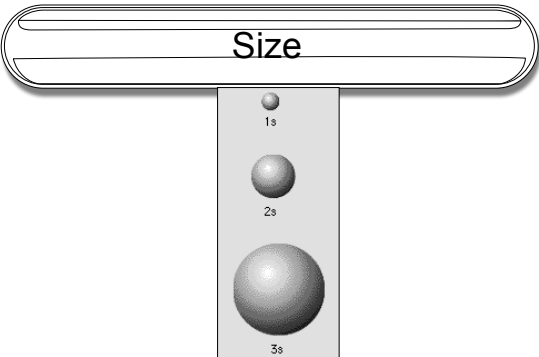## Quantum Mechanical Model
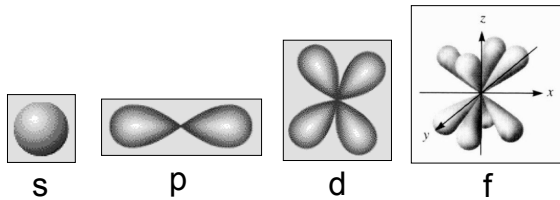
Quantum Numbers
(n, l, m$_l$, m$_s$)

- n = _____ Quantum Number
- It has whole number values (1, 2, 3, …)
- An n increases, the orbital becomes larger
- n tells you what _____ you are in
- n designates the _____

Size

1s

2s

3s

Quantum Numbers
(n, l, m$_l$, m$_s$)

- L = _____ Quantum Number
- Also known as the _____ Quantum Number
- Can have values from 0 to (n-1) for each value of n
- Defines the _____ of the orbital
- L = 0 → s
- L = 1 → p
- L = 2 → d
- L = 3 → f
- Tells you what _____ you are in
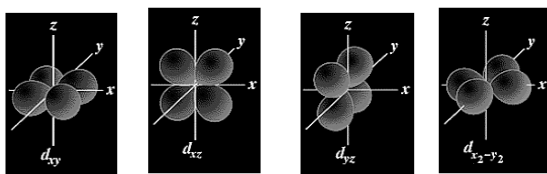
Shapes

s   p   d   f

Quantum Numbers
(n, l, m$_l$, m$_s$)

- m$_L$ = _____ Quantum Number
- Can have whole number values from – L to + L (including zero)
- This describes the orbital's _____ in space (which axis it is on)
- Tells you what _____ you are in

Orientation

Quantum Numbers
(n, l, m$_l$, m$_s$)

- m$_s$ = magnetic _____ quantum number
- Spin quantum number denotes the direction of spin of an electron within a magnetic field.
- Possibilities for m$_s$ +1/2 or -1/2

Possible Values for n, l, m_l, m_s

- n (shell) = 1, 2, 3, 4, … (whole numbers)

- L (sub shell) values from 0 → (n -1)

- m_L (orbital) values from – L to + L (including zero)

- m_s = +1/2 or -1/2

Examples

- What are the possible values for L if n =2?

Examples

- What are the possible values of n, L, and m in the 2s sub shell?

Examples

- What are the possible values for n, L, & m in the 3d sub shell?

Example

- What is the designation for the sub shell where $n = 2$ and $L = 1$?

Example

- What is the designation for the sub shell where $n = 4$ and $L = 3$?

Possible Number of Values (how many answers are there?)

- A shell with Principal Quantum Number (n) has exactly n number of sub shells
- # L's = n

Example

- If $n = 2$ how many possible number of values are there for L?

- What would those values be?

Possible Number of Values (how many answers are there?)

- For a given value of L there are 2L + 1 possible values for m

Example

- How many values of m are there if L = 0?

Example

- How many possible values are there for m if L = 2?

Example

- What are the values for m if L = 2?

Possible Number of Values
(how many answers are there?)

- The number of possible values of $m = n^2$
- Example:
- If $n = 2$, how many values are there for m?

Possible Number of Values
(how many answers are there?)

- Since each orbital can hold at most 2 electrons, the number of electrons in a shell is $2n^2$

- How many electrons are in the $n = 3$ shell?

Summary

Possible Values
- L ($0 \rightarrow$ n-1)
- m ($-L \rightarrow +L$)

# of Possible Values
- Orbitals (m)
  - #m = 2L +1
  - #m = n^2
- Sub shells (L)
  - # L = n
- Electrons
  - # electrons = $2n^2$

More examples

- How many sub shells are in $n = 4$?

More examples

- What designation would n = 5 and L = 1 have?

More examples

- In the 4d sub shell, what are the possible values for n, l, & m?

More examples

- In the 3p sub shell, what are the possible values for n, l, & m?