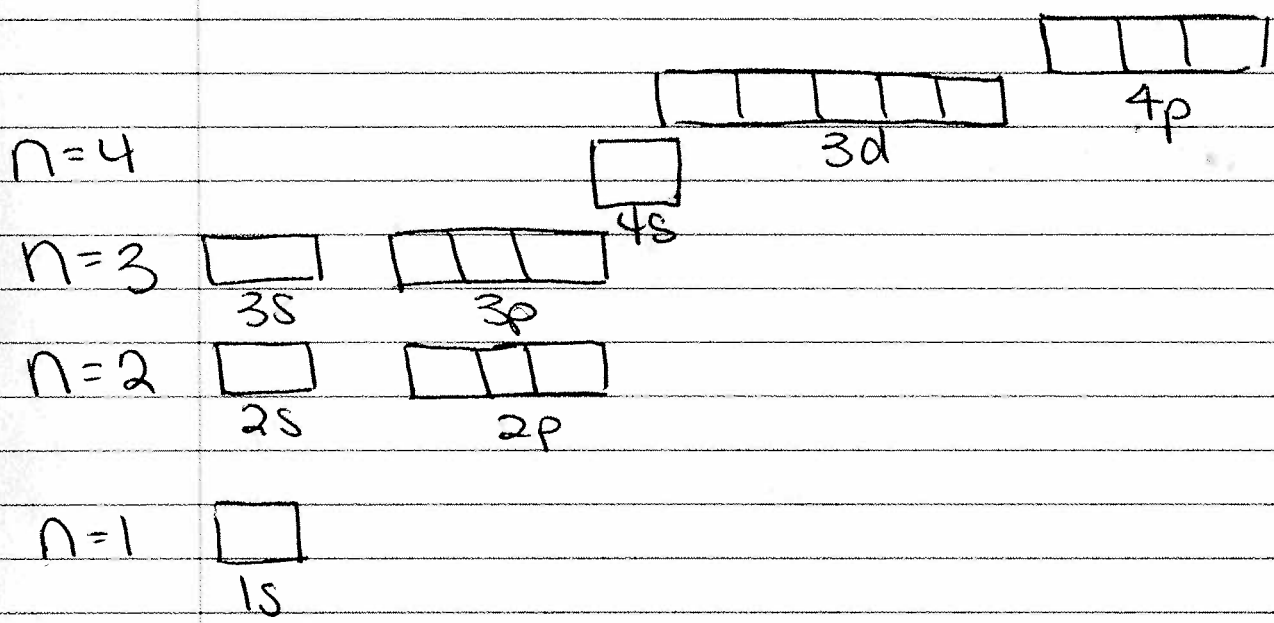
4<sup>th</sup>  $[s]$  = spin = top spin / bottom spin (bunkbeds)

$+1/2, -1/2$  or  $\uparrow \downarrow$



Energy level	Sublevels present	Directions Possible	e <sup>-</sup> per sublevel	max e <sup>-</sup> per energy level
$n$	$l$	$m$		
1				
2				
3				
4 ( $\& 5-7$ )				

energy levels overlap between "p" and "d"  
then again between "d" and "f"



electron configuration lists the placement of every e<sup>-</sup> for an atom.

example:  
Hydrogen H<sup>1</sup> 1s<sup>1</sup>

Uranium U<sup>92</sup> 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>6</sup> 3s<sup>2</sup> 3p<sup>4</sup> 4s<sup>2</sup> 3d<sup>10</sup> 4p<sup>6</sup> 5s<sup>2</sup> 4d<sup>10</sup> 5p<sup>6</sup>  
6s<sup>2</sup> 4f<sup>14</sup> 5d<sup>10</sup> 6p<sup>6</sup> 7s<sup>1</sup> 5f<sup>4</sup>

\* if you add the exponents they ~~total~~<sup>equal</sup> the total # of e<sup>-</sup>

Orbital Diagram electron config. including boxes and arrows for the orbitals + spins

Shorthand - uses last completed noble gas [ ] then lists only new e<sup>-</sup> after

example: Phosphorous [Ne] 1s<sup>2</sup> 3p<sup>3</sup>